Ulin - J Hut Trop Vol 9 (1): 129-137 pISSN 2599 1205, eISSN 2599 1183
Maret 2025 DOI: http://dx.doi.org/10.32522/ujht.v9i1.15881

The potential of stingless bees cultivation with agroforestry techniques in "Kebun Sidang" Antutan Village, Bulungan District, Indonesia

Marjenah, Harmonis, Ona Orvalinda
Faculty of Forestry, Mulawarman University Gunung Kelua Campus Jl. Penajam Samarinda 75119
*E-Mail: marjenah_umar@yahoo.com

Artikel diterima :14 November 2024 Revisi diterima 30 Januari 2025

ABSTRACT

Honey, which is generated by honey bees, is one of the prominent non-timber forest products among the population. The stingless bee is the species of bee that has the most potential for cultivation (local name: Kelulut). The stingless bee is the species of bee that has the potential to be domesticated. The stingless bee is a little black insect with a 3 to 4 mm body length and an 8 mm wing span. This study sought to identify the pattern of agroforestry in the evolution of stingless bee cultivation. To determine the plant types and possibilities for stingless bee feed, as well as the viability of growing stingless bee agriculture in the Community Forest of Antutan Village, Bulungan Regency. The descriptive approach and interviews and field surveys are utilized for sample purposes. The results revealed that the applied agroforestry pattern was meliponiculture, or the production of stingless bees in conjunction with plantations and agriculture. There are nine plant species with a total of 64 individuals that could serve as stingless bee food. For the business feasibility value, the R/C ratio is 1.9 and the B/C ratio is 0.9, which shows that the firm is both profitable and possible to operate.

Keyword: Agroforestry, Community Forest, Cultivation, Potential, Stingless Bees

ABSTRAK

Salah satu produk hasil hutan bukan kayu yang sangat populer di kalangan masyarakat adalah madu yang dihasilkan dari lebah madu. Jenis lebah yang cukup potensial untuk dibudidayakan adalah lebah kelulut. Tujuan penelitian ini untuk mengetahui pola agroforestri dalam pengembangan budidaya lebah kelulut, jenis tanaman dan potensi pakan lebah kelulut, serta menganalisis kelayakan pengembangan usaha budidaya lebah kelulut di Hutan Rakyat Desa Antutan Kabupaten Bulungan. Metode yang digunakan adalah metode deskriptif dan untuk pengambilan sampel dengan cara wawancara dan survei lapangan. Hasil penelitian menunjukkan pola agroforestri yang diterapkan adalah Meliponikultur yaitu budidaya lebah tanpa sengat/kelulut yang dipadukan dengan perkebunan dan perladangan. Terdapat 9 jenis tanaman dengan total 64 individu yang berpotensi sebagai pakan lebah kelulut. Untuk nilai kelayakan usaha menghasilkan angka R/C 1,9 dan B/C 0,9 dimana menunjukkan usaha menguntungkan dan layak dijalankan.

Kata kunci: Agroforestri, Budidaya, Hutan Rakyat, Lebah Kelulut, Potensi

INTRODUCTION

Undang-Undang No. 18 Tahun 2013 especially in human health. It can be use as home remedies such as honey musk, to cure flu and other medicinal effect. There are various types of honey in the world and also can be collected from a type of bee named stingless bees (Ya'akob et al., 2019). Honey produced by stingless bees contains antibacterial because it contains water, acidity, and flavonoid inhibitor chemicals. Stingless bees collect and store honey in their hives (Ma'ruf et al., 2018).

To achieve maximum advantages from forests and forest regions, appropriate forest management is necessary without compromising the forest's primary purpose. Using agroforestry is one of the forest management methods. Agroforestry is a sustainable land management practice that combines forestry plants with agricultural crops and/or livestock on the same plot of land, aiming to maximize economic, ecological, and social benefits (Olivi et al., 2015). Agroforestry has biophysical, social, and economic roles, including the maintenance of sustainable agricultural production, the maintenance of forest functions in supporting watersheds, the reduction of greenhouse gas concentrations in the atmosphere, and the maintenance of biodiversity. The function of agroforestry at the landscape level (meso scale) is to improve and preserve physical characteristics and soil fertility, store carbon reserves, and increase biodiversity (Noordwijk et al., 2011).

The honey produced by honey bees is one of the non-timber forest products that is quite popular with the public. The stingless bee is the species of bee that has the potential to be domesticated. The stingless bee is a little black insect with a 3 to 4 mm body length and an 8 mm wing span (Surata, 2017). Stingless bees are little, stingless bees that

can interact with people (Dewantari and Suranjaya, 2019). The development of stingless bee keeping is depending on the availability of food sources. Benefits can be reaped from the cultivation of stingless bees. In addition to producing honey, it has the potential to ensure the continued existence of plant life. According to Stoner (2012), throughout the year there needs to be a yearly spring in order to maintain both the diversity of bees and the high quantity of bees. According to research conducted by Panjaitan (2017), the feasibility of the honey bee farming business in Silo Baru Village, North Sumatra, resulted in an R/C Ratio value of 2.76 and a B/C Ratio value of 1.76. The development of this business is possible due to the fact that its R/C Ratio value is greater than 1, and its B/C Ratio value is greater than 0.

One of the communities that are situated close to the forest is called Antutan Village, and it can be found in the Tanjung Palas District of the Bulungan Regency. The forest plays a significant role in the community's way of life, and the forest itself is managed in accordance with traditional practices. The management community as a whole has not been provided with the expertise to manage forest lands in the most effective manner. The kind of forest resource management that is carried out is in the form of a combination of cultivation systems and conventional plantation systems in forest areas. This form of forest resource management, which can be described as simple agroforestry, is carried out in the forest regions. With the social forestry program now in place, a Social Forestry Business Group was established recently, and it operates under the guidance of the Antutan Village Forest Management Institution. Organization for Social Forestry (Social Forestry Business Group) Agrosilvopastura is one of the business groups that was established, and one of the business projects that was developed was the maintenance of stingless bees. Agroforestry is a combination of a few components, all of which may operate alone. Agroforestry is consisting of agriculture, forestry, animal husbandry, fisheries, and honey bee cultivation (Wulandari, 2011; Yustha, 2017).

The contribution of the surrounding community to the effective management of forests cannot be separated from that of the surrounding community. In order to provide assistance in the process of constructing village development plans, the government of the Bulungan Regency in North Kalimantan has arranged for a number of agricultural enterprises to be programmed to improve the standard of living within village communities. The Social Forestry Business Group Agrosilvopastura has chosen some customary property in the Antutan Village Community Forest as the site for the establishment of their stingless bee keeping business. Due to this fact, it is necessary to do research on the possibility of stingless bees being able to thrive in that particular environment. This investigation sought to identify the agroforestry pattern that was employed in the development of stingless bee keeping; identify the species of agroforestry plants and prospective feed for stingless bees; and examine the viability of developing a stingless bee keeping company at the research site.

MATERIALS AND METHODS

Research Location

This investigation was carried out in the "Kebun Sidang" Community Forest of Antutan Village, which is located in the Tanjung Palas District of the Bulungan Regency in the Province of North Kalimantan. The research location is shown in Figure 1.

pISSN 2599 1205, eISSN 2599 1183
DOI: http://dx.doi.org/10.32522/ujht.v9i1.15881

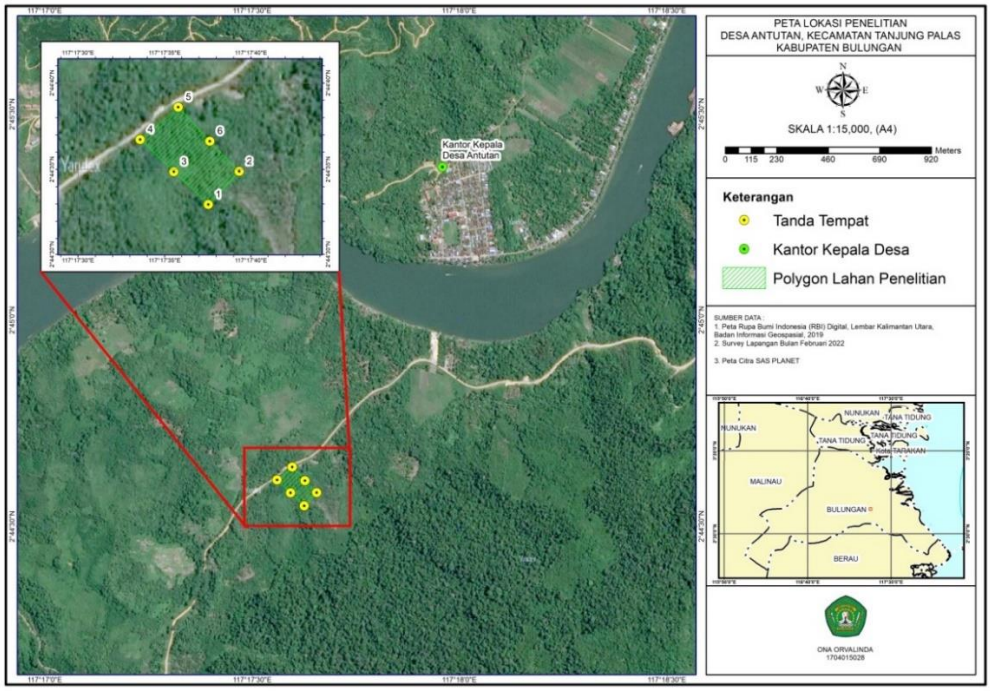

Figure 1: Map of study location

Data Collection

Primary and secondary data are the two categories of data that are utilized in the process of conducting research. a. Primary data; Primary data collected on the field through organized interviews and observations on the field itself utilizing a questionnaire. The following methods were used to acquire data for this study: 1) Observations, more specifically direct observations in the field to determine agroforestry patterns, stingless bees feed, and activities in cultivating stingless bees in the "Kebun Sidang" Community Forest of Antutan Village. Observations were conducted in this area, 2) Interview each respondent and fill out the questionnaire by having them answer direct questions about existing commodities, the amount of revenue, and the total cost of producing stingless bees, 3) When performing observations or interviews, it is necessary to take images as part of the documentation process. b. Secondary data; Secondary data collection was carried out by means of a literature study. This method was used by collecting various research supporting data obtained from literature studies and from related agencies such as the Village Forest Management Institute, library materials, articles journals, internet facilities, and other supporting books.

Data analysis

The descriptive analysis of the data gathered from the interviews and the field observations came next.

1. An inventory was taken of the various commodities found in the area where the research was carried out in order to get insight into the role that agroforestry played in the evolution of the keeping of stingless bees.
2. At the location of the study, divide the area into three plots of equal size, each measuring 20 meters by 20 meters, and note the types of plants that grow in each plot. This will allow you to assess the sorts of plants that serve as feed for stingless bees.
3. Calculating the production costs, revenues, and income of the stingless bee keeping business is necessary in order to evaluate the practicability of developing a business that specializes in the keeping of stingless bees.

A formula derived from Soekartawi (2003) can be used to calculate manufacturing costs, and the formula can be written down as follows:

TC = FC + VC

TC = Total cost (IDR/harvest)
FC = Fixed cost
VC = Variable cost

The following formula, derived from Soekartawi (2003), can be used to figure out how much money the business of keeping stingless bees is bringing in:

TR = Q × P

TR = Total Revenue (IDR/year)
Q = Quantity (kg)
P = Price (IDR/Kg)

The following formula, derived from Soekartawi (2003), can be used to estimate the

amount of money that can be made in the research sector through the keeping of stingless bees as a business:

$$\mathbf{TI = TR - TC}$$

TI =Total Income (IDR/year)
TR = Total Revenue (IDR/year)
TC = Total Cost (IDR/year)

In this investigation, the R/C ratio method and the Net B/C ratio method were utilized in order to carry out the feasibility analysis. Both of these methods are considered to be viable alternatives.

R/C Ratio

The formula that is utilized in the process of determining the value of the R/C Ratio is derived from Soekartawi (2006) and can be found as follows:

$$\mathbf{R/C} = \frac{\textit{Total Revenue}}{\textit{Total Production Cost}}$$

If the R/C Ratio > 1, it can be concluded that the business of rearing stingless bees is one that can be successfully carried out. If the R/C Ratio < 1, the business of raising stingless bees is considered to be unfeasible since it would be detrimental to the enterprise. This would indicate that the costs that would be incurred would be more than the revenues that would be made.

B/C Ratio

A company's profitability can be evaluated based on the value of the B/C Ratio, which indicates whether or not the company generates a profit. The following is the formula that should be utilized in a systematic manner, as stated by Soekartawi (2006):

$$\mathbf{B/C} = \frac{\textit{Total Income}}{\textit{Total Production Cost}}$$

If the B/C Ratio > 0, it is possible to continue operating the business. In the case that the B/C Ratio = 0, the company has reached its break event point (BEP). If the B/C Ratio < 0, it indicates that the business cannot be continued.

RESULTS AND DISCUSSION

A Pattern of Agroforestry

The responses to the questionnaire indicate that intercropping and agroforestry practices are utilized in the management of the research area. Plantations of fruit trees, rubber trees, and rice are among the various types of agriculture that are established. The location of the study is on land that is mostly utilized for the cultivation of rubber plantations. The cultivation of fruit trees and paddy fields (rice fields) serves only as a distraction when one's primary goal is to raise income or enhance land output. The illustration of the strategy/model for the management of research locations illustrated in Figure 2.

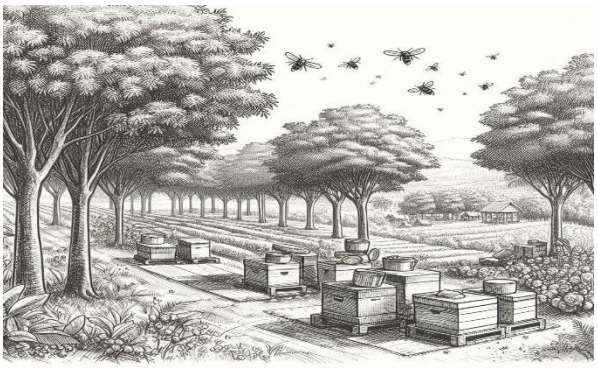

Figure 2. Pattern/Model of Agroforestry (Image Created with Copilot AI)

Meliponiculture is the name of the agroforestry pattern that was utilized at the research location to facilitate the development of stingless bees keeping. Meliponiculture or stingless bees maintaining (Cortopassi-Laurinoet et al., 2006). *Heterotrigona itama* was the species of stingless bees that flourished at the location of the study, and a total of 50 colonies were furnished with wooden board stups or box nest media. The "Kebun Sidang" Antutan Village is responsible for the cultivation of a variety of products, including rubber, cempedak (like jackfruit), petai, mata kucing, terap, rambutan, oranges, agarwood, and elai. The area at the "Kebun Sidang" consists entirely of level ground. The "Kebun Sidang" Antutan Village makes use of a cropping design that is organized in the shape of straight rows, with plants being planted alternately inside each row. The combination design features both agricultural and forest crops as its elements. This type of agricultural forestry is sometimes referred to as Alternating Rows Agrisilviculture. Idris et al. (2019) describe the cropping pattern known as alternate rows agrisilviculture as having the shape of rows.

Types of Agroforestry Plants and Potential of Forage for Stingless Bees

Based on direct observation of three 20 m × 20 m plots created.

Table 1. Plant Species in "Kebun Sidang" Antutan Village's Community Forest

pISSN 2599 1205, eISSN 2599 1183
DOI: http://dx.doi.org/10.32522/ujht.v9i1.15881

No.	Local name	Scientific name	Family	Number of Tree	Flowering period
1	Karet	*Hevea brasiliensis*	Euphorbiaceae	35	August-October
2	Cempedak	*Artocarpus integer*	Moraceae	6	September -February
3	Petai	*Parkia speciosa*	Fabaceae	3	August-October
4	Mata kucing	*Dimocarpus longan*	Sapindaceae	7	July-October
5	Terap	*Artocarpus odoratissimus*	Moraceae	2	August-October
6	Rambutan	*Nephelium lappaceum*	Sapindaceae	1	October-January
7	Lime citrus	*Citrus aurantiifolia*	Rutaceae	1	July-September
8	Agarwood	*Aquilaria malaccensis*	Thymelaeaceae	8	July-September
9	Elai	*Durio kutejensis*	Malvaceae	1	August-October

There are nine species of plants and 64 individuals in Table 1, with rubber plants dominating the group. As a result of its use for plantations and agriculture, the vegetation at the research site consists of an area with dense crown cover but no flowering plants.

The primary determinant in apiculture is the accessibility of forage for bees. The alimentary source for stingless bees at the research site comprises fruit and flowering trees. The food available at the research site is modest and lacks variety. In 2021, stingless bees in Antutan Village yielded 12 litres, with a harvesting interval of every three months. Stingless bees are limited to a flight range of 500 meters from their nests, necessitating consideration of the proximity of food and water supplies (Yanto et al., 2016). At the research site, there exists a river that traverses the area, along with multiple wells.

The hives of the stingless bees were positioned beneath the tree stands at the research site. The presence of bee stups beneath the fruit trees facilitated food foraging for the stingless bees. The stingless bees will forage for sustenance from the blossoms of nearby fruit bushes. Fruit plants are seasonal, resulting in intermittent flowering; therefore, alternative resources are necessary to sustain the stingless bee population in the area. *Caliandra* sp. is a flowering plant cultivated at the study site. *Caliandra* sp. can enhance the sweetness of honey (Syaifudins, 2020).

Certain varieties of flowering plants that serve as a food source for bees include Santos Flowers and Widuri Flowers. This kind is more economical as it is planted once and yields flowers year-round (Istikowati et al., 2019). The limited diversity of feed will hinder the stingless bees' ability to locate sustenance. One alternative is the enhancement of sustainable permanent or seasonal forage plants. Potential permanent crops for cultivation include Pumpkin, Eggplant, Cayenne Pepper, Corn, Starfruit, Sunflower, Guava, and Lamtoro (Chinese stink beans), all of which exhibit year-round flowering periods. Potential seasonal feeds include Mango, blossoming from June to September; Water Apple, flowering from July to October; and Coffee, flowering from November to February and May to September (Satriadi et al., 2015).

The final option available is to supply supplementary feed. A sugar solution serves as a supplementary meal to substitute nectar, provided during the flowering season when it is scarce (Widiarti and Kuntadi, 2012). Joice and Maramis (2015) assert that cane sugar and palm sugar possess elevated sucrose levels, suggesting their potential as supplementary nutrition for kelulut bees. The presence of bees is contingent upon the availability of food sources (Yunianto and Jannetta, 2020).

Nutritional elements produced from honey bee diet determine the quantity and composition of bee development (Rochman et al., 2014). A feed system that lacks a permanent pattern and relies on annual crops may lead to a feed famine season, which will cause colony swarming (Harmonis et al., 2007). Plants whose flowers have the potential to become food for bees are shown in Table 2.

Table 2. Potential for food for Stingless bees in the Community Forest of Antutan Village

No.	Local name	Scientific name	Family	Content
1	Ruber	*Hevea brasiliensis*	Euphorbiaceae	Nectar Extra floral and pollen
2	Cempedak	*Artocarpus integer*	Moraceae	Pollen, Nectar and Resin
3	Petai	*Parkia speciosa*	Fabaceae	Pollen and Nectar
4	Mata kucing	*Dimocarpus longan*	Sapindaceae	Pollen and Nectar
5	Terap	*Artocarpus odoratissimus*	Moraceae	Pollen and Nectar
6	Rambutan	*Nephelium lappaceum*	Sapindaceae	Pollen and Nectar
7	Lime citrus	*Citrus aurantiifolia*	Rutaceae	Pollen and Nectar
8	Agarwood	*Aquilaria malaccensis*	Thymelaeaceae	Nectar
9	Elai	*Durio kutejensis*	Malvaceae	Pollen and Nectar
10	Kaliandra	*Calliandra calothyrsus*	Fabaceae	Nectar

The availability of bee food is the most important aspect in keeping honey bees. Fruiting and flowering trees provide as food sources for stingless bees at the study site. The availability and variety of feed in the area of study are limited. In 2021, stingless bees grown in Antutan Village will yield 12 liters of honey with a three-month harvest interval. In the research site, the stingless bee hives were positioned under the tree stands. *Caliandra* sp., a floral species developed at the research location, can enhance the sweetness of honey (Syaifudin, 2020).

It will be difficult for stingless bees to find food due to the lack of variety in the food source. Sustainable permanent or seasonal feed plants can be enriched as an alternate method. Pumpkin, Eggplant, Cayenne Pepper, Corn, Carambola, Sunflowers, Guava, and Lamtoro, which bloom throughout the year, are examples of perennial foods that can be cultivated. Mango with a flowering period of June to September, guava with a flowering period of July to October, and coffee with a flowering period of November to February and May to September are some examples of seasonal feeds that can be established (Satriadi et al., 2015). Additional feed is the final alternative that can be implemented. When nectar is lacking throughout the flowering season, the sugar solution is supplied as a supplement (Widiarti and Kuntadi, 2012). Cane sugar and palm sugar contain a significant concentration of sucrose, hence it is expected that they can be utilized as supplemental food for stingless bees (Joice and Maramis, 2015).

Agribusiness Feasibility Study of Stingless Bees

Ifthe revenue from the production outcomes obtained exceeds the production costs incurred, a business is considered to be operating profitably. The Table 3 provides the specifics of the feasibility analysis of the stingless bees keeping enterprise in the "Kebun Sidang" Antutan Village, as determined by the questionnaire's results.

Table 3: Economic Feasibility Study of Stingless Bee Farming in "Kebun Sidang" Antutan Village

No.	Description	Value (IDR)
1	Production Cost	1,887,000
2	Revenue	3,600,000
3	Income	1,713,000
4	R/C Ratio	1.9
5	B/C Ratio	0.9

The stingless bees company developed in the "Kebun Sidang" Antutan Village costs IDR1,887,000 per year and generates IDR 3,600,000 in total revenue. The cultivation of stingless bees on a total of 50 hives yields 12 liters of honey each year and generates IDR 1,713,000 in revenue. The business feasibility analysis yields an R/C value of 1.9 and a B/C value of 0.9, indicating that the developing firm is possible to operate. This is as a result of the prospective location for agriculture in community forest, which is highly profitable for bees in terms of

pISSN 2599 1205, eISSN 2599 1183
DOI: http://dx.doi.org/10.32522/ujht.v9i1.15881

productivity and provides an adequate food source. The net income of the stingless bee keeping business is IDR 1,713,000 per year, which yields a monthly income of IDR 142,720 from production. This amount is inadequate to meet the manager's monthly needs. Honey from stingless bees in Antutan Village shown in Figure 3.

Figure 3. Honey from stingless bees in Antutan Village

The honey harvest coming from stingless bees is illustrated in Figure 3. The variations in the primary components of stingless bee honey are indicated by the varying colours of the canisters themselves, in specifically, the variations in the flowers that the bees collect to produce stingless bee honey.

Antutan Village has fifty colonies of stingless bees; nevertheless, the number of colonies has no effect on production output; rather, the quality of the foraging environment has an effect. To achieve optimal outcomes, it is necessary to invest effort and employ effective maintenance techniques. The value of the money created just from the cultivation of stingless bees has not yet been assessed, nor has the value of the income from the production of other commodities in the region of the study. Additional commodities produced by rubber plantations, fruit trees, and rice fields in the study area.

The manager's monthly needs have not been met by the income value. This is determined by the availability of feed at the place of cultivation and the manager's lack of experience in raising stingless bees. Hence, this enterprise is deemed unfeasible, as it has not given the farmer with significant profits. The treatment of stingless bees at the study site by farmers has not been optimal to date. Treatment is performed primarily during the harvesting season; everyday maintenance is not conducted. Lack of attention to stingless bee colonies results in swarming of the colonies, as well as multiple damaged hives and attacks by pests. A reasonable option is to divide the colony into multiple groups and place them in different areas. This can improve productivity because stingless bees will find an abundance of food without any competition.

The following actions can be taken to increase the stingless bees keeping business (Istikowati *et al*., 2019):

1. Socialization of stingless bees maintained in hives

   There is a need for socialization to introduce stingless bees keeping, its potential, challenges, and methods for overcoming them. Many cultivators do not understand fully the prospects and methods of bee keeping.
2. Flower planting preparation

   On vacant area where bee cultivation is conducted, flowers are planted. Flower planting as a source of food for bees is meticulously planned and mapped. It is preferable to grow flowers that bloom continuously, such as santos, thistle, and calliandra flowers.
3. Repeatedly and consistently stupefy

   Bees reproduce and build large colonies as a matter of course. Breaking apart a whole colony within a stup allows for its propagation. The spring is the ideal time to deconstruct the colony. The fractional colony must contain worker chicks, which will grow into queens and males.

CONCLUSION

The applied agroforestry pattern is meliponiculture with the Alternate Rows Agrisilviculture cropping pattern, based on the results of the conducted research. There are nine species of plants at the research site, including one species of stingless bee feed, Calliandra sp., nevertheless it has not provided optimal yield for stingless bee keeping. R/C ratios of 1.9 and B/C values of 0.9 indicate that the Kebun Sidang Antutan Village stingless bee farming business can be developed. With a monthly income of IDR 142,720, which is insufficient to satisfy necessities, the business is not feasible.

ACKNOWLEDGMENTS

Thank you to the administration of "Kebun Sidang" Antutan Village for the data and information contributed for this study. Thanks also to the entire Silviculture Laboratory staff for supporting this study.

REFERENCES

Cortopassi-Laurino, M., Imperatriz-Forseca, V. L., Roubik, D. W., Dollin, A., Heard, T., Aguilar, I., Venturieri, G. C., Eardley, C., & Noguiera-Neto, P. (2006). Global meliponiculture: Challenges and opportunities. *Apidologie*, *37*, 275–292. https://doi.org/10.1051/apido:2006012

Dewantari, M., & Suranjaya, I. G. (2019). Pengembangan budidaya lebah madu Trigona spp. ramah lingkungan di Desa Antapan Kecamatan Baturiti Kabupaten Tabanan. *Buletin Udayana Mengabdi*, *18*(1), 114–119. https://doi.org/10.24843/BUM.2019.v18.i01.p23

Harmonis, Sutisna, M., Mardji, D., & Iskandar, R. E. (2007). Potensi dan prospek pengembangan usaha perlebahan di Kalimantan Timur. *Rimba Kalimantan*, *12*(1), 25–34.

Idris, A. I., Arafat, A., & Fatmawati, D. (2019). Pola dan motivasi agroforestri serta kontribusinya terhadap pendapatan petani hutan rakyat di Kabupaten Polewali Mandar. *Jurnal Hutan dan Masyarakat*, *II*(2), 92–113.

Istikowati, W. T., Sunardi, S., Soendjoto, M. A., & Syaifuddin, S. (2019). Pengembangan budidaya lebah kelulut di Desa Batu Tanam, Sambung Makmur, Kabupaten Banjar, Kalimantan Selatan. *PengabdianMu: Jurnal Ilmiah Pengabdian Kepada Masyarakat*, *5*(1), 59–66. https://doi.org/10.33084/pengabdianmu.v5i1.983

Joice, R. J. I., & Maramis, R. T. D. (2015). Penggunaan metode queen rearing terhadap pembentukan sel ratu Apis mellifera untuk pengembangan perlebahan. *Jurnal Zootek*, *35*(2), 235–246.

Ma'ruf, M., Mawaddah, G. A., Eriana, N. N. A., Swari, F. I., Aslamiah, S., & Lutpiatina, L. (2018). Madu lebah kelulut (Trigona spp.) dalam aktivitas terhadap bakteri Staphylococcus aureus resisten. *Jurnal Skala Kesehatan: Politeknik Kesehatan Banjarmasin*, *9*(1), 21–26. https://doi.org/10.31964/jsk.v9i1.151

Noordwijk, M. V., Agus, F., Suprayogo, D., Hairiah, K., Pasya, G., Verbist, B., & Farida. (2011). Peranan agroforestri dalam mempertahankan fungsi hidrologi daerah aliran sungai (DAS). *Jurnal Agrivita*, *26*(1), 1–8.

Olivi, R., Qurniati, R., & Firdasari. (2015). Kontribusi agroforestri terhadap pendapatan petani di Desa Sukoharjo 1 Kecamatan Sukoharjo Kabupaten Pringsewu. *Jurnal Sylva Lestari*, *3*(2), 1–12.

Panjaitan, I. (2017). Analisis usaha dan pemasaran lebah madu (Apis melifera) (Studi kasus: Desa Silo Baru, Kecamatan Silau Laut, Kabupaten Asahan, Provinsi Sumatera Utara) [Skripsi, Fakultas Pertanian, Universitas Muhammadiyah Sumatera Utara].

Rochman, N., Junus, M., & Ciptadi, G. (2014). Estimasi bobot larva melalui panjang dan berat larva lebah hutan [Skripsi, Fakultas Peternakan, Universitas Brawijaya, Malang].

Satriadi, T., Aryadi, M., & Fauzi, H. (2015). Potensi pakan lebah pada hutan kemasyarakatan model berbasis agroforestri di Kabupaten Tanah Laut Kalimantan Selatan. In *Prosiding Seminar Nasional Agroforestri 2015* (pp. 137–143). Balai Penelitian dan Pengembangan Teknologi Agroforestri. ISBN: 978-602-17616-6-3.

Soekartawi. (2003). *Prinsip ekonomi pertanian*. Rajawali Press.

Soekartawi. (2006). *Analisis usahatani*. Penerbit Universitas Indonesia.

pISSN 2599 1205, eISSN 2599 1183
DOI: http://dx.doi.org/10.32522/ujht.v9i1.15881

Stoner, K. A. (2012). Planting flowers for bees in Connecticut. *Department of Entomology, The Connecticut Agricultural Experiment Station, New Haven, USA*.

Surata, I. K. (2017). Budidaya lebah madu kele-kele (Trigona spp.). In M. Dewantari & I. G. Suranjaya (Eds.), *Pengembangan budidaya lebah madu Trigona spp. ramah lingkungan di Desa Antapan Kecamatan Baturiti Kabupaten Tabanan* (Vol. 18, pp. 1–12).

Syaifudin, S. M. (2020). Budidaya pakan lebah Trigona sp. dengan apiculture agroforestry system di Kelurahan Anjungan Melancar, Kecamatan Anjungan Kabupaten Mempawah. *Jurnal Ilmiah Pangabdhi*, *6*(1), 17–24. https://doi.org/10.21107/pangabdhi.v6i1.6932

Widiarti, A., & Kuntadi. (2012). Budidaya lebah madu Apis mellifera oleh masyarakat pedesaan Kabupaten Pati, Jawa Tengah. *Jurnal Penelitian Hutan dan Konservasi Alam, 9*(4), 351–361.

Wulandari, C. (2011). *Agroforestry: Kesejahteraan masyarakat dan konservasi sumber daya alam*. Universitas Lampung.

Ya'akob, H., Norhisham, N. F., Mohamed, M., Sadek, S., & Endrini. (2019). Evaluation of physicochemical properties of Trigona sp. stingless bee honey from various districts of Johor. *Jurnal Kejuruteraan S1, 2*(1), 59–67. https://doi.org/10.17576/jkukm-2019-si2(1)-8

Yustha, Y. (2017). Pemanfaatan lahan pekarangan dengan sistem agroforestri oleh masyarakat di Desa Sidomulyo, Katingan Kuala, Katingan. *Jurnal Agrisilvika, 2*(4), 56–63.