

DETERMINING THE COMMODITIES AND PRIMARY AREAS OF THE PLANTATION CROP SUBSECTOR IN THE MERANTI ISLANDS REGENCY

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Article history:

Received
22 March 2024

Revised
3 June 2024

Accepted
5 July 2024

Available online
31 July 2024

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Abstract

Background: To enhance a region's economy, it is essential to implement a development strategy focused on key sectors. This includes identifying and leveraging the potential of the plantation crop subsector to create competitive, high-value agricultural activities that can increase regional income.

Purpose: This study aims to identify the key commodities and areas within each plantation crop subsector in Meranti Islands Regency, Riau Province.

Design/methodology/approach: It utilizes five years of production data (2017-2021) from the Central Bureau of Statistics of Meranti Islands Regency. Analytical methods used to identify the superior products of plantation crops include the Sectoral Contribution Index (IKS), Growth Ratio Model (MRP), Location Quotient (LQ), Dynamic Location Quotient (DLQ), Composite Index (IK) and Hot Spot (Getis-Ord G_i^*).

Findings/Result: The results indicate that the leading plantation crop commodities in Meranti Islands Regency are sago, coconut, coffee, and areca nut. These commodities are identified as the most promising based on their contribution, growth rate, production capacity to meet regional needs, export potential, and future prospects. The flagship areas are Tebing Tinggi Timur District for sago, Rangsang District for coconut, Rangsang Pesisir District for coffee, and Rangsang Barat District for areca nut. Thus, the government must make a plan for the development of plantations with the potential of each region that can improve the economy of the region.

Conclusion: The government must make a plan for the development of plantations with the potential of each region that can improve the economy of the region.

Originality/value (State of the art): This study uses GIS for spatial analysis and mapping of land potential based on factors such as soil fertility, rainfall, and topography.

Keywords: composite index, featured commodities, featured regions, plantation crop subsector, hot spot (Getis-Ord G_i^*)

How to Cite:

Harmaidi D, Yasid H, Siswati L. 2024. Determining the commodities and primary areas of the plantation crop subsector in the meranti islands regency. *Jurnal Manajemen & Agribisnis* 21(2): 211–224. <https://doi.org/10.17358/jma.21.2.211>

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INTRODUCTION

Meranti Islands Regency is the newest regency in Riau Province, established in 2009 after splitting from Bengkalis Regency. It consists of four main islands: Padang Island, Merbau Island, Tebing Tinggi Island, and Rangsang Island. The regency is renowned as one of the largest sago producers in both Indonesia and the world. Besides sago production, Meranti Islands Regency features five commodity sectors within the plantation industry, including coffee, coconut, and rubber plantations (Dinas Perkebunan dan Hortikultura Kabupaten Kepulauan Meranti, 2022; Statistik Tanaman Perkebunan, 2022)

Given the district's potential, regional planning and development should be optimized to enhance the focus and effectiveness of the five leading commodities in Meranti Islands Regency. Despite its potential, the regency has not achieved economic independence, as evidenced by the presence of underdeveloped and severely underdeveloped villages, leading to stagnant community incomes. One reason for the lack of progress is the failure to identify potential and regional economic development models, with a focus primarily on production (Bapelitbang Sikka Regency and Center for the Study of Development System Dynamics, 2023). Equitable development does not mean uniform development or the same industrialization across regions, but rather development tailored to regional needs (Rustiadi, Saefulhakim, and Panuju, 2018). Achieving regional development requires understanding the supporting factors, including the identification of superior commodities. To identify the leading plantation crop commodities, several analytical methods were employed, including the Sectoral Contribution Index (IKS), Growth Ratio Model (MRP), Location Quotient (LQ), Dynamic Location Quotient (DLQ), and Composite Index (IK). Each method has its advantages and disadvantages, so a combination of methods was used for optimal results. However, accelerated growth may face obstacles such as the suboptimal use of the comparative and competitive advantages of regional products (Hidayat and Supriharjo, 2014). In this context, superior commodities are those with strategic value based on physical factors like soil and climate conditions, as

well as socio-economic and institutional factors such as technological mastery, human resource capabilities, infrastructure, and socio-cultural conditions that can be developed in a specific region. The presence of superior commodities can facilitate agribusiness development efforts (Yuvanda, 2021).

The criteria and instruments for identifying superior commodities have been inconsistently applied, leading to mismanagement and counterproductive outcomes in their development. Determining the superior commodities in Meranti Islands Regency—sago, coffee, coconut, rubber, and areca nut—is crucial. This knowledge allows for a focused development strategy, prioritizing these commodities and enhancing their value, which can improve regional welfare.

Regional leading sectors have the potential to drive economic growth due to their unique advantages and criteria (Hajeri, Yurishintae, and Dolorosa, 2015). Development policies should therefore focus on these sectors to enhance economic growth. The influence of a leading sector extends beyond its geographic area, impacting other sectors through its growth rate, employment rate, inter-sectoral linkages, and value addition. A leading sector is characterized by a high growth rate, substantial employment, strong forward and backward linkages, and significant added value (Hajeri, Yurishintae, and Dolorosa, 2015).

Since agriculture is the primary livelihood in the region, it is essential to develop production centers that offer high added value and competitiveness based on local resources. To support the expansion of production capabilities, it is important to determine whether there is spatial concentration in the area.

Numerous studies have analyzed leading commodities in the plantation subsector, including research by Amaliah, Tufail, and Kadri (2020), Mulya et al. (2019), Nurmayenti, Syahrial, and Dermawan (2023), Nurfadhila (2020), and Rahayu, Saidah, and Risna (2021). However, similar research has not been conducted in Meranti Islands Regency. This study hypothesizes that certain plantation crop commodities are dominant in Meranti Islands Regency based on production volume, economic value, and planted area.

Table 1. Plantation land area

Commodity	Area (Ha)			Total	Production (Ton)	Productivity (Kg/Ha)	Farmer (KK)
	Immature Plants (TBM)	Plant Yielding (TM)	Old Damaged Plants (TTR)				
Sago	13.165	27.121	-	40.286	247.013	9.108	16.069
Coffee	1.274	1.027	140	2.241	1.913	1.863	2.063
Coconut	2.535	26.349	4.031	32.915	29.257	1.110	16.035
Rubber	2.126	12.636	6.194	20.956	13.426	982	12.402
Areca Nut	135	403	9	547	245	611	2.294

Source: Badan Pusat Statistik Kabupaten Kepulauan Meranti (2022)

METHODS

This study focuses on Meranti Islands Regency in Riau Province, conducted over eight months from March 2023 to November 2023. Data were collected from various sources, including the Central Statistics Agency, relevant literature, and information on leading food crop sectors. The Getis-Ord G_i^* Hotspot method was employed to delineate regional boundaries. Secondary data on plantation crops sago, coffee, coconut, rubber, and areca nut were obtained from the Central Bureau of Statistics and the Food Security and Agriculture Office of Meranti Islands Regency. The study utilized a 5-year time series approach (2017-2021), as short-term forecasting is considered more accurate than long-term forecasting (Ramandha et al. 2020). This approach, using data from the last 5 months, yielded a lower error rate (MSE) of 0.54 compared to a 10-month period. Additional data included harvest areas, regional overviews, population development, and shapefiles of sub-districts, accessed via the InaGeoportal website. Various analytical methods were applied to determine the leading food crop commodities:

Sectoral Contribution Index (IKS)

$$IKS = X_{ij} / X_{in}$$

Information: IKS (Sectoral Contribution Index); X_{ij} (The value of commodity production i at the sub-district level in 2017-2021); X_{in} (The value of commodity production at the district level in 2017 - 2021); i (Commodities of sago, coffee, coconut, areca nut and rubber); j (Each sub-district); n (Meranti Islands Regency); IKS = 0 (meaning that the sub-district in the district does not have a role or contribution in producing commodities); IKS = 1 (meaning that the sub-district in the district plays the largest and dominant role in producing commodities).

Growth Ratio Model (MRP)

$$MRP = (\Delta X_{ij} / X_{ij}) / (\Delta X_{in} / X_{in})$$

Information: MRP (Growth Ratio Model); ΔX_{ij} (Difference in commodity production value i at the sub-district level in 2017 – 2021); X_{ij} (The value of commodity production at the sub-district level in 2017 - 2021); ΔX_{in} (Changes in commodity production value i at the Regency level in 2017 – 2021); X_{in} (The value of commodity production i at the district level in 2017 – 2021); i (Commodities of sago, coffee, coconut, areca nut and rubber); j (Each sub-district); n (Meranti Islands Regency).

The MRP results describe the leading commodities with the following classifications:

MRP (+), meaning that the growth of production in the sub-district within the district is prominent.

MRP (-), meaning that the growth of production in the sub-district within the district is not prominent

Location Quotient (LQ)

$$LQ = (X_{ij} / X_j) / (Y_{in} / Y_n)$$

Information: LQ (Location Quotient); X_{ij} (Commodity production value i at the sub-district level in 2017 - 2021); X_j (The production value of the food crop subsector at the sub-district level in 2017 - 2021); Y_{in} (Value of commodity production at the district level in 2017 - 2021); Y_n (The production value of the food crop subsector at the district level in 2017 - 2021); i (Commodities of sago, coffee, coconut, areca nut and rubber); j (Each sub-district); n (Meranti Islands Regency)

LQ > 1: Indicates that the commodity is a growth driver with comparative advantages, capable of meeting regional needs and being exported.

LQ = 1: Signifies that the commodity has no comparative advantage and only meets regional needs without surplus.

LQ < 1: Shows that the commodity lacks comparative advantage, with local production insufficient to meet regional needs, requiring external supply.

Dynamic Location Quotient (DLQ)

$$DLQ = \frac{(1+g_{ij})/(1+g_j)}{(1+G_{in})/(1+G_n)}$$

Information: DLQ (Dynamic Location Quotient); g_{ij} (Average commodity rate i at the sub-district level in 2017 - 2021); g_j (Average growth rate of food crop subsector at the sub-district level in 2017 - 2021); G_{in} (Average growth rate of commodities i at the district level in 2017 - 2021); G_n (Average growth rate of food crop subsector at the district level in 2017-2021); i (Commodities of sago, coffee, coconut, areca nut and rubber); j (Each sub-district); n (Meranti Islands Regency)

DLQ > 1: Indicates that the growth rate of commodity i at the sub-district level exceeds its growth rate at the district level. This suggests that the commodity is promising and may become a future economic base.

DLQ < 1: Indicates that the growth rate of commodity i at the sub-district level is slower than its growth rate at the district level. This suggests that the commodity is less promising and unlikely to become a future economic base.

DLQ = 1: Indicates that the growth rate of commodity i at the sub-district level is proportional to its growth rate at the district level.

Composite Index (IK)

$$y = \frac{(X_{in}^- - X_{inMin}^-)}{(X_{inMax}^- - X_{inMin}^-)}$$

Information: y (*Scaling*); X_{in}^- (Average method value in commodity i in all sub-districts); X_{inMax}^- (The average method value is highest in commodity i in all sub-districts); X_{inMin}^- (The average value of the method is the lowest in commodity i in all sub-districts); X_i^- (Average IKS, MRP, LQ & DLQ values); i (Commodities of sago, coffee, coconut, areca nut and rubber); n (Meranti Islands Regency).

$$IK = (X_1 + X_2 + X_3 + X_4) / n$$

Information: IK (Composite Index); X_1 (Sectoral Contribution Index); X_2 (Growth Ratio Model); X_3 (Location Quotient); X_4 (Dynamic Location Quotient); n (Number of Indicators).

Each of these methods has its own advantages and disadvantages, so a combination of several analytical methods was used to provide optimal analysis results.

Hot Spot (Getis-Ord G_i^*)

One of the GIS-based spatial pattern analysis methods is *Hot Spot (Getis-Ord G_i^*)*. Hot Spot Analysis (*Getis-Ord G_i^**) is a GIS-based spatial statistical analysis used to determine spatial distribution patterns (Kurniawan and Sadali, 2015). The results of data processing with *Hot Spot analysis (Getis-Ord G_i^*)* are determined based on the Z-Score value which is the standard deviation value, while the *p-value* is the degree of confidence or *probability*. Mathematically, the formula for *Hot Spot analysis (Getis-Ord G_i^*)* is:

$$G_i^* = (X_i - \bar{X}) / SD$$

Information: G_i^* (*Hot Spot (Getis Ord- G_i^*)*); X_i (Commodity production i per sub-district in 2017 - 2021 (Tons/Year)); \bar{X} (Average commodity production i of all sub-districts in 2021 (Tons/Year)); SD (Standard deviation)

RESULTS

Top Commodities of Food Crops

Sectoral Contribution Index (IKS)

According to Hanif, Restuhadi, and Arifudin (2023), the Sectoral Contribution Index (IKS) ranges from 0 to 1, with higher values indicating that a commodity has superior production aspects compared to others. An index value close to 1 signifies that the commodity plays a significant and dominant role in the regional economy, potentially making it a key or base commodity. In Meranti Islands Regency, the highest contribution values are as follows (Table 2):

- Sago: Tebing Tinggi Timur District with an IKS value of 0.40 (40%).
- Coconut: Rangsang District with an IKS value of 0.43 (43%).
- Rubber: Tasik Putri Puyu District with an IKS value

- of 0.26 (26%).
- Coffee: Rangsang Pesisir District with an IKS value of 0.75 (75%).
- Areca Nut: West Rangsang District with an IKS value of 0.47 (47%).

Growth Ratio Model (MRP)

The Merbau sub-district exhibits the highest growth ratio for sago production, with a value of 1.62, the highest among all sub-districts in Meranti Islands Regency (Table 3). This indicates that the average growth rate of sago production in Merbau is 1.62 times faster than in other sub-districts from 2017 to 2021. Similarly, Tebing Tinggi Timur has the highest growth ratio for coconut production, with a value of 1.74, indicating that its growth rate is 1.74 times higher than the average in other sub-districts during the same period.

However, no sub-districts show a growth ratio for rubber commodities, as the average growth ratio has declined across nine sub-districts. In contrast, Pulau Merbau has the highest growth ratio for coffee production at 9.75, meaning its growth rate is 9.75 times higher than the average in other sub-districts from 2017 to 2021. Lastly, Rangsang sub-district leads in areca nut production with a growth ratio of 1.06, the highest in the Meranti Islands, although other sub-districts have very low growth ratios for this commodity.

According to Sudiyarti, Usman, and Irawan (2019), the Growth Ratio Model (MRP) analysis identifies several sectors with positive growth in the study and reference areas. These sectors are considered dominant growth drivers, reflecting an increase in economic growth structure.

Table 2. Average sectoral contribution index on plantation crop commodities in Meranti Islands Regency in 2017–2021

District	Sectoral Contribution Index				
	Sago	Coconut	Rubber	Coffee	Areca Nut
Tebing Tinggi	0.02	0.01	0.02	0.00	0.02
T. Tinggi barat	0.32	0.01	0.23	0.01	0.09
Rangsang	0.02	0.43	0.04	0.18	0.21
Rangsang Barat	0.01	0.09	0.07	0.13	0.47
Merbau	0.10	0.01	0.20	0.00	0.03
T. Tinggi Timur	0.40	0.07	0.13	0.02	0.04
Pulau Merbau	0.05	0.02	0.17	0.00	0.07
Rangsang Pesisir	0.09	0.22	0.04	0.75	0.06
Tasik Putri Puyu	0.14	0.01	0.26	0.00	0.04

Table 3. Average growth ratio model for plantation crops in Meranti Islands District in 2017 – 2021

District	Growth Ratio Model				
	Sago	Coconut	Rubber	Coffee	Areca Nut
Tebing Tinggi	0.00	0.00	-0.01	0.00	0.00
T. Tinggi barat	0.20	0.11	0.47	2.64	0.48
Rangsang	0.89	0.46	0.73	1.26	1.06
Rangsang Barat	0.29	0.00	0.00	0.66	0.50
Merbau	1.62	0.38	0.54	0.00	0.00
T. Tinggi Timur	0.69	1.74	0.31	0.00	0.00
Pulau Merbau	0.25	0.06	0.27	9.75	0.00
Rangsang Pesisir	0.15	0.50	0.65	0.00	0.00
Tasik Putri Puyu	0.11	0.11	0.87	0.00	0.00

Location Quotient (LQ)

Five sub-districts exhibit an average Location Quotient (LQ) value greater than 1 for sago commodities: Tebing Tinggi (1.01), Tebing Tinggi Barat (1.13), Merbau (1.07), Tebing Tinggi Timur (1.13), and Tasik Putri Puyu (1.06) (Table 4). These sub-districts have comparative advantages, allowing them to meet regional needs and also export beyond their borders. For coconut commodities, three sub-districts stand out: Rangsang (7.62), Rangsang Barat (4.98), and Rangsang Pesisir (2.66). For rubber commodities, five sub-districts show high LQ values: Tebing Tinggi (1.27), Rangsang Barat (2.85), Merbau (1.96), Merbau Island (3.05), and Tasik Putri Puyu (1.93). Coffee commodities have three leading sub-districts: Rangsang (2.74), Rangsang Barat (5.68), and Rangsang Pesisir (7.20). For areca nut commodities, four sub-districts are notable: Tebing Tinggi (1.23), Rangsang (3.42), Rangsang Barat (1.08),

and Merbau Island (1.32). According to Arundaa, Hermadi, and Monintja (2017), using LQ alone for location analysis is insufficient for determining industrial sites, as it considers only production volume. Nonetheless, LQ analysis can offer valuable insights into potential alternative development locations.

Dynamic Location Quotient (DLQ)

Nine sub-districts exhibit an average Dynamic Location Quotient (DLQ) value greater than 1 for sago commodities (Table 5): Tebing Tinggi (1.00), Tebing Tinggi Barat (1.00), Rangsang (1.01), Rangsang Barat (1.00), Merbau (1.00), Tebing Tinggi Timur (1.00), Merbau Island (1.00), Rangsang Pesisir (1.00), and Tasik Putri Puyu (1.00). This indicates that sago commodities in these regions have significant potential for development.

Table 4. Average location quotient on plantation crops in Meranti Islands Regency in 2017 – 2021

District	Average LQ				
	Sago	Coconut	Rubber	Coffee	Areca Nut
Tebing Tinggi	1.01	0.84	1.27	0.00	1.23
T. Tinggi barat	1.13	0.07	0.80	0.03	0.35
Rangsang	0.22	7.62	0.50	2.74	3.42
Rangsang Barat	0.38	4.98	2.85	5.68	1.08
Merbau	1.07	0.07	1.96	0.00	0.33
T. Tinggi Timur	1.13	0.27	0.35	0.05	0.13
Pulau Merbau	0.98	0.40	3.05	0.06	1.32
Rangsang Pesisir	0.78	2.66	0.41	7.20	0.58
Tasik Putri Puyu	1.06	0.14	1.93	0.00	0.30

Table 5. Average dynamic location quotient on plantation crops in Meranti Islands Regency in 2017 - 2021

District	Average LQ				
	Sago	Coconut	Rubber	Coffee	Areca Nut
Tebing Tinggi	1.00	1.00	1.00	1.01	0.99
T. Tinggi barat	1.00	1.00	1.00	1.03	1.00
Rangsang	1.01	1.00	1.01	1.02	1.00
Rangsang Barat	1.00	1.00	0.99	1.02	0.99
Merbau	1.00	0.98	0.98	0.98	0.96
T. Tinggi Timur	1.00	1.00	0.99	1.00	0.98
Pulau Merbau	1.00	1.00	1.00	1.09	0.99
Rangsang Pesisir	1.00	1.00	1.01	1.01	0.99
Tasik Putri Puyu	1.00	1.00	1.01	1.01	0.99

According to Fabiany (2021), DLQ analysis is essential for assessing the future repositioning of sectors and sub-sectors. It helps determine whether certain sectors will continue as base sectors or if previously non-base sectors have the potential to become key sectors in the future. For coconut commodities, all sub-districts except Merbau have an average DLQ value greater than 1. For rubber commodities, six sub-districts have an average DLQ value exceeding 1: Tebing Tinggi (1.00), Merbau Island (1.00), Tebing Tinggi Barat (1.00), Tasik Putri Puyu (1.01), Rangsang (1.01), and Rangsang Pesisir (1.01). Eight sub-districts have an average DLQ value greater than 1 for coffee commodities, excluding Merbau (0.98). For areca nut commodities, only two sub-districts have an average DLQ value above 1: Rangsang (1.00) and Tebing Tinggi Barat (1.00).

Composite Index (IK)

Table 6 presents the IK values for sago commodities across various analytical methods (IKS, MRP, LQ, DLQ). After aggregating and averaging these values, the Tebing Tinggi Timur sub-district achieved the highest average IK score of 80.37 for sago commodities. This sub-district leads due to its high scores in IKS (100), MRP (100), LQ (99.78), and DLQ (21.71). Tebing Tinggi Timur is identified as the top performer in sago commodities, with a 40% contribution, and exhibits a growth ratio of 1.74, surpassing the district average. This sub-district meets the criteria for a base sector and holds significant potential for further development and prosperity.

Table 7 presents the IK value for coconut commodities, derived by scaling and averaging the scores from the IKS, MRP, LQ, and DLQ methods. Rangsang sub-district achieves the highest average IK score of 76.39 for coconut commodities. This superior score reflects Rangsang's strong performance across all four analytical methods (IKS: 100, MRP: 26.27, LQ: 100, DLQ: 79.30), making it the leading producer of coconut commodities with a 43% contribution compared to other sub-districts. Additionally, Rangsang's average growth ratio for coconut production is 0.46 times faster than the district average. Given these factors, Rangsang sub-district is well-positioned to become a key base sector in the future.

Table 8 shows the Index of Key Sectors (IK) value for rubber commodities. This value, calculated by scaling, summing, and averaging scores from the IKS, MRP, LQ, and DLQ methods, results in an IK score of 81.57 for Pulau Merbau sub-district. Pulau Merbau's high score is due to its strong performance in all analysis methods (IKS: 61.43, MRP: 100, LQ: 100, DLQ: 62.8). It ranks fourth in contribution among sub-districts with 17% and has a growth ratio for rubber commodities 9.75 times faster than the district average. Despite these strengths, the current growth rate suggests that rubber commodities in Pulau Merbau may not be a significant focus for future development.

Table 6. Scaling IKS, MRP, LQ, DLQ & Composite Index Assessment on Sago Commodities in Sub-districts within Meranti Islands Regency

District	IKS	MRP	LQ	DLQ	Scaling IKS	Scaling MRP	Scaling LQ	Scaling DLQ	IK
Tebing Tinggi	0.02	0.00	1.01	1.00	1.64	0.00	87.25	48.61	34.37
T. Tinggi barat	0.32	0.11	1.13	1.00	80.49	6.62	100.00	36.23	55.83
Rangsang	0.02	0.46	0.22	1.01	1.64	26.27	0.00	100.00	31.98
Rangsang Barat	0.01	0.00	0.38	1.00	0.00	0.00	17.29	67.23	21.13
Merbau	0.10	0.38	1.07	0.99	24.15	22.18	93.55	0.00	34.97
T. Tinggi Timur	0.40	1.74	1.13	1.00	100.00	100.00	99.78	21.71	80.37
Pulau Merbau	0.05	0.06	0.98	1.00	11.01	3.73	83.12	35.41	33.32
Rangsang Pesisir	0.09	0.50	0.78	1.00	19.50	28.73	61.98	37.00	36.80
Tasik Putri Puyu	0.14	0.11	1.06	1.00	34.04	6.47	92.81	33.18	41.63

Table 7. Scaling IKS, MRP, LQ, DLQ & Composite Index assessment on coconut commodities in sub-districts within Meranti Islands Regency

District	IKS	MRP	LQ	DLQ	Scaling IKS	Scaling MRP	Scaling LQ	Scaling DLQ	IK
Tebing Tinggi	0.01	0.00	0.84	1.00	0.98	0.00	10.20	100.00	27.80
T. Tinggi barat	0.01	0.11	0.07	1.00	1.98	6.62	0.00	84.59	23.30
Rangsang	0.43	0.46	7.62	1.00	100.00	26.27	100.00	79.30	76.39
Rangsang Barat	0.09	0.00	4.98	1.00	21.01	0.00	65.07	87.94	43.50
Merbau	0.01	0.38	0.07	0.98	0.00	22.18	0.09	0.00	5.57
T. Tinggi Timur	0.07	1.74	0.27	1.00	15.83	100.00	2.74	85.85	51.10
Pulau Merbau	0.02	0.06	0.40	1.00	2.62	3.73	4.39	77.36	22.02
Rangsang Pesisir	0.22	0.50	2.66	1.00	50.14	28.73	34.34	99.65	53.21
Tasik Putri Puyu	0.01	0.11	0.14	1.00	2.08	6.47	1.02	89.64	24.80

Table 8. Scaling IKS, MRP, LQ, DLQ & Composite Index assessment on rubber commodities in sub-districts within Meranti Islands Regency

District	IKS	MRP	LQ	DLQ	Scaling IKS	Scaling MRP	Scaling LQ	Scaling DLQ	IK
Tebing Tinggi	0.02	-0.01	1.27	1.00	0.00	0.00	34.04	62.58	24.16
T. Tinggi barat	0.23	0.47	0.80	1.00	87.70	4.89	16.72	82.09	47.85
Rangsang	0.04	0.73	0.50	1.01	6.45	7.53	5.47	95.84	28.82
Rangsang Barat	0.07	0.00	2.85	0.99	22.41	0.09	92.60	53.51	42.15
Merbau	0.20	0.54	1.96	0.98	75.09	5.59	59.61	0.00	35.07
T. Tinggi Timur	0.13	0.31	0.35	0.99	43.71	3.25	0.00	44.86	22.96
Pulau Merbau	0.17	9.75	3.05	1.00	63.41	100.00	100.00	62.88	81.57
Rangsang Pesisir	0.04	0.04	0.41	1.01	9.50	0.54	2.15	100.00	28.05
Tasik Putri Puyu	0.26	0.87	1.93	1.01	100.00	9.05	58.36	95.03	65.61

Table 9 shows the IK value for coffee commodities. After scaling and averaging scores from the IKS, MRP, LQ, and DLQ methods, Rangsang Pesisir sub-district achieved the highest IK score of 56.08. This score reflects its exceptional performance across the methods (IKS: 100, MRP: 0.00, LQ: 100, DLQ: 24.31). Rangsang Pesisir stands out as the leading producer of coffee commodities, contributing 75% of the total. It also has an average growth ratio of 0.00 compared to the district level, meeting the base sector criteria and showing strong potential for future development as a base sector.

Table 10 presents the IK value for areca nut commodities. This value, obtained by scaling, summing, and averaging scores from the IKS, MRP, LQ, and DLQ methods, results in an IK score of 83.55 for Rangsang

Barat sub-district. This high score reflects Rangsang Barat's strong performance across all methods (IKS: 100, MRP: 47.67, LQ: 100, DLQ: 86.51). The sub-district leads in areca nut production, with the highest contribution of 47% among other sub-districts and an average production growth ratio of 0.50 times faster than the district level. It also demonstrates significant potential to become a key base sector in the future.

The determination of featured areas begins with categorizing each value according to the Composite Index. This index is divided into five classes: very low, low, medium, high, and very high. The highest and lowest values are identified within the Composite Index for plantation crops. The categories of the Composite Index are detailed in Table 11.

Table 9. Scaling IKS, MRP, LQ, DLQ & Composite Index assessment on coffee commodities in sub-districts within Meranti Islands Regency

District	IKS	MRP	LQ	DLQ	Scaling IKS	Scaling MRP	Scaling LQ	Scaling DLQ	IK
Tebing Tinggi	0.00	0.00	0.00	1.01	0.00	0.00	0.00	28.11	7.03
T. Tinggi barat	0.01	2.64	0.03	1.03	0.97	27.12	0.41	51.00	19.88
Rangsang	0.18	1.26	2.74	1.02	24.42	12.94	38.11	33.48	27.24
Rangsang Barat	0.13	0.66	5.68	1.02	18.08	6.82	78.84	33.04	34.20
Merbau	0.00	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
T. Tinggi Timur	0.02	0.00	0.05	1.00	2.52	0.00	0.76	14.91	4.55
Pulau Merbau	0.00	9.75	0.06	1.09	0.39	100.00	0.78	100.00	50.29
Rangsang Pesisir	0.75	0.00	7.20	1.01	100.00	0.00	100.00	24.31	56.08
Tasik Putri Puyu	0.00	0.00	0.00	1.01	0.00	0.00	0.00	24.23	6.06

Table 10. Scaling IKS, MRP, LQ, DLQ & Composite Index assessment on areca nut commodities in district in Meranti Islands Regency

District	IKS	MRP	LQ	DLQ	Scaling IKS	Scaling MRP	Scaling LQ	Scaling DLQ	IK
Tebing Tinggi	0.02	0.00	1.23	0.99	0.00	0.00	5.25	83.18	22.11
T. Tinggi barat	0.09	0.48	0.35	1.00	16.33	45.58	1.06	100.00	40.74
Rangsang	0.21	1.06	3.42	1.00	42.15	100.00	15.72	95.88	63.44
Rangsang Barat	0.47	0.50	21.08	0.99	100.00	47.67	100.00	86.51	83.55
Merbau	0.03	0.00	0.33	0.96	3.00	0.00	0.94	0.00	0.99
T. Tinggi Timur	0.04	0.00	0.13	0.98	5.65	0.00	0.00	44.13	12.44
Pulau Merbau	0.07	0.00	1.32	0.99	11.02	0.00	5.70	65.07	20.45
Rangsang Pesisir	0.06	0.00	0.58	0.99	8.75	0.00	2.14	71.92	20.70
Tasik Putri Puyu	0.04	0.00	0.30	0.99	4.60	0.00	0.83	71.70	19.28

Table 11. Composite index classification in the plantation crop subsector in Meranti Islands District

District	Composite Index				
	Sago	Coconut	Rubber	Coffee	Areca Nut
Tebing Tinggi	Very Low	Very High	Very Low	Medium	High
Tebing Tinggi Barat	Very High	High	Medium	Very High	Low
Rangsang	High	Low	Very Low	Low	Medium
Rangsang Barat	Low	Low	Very Low	Very Low	Low
Merbau	Low	Medium	Low	Very Low	Very Low
T. Tinggi Timur	Low	Low	Very High	Very Low	Low
Pulau Merbau	Very Low	Very Low	Low	Tinggi	Very High
Rangsang Pesisir	High	High	Low	Very Low	Very Low
Tasik Putri Puyu	Very High	Low	Medium	Very High	Low

Spatial Pattern Analysis Using Getis-Ord Hot Spot Analysis Gi*

One GIS-based spatial pattern analysis method is the Hot Spot Getis-Ord Gi*. This spatial statistical analysis, used to determine spatial distribution patterns, is applied in various fields (Kurniawan and Sadali, 2015). It has been utilized in studies such as

Aghajani et al. (2017) for analyzing vehicle accident patterns on highways, Mutheni et al. (2018) for epidemiological research, Gastineau et al. (2019) for animal conservation, and Ijumulana et al. (2020) for environmental health studies. Results from the Getis-Ord Gi* Hot Spot analysis are based on the Z-Score, which measures standard deviation, and the p-value, which indicates the degree of confidence or probability.

Leading Areas of Plantation Crop Commodities

Sago

In Table 11, it can be seen that Tebing Tinggi Timur District has a Hot Spot (Z-score = 2.04) and significant (P-Value = 0.01). The Hot Spot pattern shows that the majority of sago production is classified as grouped in East Tebing Tinggi District and if mapped, it can be seen in Figure 1.

Table 11. Gi* Z-Score & Gi* P-Value on Sago Commodities in Meranti Islands Regency

District	Average Production	Gi Z-Score	Gi P-Value
Tebing Tinggi	3,210.26	-0.84	Not Significant
T. Tinggi barat	66,486.22	1.47	Not Significant
Rangsang	3,212.29	-0.84	Not Significant
Rangsang Barat	1,894.07	-0.89	Not Significant
Merbau	21,277.24	-0.18	Not Significant
T. Tinggi Timur	82,147.22	2.04	Hot Spot
Pulau Merbau	10,728.25	-0.56	Not Significant
Rangsang Pesisir	17,544.26	-0.32	Not Significant
Tasik Putri Puyu	29,213.74	0.11	Not Significant

Coconut

In Table 12, it can be seen that Rangsang sub-district has a Hot Spot (Z-score = 2.48) and significant (P-Value = 0.01). The Hot Spot pattern shows that the majority of coconut production is classified as grouped in Rangsang sub-district and if the mapped can be seen in Figure 2.

Table 12. Gi* Z-Score & Gi* P-Value on Coconut Commodities in Meranti Islands Regency

District	Average Production	Gi Z-Score	Gi P-Value
Tebing Tinggi	321.54	-0.65	Not Significant
T. Tinggi barat	460.95	-0.62	Not Significant
Rangsang	14,133.80	2.48	Hot Spot
Rangsang Barat	3,115.68	-0.02	Not Significant
Merbau	184.35	-0.68	Not Significant
T. Tinggi Timur	2,392.07	-0.18	Not Significant
Pulau Merbau	549.94	-0.60	Not Significant
Rangsang Pesisir	7,178.24	0.90	Not Significant
Tasik Putri Puyu	474.10	-0.62	Not Significant

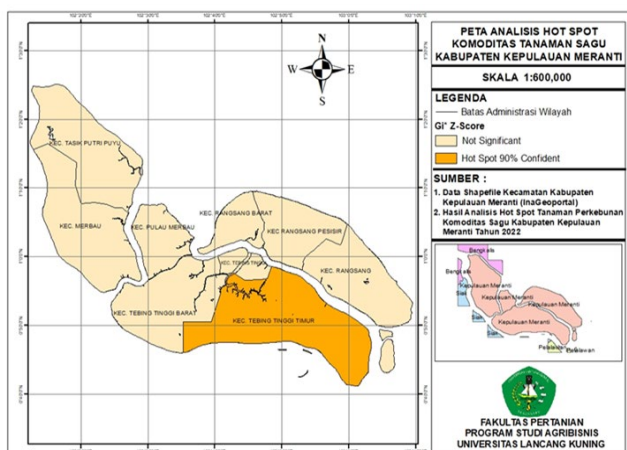


Figure 1. Hot Spot Map (Getis Ord Gi*) of Sago Commodities in Meranti Islands Regency in 2023

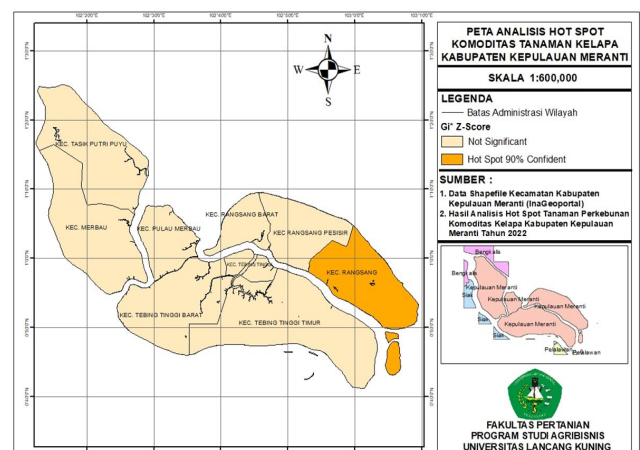


Figure 2. Hot Spot Map (Getis Ord Gi*) of Coconut Commodities in Meranti Islands Regency in 2023

Rubber

In the Table 13, it can be seen that all sub-districts in Meranti Islands Regency have a Random pattern (Z-Score = -1.28 – 1.54. That is, the majority of rubber production is classified as not clustered nor spread and insignificant.

Coffee

In Table 14, it can be seen that Rangsang Pesisir sub-district has a Hot Spot (Z-score = 2.72) and significant (P-Value = 0.04). The Hot Spot pattern shows that the

majority of coffee production is classified as grouped in Rangsang Pesisir District and if mapped, it can be seen in Figure 3.

Areca Nut

In Table 15, it can be seen that Rangsang Barat sub-district has a Hot Spot (Z-score = 2.60) and significant (P-Value = 0.08). The Hot Spot pattern shows that the majority of areca nut production is classified as grouped in West Rangsang District and if mapped, it can be seen in Figure 4.

Table 13. Gi* Z-Score & Gi* P-Value on Rubber Commodities in Meranti Islands Regency

District	Average Production	Gi Z-Score	Gi P-Value
Tebing Tinggi	203.14	-1.28	Not Significant
T. Tinggi barat	2,348.02	1.19	Not Significant
Rangsang	360.98	-1.09	Not Significant
Rangsang Barat	751.29	-0.65	Not Significant
Merbau	2,039.55	0.84	Not Significant
T. Tinggi Timur	1,272.06	-0.05	Not Significant
Pulau Merbau	1,753.98	0.51	Not Significant
Rangsang Pesisir	435.38	-1.01	Not Significant
Tasik Putri Puyu	2,648.73	1.54	Not Significant

Table 14. Gi* Z-Score & Gi* P-Value on Coffee Commodities in Meranti Islands Regency

District	Average Production	Gi Z-Score	Gi P-Value
Tebing Tinggi	-	-0.53	Not Significant
T. Tinggi barat	12.39	-0.50	Not Significant
Rangsang	311.42	0.26	Not Significant
Rangsang Barat	230.55	0.06	Not Significant
Merbau	-	-0.53	Not Significant
T. Tinggi Timur	32.16	-0.45	Not Significant
Pulau Merbau	4.92	-0.52	Not Significant
Rangsang Pesisir	1,275.04	2.72	Hot Spot
Tasik Putri Puyu	-	-0.53	Not Significant

Table 15. Gi* Z-Score & Gi* P-Value on Areca Nut Commodities in Meranti Islands Regency

District	Average Production	Gi Z-Score	Gi P-Value
Tebing Tinggi	3.60	-0.70	Not Significant
T. Tinggi barat	19.24	-0.16	Not Significant
Rangsang	43.95	0.69	Not Significant
Rangsang Barat	99.32	2.60	Hot Spot
Merbau	6.48	-0.60	Not Significant
T. Tinggi Timur	9.01	-0.52	Not Significant
Pulau Merbau	14.15	-0.34	Not Significant
Rangsang Pesisir	11.98	-0.41	Not Significant
Tasik Putri Puyu	8.00	-0.55	Not Significant

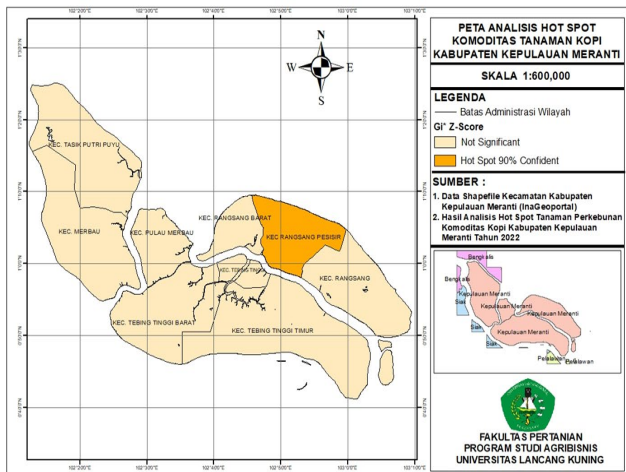


Figure 3. Hot Spot Map (Getis Ord G_i^*) of Coffee Commodities in Meranti Islands Regency in 2023

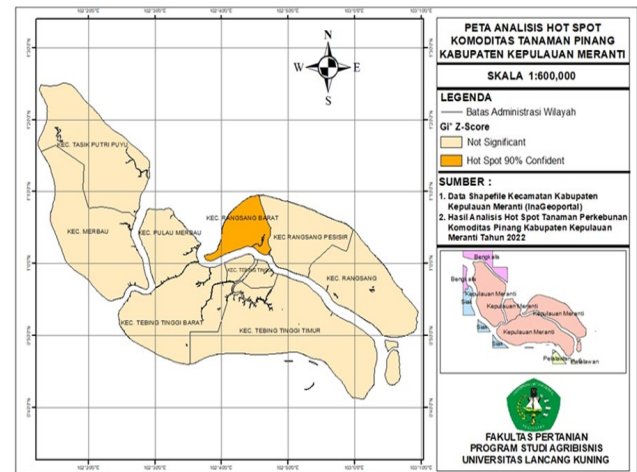


Figure 4. Hot Spot Map (Getis Ord G_i^*) of Areca Nut Commodities in Meranti Islands Regency in 2023

The determination of the production area of plantation crops in this study is quite different when compared to other studies. For example, research conducted by (Delviana et al. 2019) which analyzed the distribution of superior commodities in the development of agropolitan areas in Malacca Regency. The analysis of superior products is based on sub-district units so that superior products are developed in several sub-districts. Almost the same as research (Agus, 2017) which conducts superior product analysis based on sub-district units so that the analysis of area determination becomes more general. Slightly different, (Novitasari and Ayuningtyas, 2018) identify superior commodities at the sub-district level, but without referring to detailed locations or villages in determining their superior commodity development areas.

Managerial Implications

The managerial implications of this study can include several important things:

1. Strategic Decision Making:

- **Investment Priorities:** This research will assist managers and policymakers in determining which commodities and regions should be the main focus for investment. By knowing the superior commodities, the government can plan resource allocation more efficiently.
- **Infrastructure Development:** The findings from the study can influence decisions related to the development of infrastructure such as roads, storage facilities, or processing facilities in the selected area.

2. Resource Planning and Management:

- **Extension and Training:** The government and related institutions/agencies can design training and extension programs for farmers in the prime areas to improve their skills and productivity according to the targeted commodities.
- **Risk Management:** Identification of key commodities and regions can help in designing risk mitigation strategies, such as climate or market risks, that could affect plantation yields.

3. Policy Development:

- **Policy Support:** The results of the study can be the basis for the development of local government policies related to subsidies, incentives, or support for the development of plantation crop subsectors.
- **Regulations and Standards:** Findings about the area of excellence may require adjustments in regulations and standards to ensure sustainable management and development.

4. Improvement of Economic Well-Being:

- **Job Creation:** A focus on commodities and superior regions can create new job opportunities in the plantation sector, from production to marketing.
- **Farmer Income:** By identifying commodities that have high market potential, farmers can increase their income through more valuable products and better market demand.

5. Marketing and Export:

- **Marketing Strategies:** The findings from the research can be used to formulate more effective marketing strategies for superior commodities, both in domestic and international markets.

- Export Market Development: Identifying commodities that have advantages can help in designing strategies for export market penetration, increasing regional income from the agricultural sector.

Overall, the results of this study can provide strategic guidance for the development of plantation crop subsectors, help in better planning, and increase managerial effectiveness in the management and development of the agricultural sector in Meranti Islands Regency.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The leading plantation crop commodities in Meranti Islands Regency are sago, coconut, coffee, and areca nut. These commodities excel in terms of contribution, growth rate, and production capacity, meeting regional needs and possessing export potential. They are well-positioned to become significant economic drivers in the future. Specifically, the top producing areas are Tebing Tinggi Timur for sago, Rangsang for coconut, Tasik Putri Puyu for rubber, Rangsang Pesisir for coffee, and Rangsang Barat for areca nut.

Recommendations

To enhance the competitiveness of these plantation crop sub-sectors, it is recommended that the Meranti Islands Regency Government incorporate the development of agropolitan superior areas into the Regional Medium-Term Development Plan for 2023–2028, with policies tailored to address regional disparities. Furthermore, farmers should focus on maintaining and improving cultivation practices in the identified leading sub-districts, which could serve as benchmarks for other areas within the regency. Future research should explore additional analytical methods to further refine the identification of superior regions and commodities

FUNDING STATEMENT: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CONFLICTS OF INTEREST: The authors declare no conflict of interest.

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