

Identification and Economic Contribution of Intercrops to the Income of Oil Palm Farmers on Bangka Island

Rostiar Sitorus¹, Maera Zasari²

¹ Agribusiness Study Program, Faculty of Agriculture, Fisheries and Biology, University of Bangka Belitung, Indonesia.

² Agrotechnology Study Program, Faculty of Agriculture, Fisheries and Biology, University of Bangka Belitung, Indonesia.

* Correspondence: oty.torus72@gmail.com

Abstract: *Oil palm smallholders have the initiative to plant intercrops in immature smallholder oil palm plantations to obtain additional income ahead of the oil palm harvest. The research was conducted to identify which intercrops were cultivated by farmers and to calculate the value of the contribution made to the income of oil palm farmers. The survey method was carried out in smallholder oil palm plantations on the island of Bangka. The researchers concluded that the types of intercrops cultivated by farmers included cucumber, tomato, long beans, and cassava. The intercropping contributes to income while at the same time supporting the maintenance costs of young oil palm plants. In this study, intercropping contributed 13.5% toward covering these costs. This means that intercrops are feasible to cultivate in order to intercrop with immature oil palm plants so that they can cover the costs of oil palm farming before producing FFB.*

Keywords: Intercrops; Contribution; Income, Oil Palm Farmers

JEL: Q1, Q5, R1

1. INTRODUCTION

The existence of oil palm plantations on Bangka Island is growing very rapidly because this commodity is a source of Regional Original Income, absorbs labor, and provides big profits for companies. The presence of investors who are expanding oil palm plantations until 2022 in all districts on Bangka Island has caused a massive spread of oil palm plantations. In addition to providing benefits for the company, this commodity is the main source of income for farming families, especially smallholder plantations. The important role of the palm oil industry in the era of green agriculture on Bangka Island has also been seen based on Green objectives (Sitorus and Zasari (2022)). On the other hand, oil palm plantations have the main problem felt by farmers, namely the length of waiting time/grace period required for producing oil palm plantations. This is the main reason for farmers to look for alternative businesses to increase income while waiting for a return on farming capital.

The presence of business diversification is one of the strategies to increase land productivity and the economic value of plantation companies. Land optimization is carried out through intercropping of various food and horticultural crop commodities as intercrops in the main crop planting area. Intercropping is a form of cropping pattern that cultivates more than one type of plant in a certain time unit intending to obtain optimal production results and maintain soil fertility (Rochmah *et al.*, (2020)). An intercropping pattern is a form of polyculture (mixed) cropping pattern. which is carried out between types of annual crops and annual crops. This system is usually carried out on estate crops or forestry crops, for example, rubber, teak, and oil palm plantations. In this system, annual crops are planted when annual crops are still small and immature plants. the immature plant area still has room to grow where it can be planted with intercrops. The fronds or crowns of the oil palm plants in the immature plant areas do not yet cover each other so that sunlight can still be used by intercrops planted in intercropping (Hasibuan *et al.*, (2017); Nurhayati *et al.*, (2020)).

The intercropping pattern is beneficial for companies and partners as additional income because the company can manage it independently or in collaboration with employees or employee cooperatives, farmers or farmer groups, or other companies with a profit-sharing system (Kusumawati *et al.*, (2019), another advantage of the system Intercropping includes efficiency improvements (labor, land use, and sunlight absorption); utilization of space between rows of young oil palm plants; technical culture of intercrops under plantation stands is similar to a monoculture cropping pattern and does not interfere with the growth and development of plantation crops; creating biological stability so that it can suppress pest and disease attacks and maintain the sustainability of land resources, especially soil fertility (Junaidi (2020); Rochmah *et al.*, (2020).

Considering that smallholder oil palm plantations in the Bangka Island region are the main source of income for farmers, while the waiting time for harvesting oil palm is quite long, namely three years after planting, the availability of data on types of intercrops and their role in the lives of oil palm farmers is very useful as a policy basis for stakeholders. to prioritize the welfare of farmers. Based on this description, the research was conducted to identify intercrops cultivated by farmers and calculate the value of the contribution made to the income of oil palm farmers.

2. LITERATURE REVIEW

The The Big Indonesian Dictionary (KBBI) states that the meaning of intercrops is planted among annual plants which are arranged regularly in the form of straight rows. According to Winarna (2015), intercropping is also known as intercropping, planting on a plot of land, where more than one type of plant is planted and grows together with regular spacing and rows. Intercropping in oil palm plantations is a seasonal cropping system (including Pajale) in rows between oil palm plantation lines to exploit empty areas during the immature period at 1 and 2 years of age.

Various reference sources explain that intercropping in oil palm can be done on seasonal and annual crops. Seasonal crops that can be planted include food crops (such as corn, rice, soybeans, and cassava) and horticulture (vegetables such as chilies, bitter melon, shallots, and fruits such as watermelons, pineapples, and bananas). According to Sutarta *et al.*, (2012), the period of land use for oil palm for intercropping with intercropping is recommended to be only 2 years with consideration of the growth of the oil palm plants and the maintenance of the oil palm plants starting to be intensive. Meanwhile, intercrops in the form of annual plants can be agarwood, white teak, cocoa, and rubber. Gaharu is planted between oil palm plantations by adjusting the spacing. Meanwhile, white teak, cocoa, and rubber are planted on the edges of oil palm plantations (Sebayang and Winarto, 2014).

Proof that diversification of intercrops in oil palm plantations by planting various types of plants is useful for increasing the income of companies and partners, which have been cultivated by farmers, including chili plants (Suherman *et al.*, (2018), corn (Saputra, H. (2018), and fruit plants (Hazzouri *et al.*, (2015); (Mulyani and Las (2008) and various food crops (Arifin *et al.*, (2016); Afandi, (2014).

3. METHOD

The Identification of intercrops in oil palm plantations was carried out using a survey method. Surveys are field activities aimed at obtaining facts from existing phenomena and seeking factual information, whether social, economic, or political, from a group or an area (Nazir, 2013). The survey was carried out on smallholder oil palm plantations on the island of Bangka covering South Bangka Regency, Central Bangka Regency, West Bangka Regency, and Bangka Regency. The data collected includes Types of plants, land area, and socioeconomic data of intercrop farming. The data obtained in this study were analyzed qualitatively and quantitatively. Qualitative methods are used to describe general conditions related to intercrop diversification data.

To calculate farmers' income from intercrops, the formula according to Suratiyah (2015) is used as follows:

a. Cost Analysis

Calculation of Total Cost is obtained by adding up Fixed Cost/FC with variable costs with the formula:

$$TC = FC + VC$$

annotation:

$$TC = \text{Total Cost}$$

$$FC = \text{Fixed Cost}$$

$$VC = \text{Variable Cost}$$

b. Revenue Analysis

Calculation of Total Revenue/ TR, is the multiplication between the amount of production (Y) and the selling price (Py) and is expressed by the following formula:

$$TR = Py \cdot Y$$

annotation :

$$TR = \text{Total Revenue}$$

$$Py = \text{price of product}$$

$$Y = \text{quantity of production}$$

c. Income Analysis

Income is the difference between revenue (TR) and total costs (TC) and is expressed by a formula:

$$I = TR - TC$$

dimana :

$$I = \text{Income}$$

$$TR = \text{Total Revenue}$$

$$TC = \text{Total Cost}$$

d. Intercropping Income Contribution

Intercropping income contribution is calculated as a percentage (%) of the contribution made by intercropping farming to the costs of smallholder oil palm plantations.

4. RESULTS AND DISCUSSION

Planting intercrops between oil palm trees is a matter that is still being discussed, the pros and cons. The positive perception of intercropping states that intercropping in oil palm plantations is a system of planting annuals (including rice, corn, soybeans/pajale) in rows between the oil palm plantations to take advantage of the empty area during the 1 and 2-year immature period (Winarna et al., (2015) Utilization of immature plant areas in oil palm has several advantages, namely in optimizing land use aimed at the Land Equivalent Ratio (LER), producing a variety of products, obtaining additional yields, improving fertility land and prevent erosion (BPTP, 2012). According to (Sutarta et al., (2012) the period of using oil palm land for intercrops with intercropping is recommended to be only 2 years with consideration of the growth of oil palm plants and maintenance of oil palm plants intensive start..

The results of a tracing survey of oil palm plantations in the Bangka Island region show that intercrop cultivation is only carried out by oil palm smallholders on smallholder plantations. This condition was also ascertained based on the results of interviews conducted with managers of palm oil companies operating in the Bangka region, namely PT. Gunung Maras Lestari, PT. Son of Bangka Mandiri, PT. Laying out the spread of Eka Persada, PT. Gunung Sawit Bina Lestari, PT. Bangka Agro Mandiri, and PT. The First Success of Oil Palm Earth. All oil palm plantation companies stated that they did not permit to plant intercrops on the oil palm plantations owned by the company, as well as the nucleus plasma plantations because the company wanted to prioritize so that the growth of the main crop, namely oil palm, was not disturbed. If intercrops

are planted together with immature oil palm then the nutrients available around the roots of the oil palm will likely be absorbed by the by-crops/intercrops.

Even though the oil palm companies in the nearby village location are adamant against intercropping in oil palm plantations, the image of intercropping in nine villages is a fact that strengthens the claim that farmers are trying to find additional income opportunities while waiting for the oil palm to be ready to harvest. The findings from observations in smallholder oil palm plantations show that several types of intercrops are still cultivated by farmers in the Bangka Island region. Table 1 and Table 2 below show the location of smallholder plantations and the types of intercrops cultivated by farmers.

Table 1. Results of Identification of Intercrops in smallholder oil palm plantations in Bangka Regency

No	Location	description
1	Labu Village, Puding Besar District, Bangka Regency Product : Cucumber, harvest age after 3 months – 5 months	
2	Mabat Village, Bakam District, Bangka Regency Product : Cassava, harvest age after 9 months – 12 months	
3	Kace Village, West Mendo District, Bangka Regency Product : Tomatoes, harvest age after 2 months – 3 months	
4	Neknang Village, Bakam District, Bangka Regency Product : Cucumber, harvest age after 3 months – 5 months	
5	Gunung Pelawan Village, Belinyu District, Bangka Regency Product : Long Beans, harvest age after 45 days	

Source: Field survey, 2022

Table 2. Identification Results of Intercrops in smallholder oil palm plantations in Central Bangka, West Bangka and South Bangka Regencies

No	Location	Description
1.	Pinang Sebatang Village, Simpang Katis District, Central Bangka Regency	
	Product: Long bean, harvest age after 45 days	
2	Tempilang Village, Tempilang District, West Bangka Regency	
	Product Tomatoes, harvest age after 2 months – 3 months	
3	Sinar Surya Village, Tempilang District, West Bangka Regency	
	Product: Long bean, harvest age after 45 days	
4	Simpang Rimba Village, Simpang Rimba District, South Bangka Regency	
	Product: Pineapple, harvest age after 18-24 months	

Source: Field survey, 2022

Not in every oil palm plantation it is easy to find farmers planting intercrops. This condition is due to the monoculture pattern of oil palm plantations, and the age of the oil palm plantations, in general, has entered the age of production (above 3 years). From the search results, only 18 farmers were found planting intercrops. Observations in smallholder oil palm plantations show that there are intercrops that are cultivated intensively and the planting layout is in an orderly manner and the produce is sold, but most of the other smallholders only manage sober intercrops. Socio-economic data of farmers who plant intercrops can be seen in Table 3 below.

Table 3. Data of farmers planting intercrops in smallholder oil palm plantations in Bangka

Uraian	Lowest	Highest
Level of education	SD	SMA
Age	38 th	52 th
Farming experience	6 th	20 th
Land area	2 ha	4 ha

Source: Field survey, 2022

The following farming analysis proves the farmer's statement that intercropping provides economic benefits for farmers, more clearly seen in Table 4. The income calculated in this study is only the income of intercropping farmers because the oil palm plantations have not yet produced but have already incurred costs. Therefore, with the increasing cost burden, namely the operating costs of oil palm plants and the operational costs of intercrops, the income from intercrops can still be overcome to reduce the burden on oil palm farmers who carry out replanting activities of old oil palm plants.

Table 4. Analysis of the average cost of intercropping farming in immature oil palm plantations, <https://equity.ubb.ac.id/index.php/equity> doi 10.33019/equity.v11i1

2022					
Oil palm plants			Intercrops		
Description	amount (Rp/month/ha)	Percentage (%)	Description	amount (Rp/month/ha)	Percentage (%)
Fix Cost			Fix Cost		
Hoe	6.250	3.5	Hoe	12.500	7,0
Machete	4.166	2.3	Machete	4.166	2,3
Chopper	2.916	1.6		-	
Rickshaw	8.333	4.6		-	
amount	21.665		amount	16.666	
Variabel Cost			Variabel Cost		
- SP 36	50.233	27.9	NPK	106.681	59,3
- Urea	80.736	44.9	Urea	89.528	49,8
- Dolomit	27.364	15.2	Dolomit	86.042	47,8
amount	158.153		amount	289.079	
Total Cost	179.818	100	Total Cost	305.745	100

Source: Results of primary data processing, 2022

In the calculations, the analysis of cucumber and long bean farming is used which is cultivated more intensively and the land area is measured and allows for calculations. Meanwhile, other crops such as tomatoes, pineapples, and cassava are only for farmers' daily consumption, and the number of plants is only small.

Table 5. Income Analysis of intercropping farming in immature oil palm plantations, 2022

Description	Amount / unit per month	
Number of plant	1.500	Stem
Production	450	Kg/ha
Price	8.000	Rp/kg
Revenue	3.600.000	Rp/ha
Cost per month	305.745	Rp/ha
Income	3.294.255	Rp/ha

Source: Results of primary data processing, 2022

Revenue from intercropping farming is the result of production multiplied by the selling price of the product. The amount of revenue depends on the price at the time the production is marketed. The average production of intercrop farming is 450 kg/ha/month with an average production selling price of Rp. 8000 / kg, so that an average income of IDR 3,600,000 / Ha/month after deducting farming costs is obtained, the income from intercropping plants is an average of IDR 3,294,255 Ha/ month. Intercrop farming income that has been deducted from oil palm farming costs is Rp. 3,114,437 /ha/month can cover the operational costs of young oil palm plants and the operational costs of intercrops.

The contribution of intercropping income to the cost of young oil palm plantations is the amount of contribution made by intercropping farming in covering the costs of smallholder oil palm plantations expressed as a percentage (%)

Table 6. Analysis of Income Contribution of intercropping farming in immature oil palm plantations, 2022

Description	Rp/ha (for 2 years)	
Oil palm farming costs	20.315.632	(a)
Intercrop income	74.746.488	(b)
Farm expenditure	72.000.000	(c)
Net income	2.746.488	(d= b-a-c)
Contribution of Intercrop income	0,135	(d/a)%

Source: Results of primary data processing, 2022

In this study, it is known that intercropping contributes 13.5% in covering these costs. This means that <https://equity.ubb.ac.id/index.php/equity> doi 10.33019/equity.v11i1

intercrops are feasible to cultivate to intercrop with immature oil palm plants so that they can cover the costs of oil palm farming before producing FFB.

5. CONCLUSION AND SUGGESTION

CONCLUSION

1. Intercrops cultivated by farmers in smallholder oil palm plantations on Bangka Island include long beans, cucumbers, tomatoes, cassava, and pineapples.
2. Intercrops contribute 13.5% in covering maintenance costs for young oil palm plantations. This means that intercrops are feasible to cultivate to intercrop with immature oil palm plants so that they can cover the costs of oil palm farming before producing FFB.

SUGGESTION

Considering that the contribution of intercropping is quite large for farmers in covering the costs of oil palm farming, it is necessary to provide intensive assistance from agricultural extension workers to provide knowledge for farmers in managing intercrops in the most economical way and at the same time optimally support the growth of the main crop, namely oil palm.

ACKNOWLEDGMENTS (times news roman 11, capital bold)

"Thank you to the University of Bangka Belitung for research funding through the Acceleration Research Scheme in 2022 with no LPPM Research Contract No: 282/H/UN50/L/PP /2022

REFERENCE

- Arifin, L., Irfan, M., Permanasari, I., Annisava, A. R., & Arminudin, A. T. (2016). Keanekaragaman serangga pada tumpangsari tanaman pangan sebagai tanaman sela di pertanaman kelapa sawit belum menghasilkan. *Jurnal Agroteknologi*, 7(1), 33-40.
- Afandi, A. B. (2014). Karakteristik radiasi matahari pertanaman kelapa sawit (implikasinya terhadap iklim mikro dan potensi tanaman sela).
- BPTP SU. Balai Pengkajian Teknologi Pertanian Sumatera Utara (2012). Pemanfaatan Lahan Sela di antara Tanaman Kelapa Sawit Belum Menghasilkan di Kabupaten Langkat.
- Hasibuan MI, WDU Parwati, H, Wirianata. (2017). Kajian Tumpang Sari Nanas Pada Berbagai Umur TBM Kelapa Sawit Di Perkebunan Rakyat. *Jurnal AGROMAST*, Vol.2 (1): 1-9.
- Hazzouri, K. M., Flowers, J. M., Visser, H. J., Khierallah, H. S., Rosas, U., Pham, G. M., & Purugganan, M. D. (2015). Whole genome re-sequencing of date palms yields insights into diversification of a fruit tree crop. *Nature Communications*, 6(1), 1-11.
- Junaidi (2020) Strategi Peningkatan Nilai Tambah Perkebunan Karet Melalui Diversifikasi Usaha. *AGRIEKONOMIKA*, Volume 9 (1): 72-89. <https://doi.org/10.21107/agriekonomika.v9i1.6928>.
- Kusumawati SA, S. Yahya, Hariyadi, S.I Mulatsih, DN. Istina. (2019). Analisis Pendapatan Usahatani Tumpangsari pada Peremajaan Kebun Kelapa Sawit Rakyat. *Income Analysis Intercropping Farming System on Smallholder Oil Palm Replanting Area. Buletin Palma Volume 20(1): 45 – 56.*
- Mulyani, A., & Las, I. (2008). Potensi sumber daya lahan dan optimalisasi pengembangan komoditas penghasil bioenergi di Indonesia. *Jurnal litbang pertanian*, 27(1), 31-41.
- Nazir, M. (2013). Metode Penelitian. Ghalia Indonesia. Bogor.
- Nurhayati, Usman, E.i Ritonga, I. Nur Istina. (2020). “Komoditas Sumber Pangan untuk Meningkatkan Kualitas Kesehatan di Era Pandemi Covid -19” Potensi Pengembangan <https://equity.ubb.ac.id/index.php/equity> doi 10.33019/equity.v11i1

- Tumpang Sari Kedelai di Perkebunan Kelapa Sawit Belum Menghasilkan di Provinsi Riau. Prosiding Seminar Nasional Lahan Suboptimal ke-8 Tahun 2020. Editor: Siti Herlinda et. al. Penerbit & Percetakan Universitas Sriwijaya (UNSRI): 741-747.
- Rochmah HF, Suwanto, AA. Muliastari. (2020). Optimasi Lahan Replanting Kelapa Sawit dengan Sistem Tumpang Sari Jagung (*Zea mays*) dan Kacang Tanah (*Arachis hypogaea*) . JURNAL SIMETRIK VOL.10 (1): 256-262.
- Saputra, H. (2018). artikel tumpang sari jagung dan kelapa sawit-1 Hadi Saputra.
- Sebayang, L. dan L. Winarto. (2014). Teknologi Budidaya Kedelai untuk Mengoptimalkan Sela Tanaman Kelapa Sawit yang Belum Menghasilkan (TBM). Medan: Balai Pengkajian Teknologi Pertanian Sumatera Utara.
- Sitorus, R dan Zasari, M. (2022). Analytical Hierarchy Process for Identification of Green Supply Chain Management of The Palm Oil Industry in Bangka Island. International Journal of Progressive Sciences and Technologies (IJPSAT, ISSN:2509-0119) Vol.35 No.1 Oktober 2022.
- Suherman, C., Soleh, M. A., Nuraini, A., & Fatimah, A. N. (2018). Pertumbuhan dan hasil tanaman cabai (*Capsicum* sp.) yang diberi pupuk hayati pada pertanaman kelapa sawit (*Elaeis guineensis* Jacq.) TBM I. Kultivasi, 17(2), 648-655.
- Suratijah, K. (2015). Ilmu Usahatani. Penebar Swadaya. Jakarta.
- Sutarta, E.S., S. Rahutomo, Winarna, E.N. Ginting, D. Wiratmoko, R. Nurkhoiry. (2012). Sistem Peremajaan Kelapa Sawit untuk Perkebunan Rakyat, Pusat Penelitian Kelapa Sawit
- Winarna, M.A. Yusuf, I. Pradiko, M. Syahrovy, dan E.S. Sutarta, (2015). Buku Pedoman Peremajaan Perkebunan Kelapa Sawit Rakyat (Bagian II). Pusat Penelitian Kelapa Sawit.
- Winarna, M.A. Yusuf, I. Pradiko, M. Syarovy, dan E.S. Sutarta, (2015). Buku Pedoman Peremajaan Perkebunan Kelapa Sawit Rakyat (Bagian II). Pusat Penelitian Kelapa Sawit.