Implications of the application of rafaksi on cassava farmers' income in Central Lampung Regency

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Abstract. This study aims to analyze starch content, production costs, and farmers' income for three cassava seed varieties (Adira 4, Garuda, and Sekoci) in Central Lampung Regency, and to evaluate the implications of the rafaksi standard imposed by tapioca factories on farmers' income. Data were collected through interviews with 174 farmers and analyzed using the Luff-Schoorl method for starch content and the revenue-to-cost (R/C) ratio to assess the relationship between costs and income. The results show that the Adira 4 variety has the highest starch content at 33.64%, compared to Garuda and Sekoci. However, the application of an 43% rafaksi reduced farmers' income, making cassava farming unprofitable. In the case of Adira 4, cash costs accounted for 76.24% of total revenue, while total costs reached 108.18% of total revenue, resulting in a net loss of IDR 1,923,072. A similar pattern was observed in the Garuda and Sekoci varieties, where the proportion of total costs exceeded revenue, resulting in a total income loss. These losses indicate a need to review the base price policy and implement a lower, fairer rafaksi standard to improve farmers' welfare, while taking into account the potential benefits of high-starch cassava varieties.

1 Introduction

Cassava (*Manihot esculenta*) is a major industrial food crop in Indonesia, used primarily as a raw material for food and processed products such as tapioca flour. Lampung Province is Indonesia's largest cassava producer, and its share of national output increased from 39.74% in 2022 to 43.11% in 2023 and 47.32% in 2024, with production of 7,906,179 ton out of a national total of 16,706,443 ton [1]. The upward trajectory in Lampung's share indicates sustained expansion of production capacity, bringing the province close to one half of national cassava output over the last three years. At the intra-provincial level (Figure 1), Central Lampung Regency records the highest cassava output in Lampung, contributing

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44.0% (3.01 million ton), exceeding North Lampung (21.6%), East Lampung (15.5%), Tulang Bawang (11.6%), and West Tulang Bawang (7.2%) [1]. Given the magnitude of this contribution, adjustments in pricing mechanisms and trading arrangements for cassava in Lampung may affect farm-household incomes, including in Central Lampung as a key production node within the provincial cassava supply chain [2].

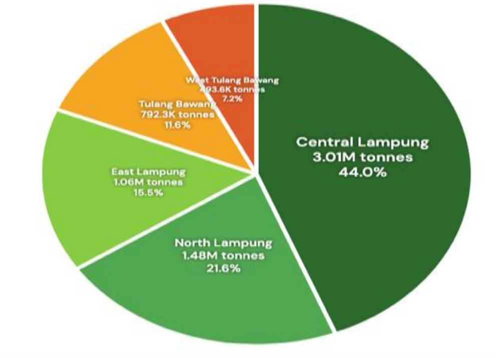

Fig. 1. Cassava production in Lampung Province by regency (2023)
Source: Pusat Data dan Sistem Informasi Pertanian (2024)

Figure 2 illustrates the average cassava price trend at the farmer level in Lampung Province from 2021 to 2025. Overall, prices show an upward trend during this period. In 2021, the average price was recorded at IDR 775 per kilogram, which then saw a significant increase to IDR 1,024 per kilogram in 2022, reflecting a 32.1% rise. In 2023, the price slightly decreased to IDR 970 per kilogram, but it resumed its increase in 2024 and 2025, reaching IDR 1,241 per kilogram and IDR 1,350 per kilogram, respectively [3]. While the price data shows an upward trend in nominal cassava prices at the farmer level, the real income received by farmers may not necessarily rise proportionally. Cassava farmers' income is not solely determined by the price per kilogram, but also by the quality assessment and net weight measurement mechanisms employed by the industry and traders.

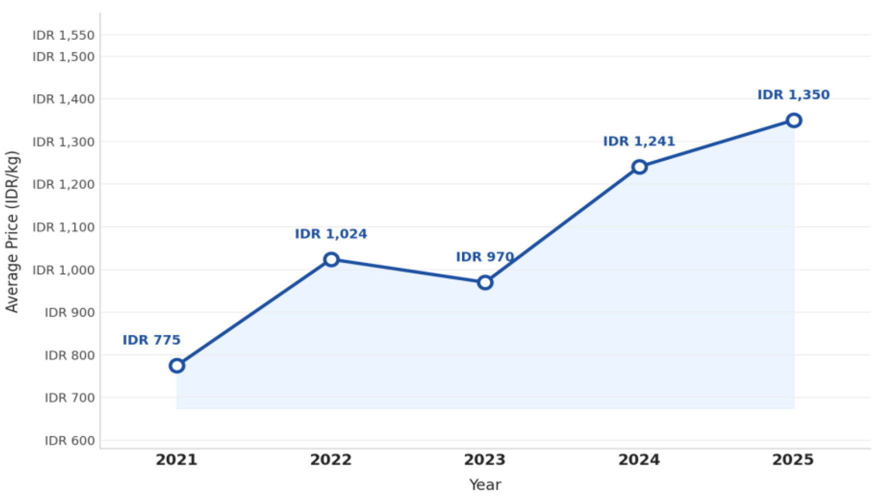

Fig. 2. Graph of the average cassava price at the farmer level in Central Lampung 2021-2025
Source: Dinas Tanaman Pangan dan Hortikultura (2025)

Cassava production, the primary raw material for tapioca flour, involves two main types of costs: fixed and variable costs. Fixed costs include expenditures that remain unchanged regardless of production volume, such as land rental, equipment depreciation, machine repairs, and loan interest [4]. In contrast, variable costs depend on production scale and include expenses for seeds, pesticides, organic and chemical fertilizers, and external labor required for the production process. The tapioca flour production process, which involves transforming cassava into various product forms, incurs additional costs, including processing, transportation, and packaging [4]. Understanding these production costs is critical for farmers and producers to evaluate profitability and optimize production efficiency [5]. Cassava farming per hectare without rafaksi results in a total production cost of IDR 21,737,500, with a total output of 26,832 kg [6]. Labor costs and production inputs, such as seeds, fertilizers, and pesticides, make up the main cost components. At a selling price of IDR 1,350 per kilogram, the net income generated is approximately IDR 14,485,700, with a cost-to-revenue ratio (R/C) of 1.67. However, production costs can rise further with the implementation of a rafaksi system in tapioca processing factories. Rafaksi, a weight deduction method used to assess cassava quality, can significantly affect farmer income, particularly for those cultivating cassava with low starch content or lower quality [7].

The variation in cassava starch quality, largely influenced by differences in seed varieties, has become increasingly complex [8]. In Central Lampung, three common cassava varieties are Adira 4, Garuda, and Sekoci. While these varieties have different agronomic characteristics, research on starch content and moisture levels—two key factors determining cassava quality and market value—remains limited. Factories typically assess cassava quality based on starch content, variety, harvest age, and the presence of foreign matter or impurities at harvest. Cassava with high starch content and low impurities will command a higher market price, while cassava with lower starch content and higher impurity levels will experience greater weight deductions [7]. Therefore, farmers growing lower-quality varieties will face higher costs due to the weight deductions in the rafaksi system [9]. Rafaksi determination, often unilaterally made by factories without standardized criteria, can add to the financial burden on farmers and lead to disputes regarding fair pricing.

The government, through Governor Instruction No. 2 of 2025, has set a base price for cassava at IDR 1,350 per kilogram, with a 30% rafaksi deduction for industrial factories in Lampung Province [10]. This decision overlooks starch content, which significantly influences factory yields and profitability in the tapioca production process. The policy and its implementation suggest the need for further research to determine how rafaksi affects net farmer income through cost allocation mechanisms that directly reduce the value received by farmers. Moreover, it is crucial to understand how differences in seed varieties, which influence starch content and moisture levels, are related to the magnitude of rafaksi deductions applied by factories. This study aims to analyze the implications of rafaksi implementation on cassava farmers' incomes in Central Lampung Regency, specifically focusing on how starch content, influenced by seed variety, can explain the income disparities among cassava farmers.

2 Research methods

2.1 Research location

The research on testing starch and moisture content was conducted at the Agricultural Product Technology Laboratory, Lampung State Polytechnic. The selection of the cassava research locations was carried out purposively, taking into account two main considerations: (1) production volume and harvest area, and (2) the availability of processing industries (tapioca factories) as a market.

Cassava serves as the primary raw material for the production of tapioca flour, which is widely used in the food, feed, and industrial sectors [7]. Central Lampung Regency is one of the largest cassava-producing regions in Lampung Province, with a total cassava production of 3,286,998.43 tons from 28 districts in 2024 [3]. The abundant supply of cassava supports the development of tapioca flour processing industries in the Central Lampung area. Bandar Mataram District was selected as the primary site due to its status as the largest cassava producer, with a production of 369,835.28 tons in 2024 [3], supported by seven tapioca factories that function as off-takers. In contrast, Gunung Sugih District is characterized by medium-scale production, with cassava production of 232,208.21 tons in 2024, supported by three tapioca factories [3]. This study was conducted between September and November 2025.

2.2 Data collection

The data used in this study is cross-sectional for the year 2025. Primary data was collected through in-depth interviews with cassava farmers. This research is further supported by secondary data sourced from the Central Statistics Agency (BPS), the Ministry of Agriculture, scientific journals, and other relevant publications.

The sampling procedure was conducted in several stages, starting with multistage purposive sampling followed by stratified random sampling. In the first stage, the research locations were determined to be Lampung Province and Central Lampung Regency. In the second stage, two districts were selected based on production scale: Bandar Mataram (the largest production area) and Gunung Sugih (a medium-scale production area). In the third stage, villages within the selected districts were chosen based on cassava production levels. In the fourth stage, respondents were randomly selected from three seed variety strata. The number of respondents for each seed variety was determined based on the relative prevalence of Adira 4, Garuda, and Sekoci in the selected districts. Adira 4, being the most widely cultivated variety in the study area, had the highest number of respondents, with 86 farmers, reflecting its broader distribution in the area. Meanwhile, Garuda, which is also widely cultivated, had 70 respondents. Sekoci, a less commonly grown variety with a more limited cultivation area, had 18 respondents, bringing the total number of farmers to 174. The distribution of respondents aims to ensure that the sample proportionally represents the distribution of each seed variety in the study area, with numbers based on the relative prevalence and cultivation area of these varieties in Bandar Mataram and Gunung Sugih.

2.3 Data analysis

Starch content was determined using the Luff–Schoorl method, in accordance with AOAC standards (2023). The samples were first dried and finely ground, then carefully weighed. Subsequently, the samples were hydrolyzed with hydrochloric acid (HCl) at 100 °C to convert the starch into glucose. Upon completion of the hydrolysis, the solution was neutralized with sodium hydroxide (NaOH) to a neutral pH. The filtrate obtained from the hydrolysis was then reacted with the Luff–Schoorl reagent, which contains copper(II) sulfate, sodium citrate, and sodium carbonate, and heated to facilitate the reduction of Cu^{2+} ions by reducing sugars. After cooling, potassium iodide (KI) and sulfuric acid (H_2SO_4) were added to the solution, forming iodine (I_2). The iodine formed was subsequently titrated with sodium thiosulfate ($Na_2S_2O_3$) solution, using starch as an indicator, until the endpoint was reached, marked by the disappearance of the blue color. The volume of the titrant used was recorded and employed to calculate the reducing sugar content. The reducing sugar value was then converted to starch content using a conversion factor of 0.9.

The moisture content was determined by oven drying (gravimetry), as per AOAC standards (2023). The sample was weighed using an analytical balance and then placed into a pre-weighed porcelain dish. The sample was dried in an oven at 105°C until a constant weight was achieved. After drying, the dish containing the sample was cooled in a desiccator and weighed again. Weighing and drying were repeated until a constant weight difference was obtained. The moisture content was calculated from the weight difference before and after drying, expressed as a percentage of the wet weight (% wb).

Cassava production, which serves as the primary raw material for tapioca flour, incurs two main types of costs: fixed costs and variable costs. Fixed costs include expenditures that remain constant despite variations in production volume, such as land rental, depreciation of equipment, machinery repairs, and interest on loans. In contrast, variable costs depend on the scale of production and include expenses for seeds, pesticides, organic and chemical fertilizers, as well as external labor required during the production process. Understanding these costs is essential for farmers and producers to assess profitability and optimize production efficiency.

Cost and revenue analysis is conducted using Microsoft Excel 2019 software. The analysis distinguishes between fixed costs (such as land rent, depreciation, equipment repairs, and machinery costs) and variable costs (such as seeds, pesticides, fertilizers, and external labor). Revenue generated is calculated by first determining total costs using the following formula:

$$TC = TFC + TVC \quad (1)$$

Where:
TC = Total Cost
TFC = Total Fixed Cost
TVC = Total Variable Cost

Revenue analysis in agricultural businesses encompasses the total value of products generated from farming activities over a specific period, typically a planting season. The formula for calculating revenue is as follows:

$$TR = Py + Y \quad (2)$$

Where:
TR = Total Revenue
Y = Quantity of Product (Kg)
Py=Selling Price per Unit Area (Rp/Kg)

The income of the cassava farming business is calculated by subtracting the total costs from the total revenue. If the income is positive, the business is profitable; conversely, if it is negative, the business incurs a loss.

$$\Pi = TR-TC \quad (3)$$

Where:
π = Profit
TR = Total Revenue
TC = Total Cost

The R/C Ratio (Revenue-Cost Ratio) analysis compares the value of inputs and the value of products (outputs) at the end of the production process. After determining the profit for each agricultural product, the R/C Ratio can be calculated by comparing revenue to production costs. This ratio is calculated using the following formula:

$$R/C\ Ratio = (Total\ Revenue\ (Rp)) / (Total\ Cost\ (Rp)) \quad (4)$$

If the R/C ratio is greater than 1, the business is profitable, as every rupiah spent generates more than one rupiah in revenue. If the R/C ratio equals 1, the business breaks even (no profit or loss). If the R/C ratio is less than 1, the business is operating at a loss.

3 Result and discussion

3.1 Starch content and moisture levels of cassava seed varieties

The quality of cassava is significantly influenced by the seed variety, as well as the soil and environmental conditions in which it is cultivated. Based on research conducted on three cassava seed varieties harvested at 9 months of age Makan (Adira 4), Garuda, and Sekoci cassava in Central Lampung, distinct characteristics were observed in each variety. Figure 3a illustrates the Makan (Adira 4) variety, which has thick, dark brown skin. The flesh of this cassava is pale yellow with a firmer texture. Figure 3b shows the Garuda variety, which has smoother, cleaner skin and a light brown or off-white color. The flesh of the Garuda cassava is white and has a softer texture. Figure 3c depicts the Sekoci variety, which has thicker, rougher skin and a dark brownish-black hue. The tougher skin provides better resistance to physical damage. The flesh of the Sekoci cassava is pale yellow and has a denser, firmer texture.

(a) (b) (c)

Fig. 3. (a) Adira 4 variety (Makan), (b) Garuda variety, (c) Sekoci variety

Starch content and moisture levels are two critical factors that determine the quality of cassava for various processing purposes, such as the production of flour or other processed products. High starch content and low moisture levels are particularly important in the processing industry, as they influence the efficiency of processes such as drying and further processing [11]. The results presented in Table 1 provide an overview of the chemical composition of the cassava seed varieties tested for starch and moisture content.

Table 1. Starch content and moisture levels of various cassava seed varieties

Seed Variety	Starch Content (% wb)	Moisture Content (% wb)
Makan (Adira 4)	33.6459	56.5680
Garuda	30.8684	58.7564
Sekoci	27.3514	61.7169

Table 1 shows that the cassava variety Makan (Adira 4) exhibits the highest starch content, 33.6459% on a dry basis (DB), with a relatively lower moisture content of 56.5680% on a DB basis. This suggests that the Makan cassava (Adira 4) is more efficient for processing into flour or other processed products. The higher starch content and lower moisture content enable faster and more efficient processing. Lower moisture content enhances the cassava's strength when pressed or displaced, making processes such as cutting and transportation more efficient [10]. Theoretically, reduced moisture content improves the physical and mechanical quality of cassava, making it easier to process in the food industry. This is related to the denser and more stable physical properties of cassava, which require less time and energy for processing, such as drying and cooking. Starch with a lower moisture content is more efficient to process because it has a harder texture and is less prone to hydration [12]. Furthermore, the reduced moisture content decreases the potential for microbial degradation and extends the shelf life, making the Makan variety more efficient for long-term industrial use.

The cassava variety Garuda has a starch content of 30.8684% on a dry basis (DB) and a moisture content of 58.7564% on a DB basis. Although the starch content is relatively high, the relatively high moisture content in Garuda cassava may affect processing efficiency, such as drying or flour production. High starch content is highly desirable in the processing industry; however, higher moisture content can slow processing rates. Increasing moisture content in cassava starch may delay overall processing, even though high starch content is preferred for industrial applications [13].

The cassava variety Sekoci has the lowest starch content at 27.3514% on a dry basis (DB) and a relatively high moisture content of 61.7169% on a DB basis. Although Sekoci cassava has a high moisture content, which can affect its storage capacity, the lower starch content makes it less optimal for processing purposes that require high starch levels. Furthermore, Sekoci's lower starch content makes it less suitable for applications requiring high-quality starch, such as flour production. Lower starch content makes processing more difficult in industrial applications, especially because the starch structure is more fragile when hydrated [12]. The moisture content affects the physical quality of cassava and the efficiency of industrial processing, as higher moisture can slow processing. Therefore, varieties with higher starch content and lower moisture content, such as Makan (Adira 4), are more recommended for industrial processing that requires high starch quality and optimal process efficiency.

3.2 Revenue of farmers based on cassava seed variety variations

The revenue from cassava sales received by farmers is influenced by the application of raffination. Raffination refers to the deduction or reduction from the selling price applied by companies based on various factors, including product quality that does not meet standards or other losses during distribution and processing. Based on research findings, the average raffination rate is 43%, meaning nearly half of the selling price will be deducted. Therefore, although the government sets the average selling price of cassava at IDR 1,350 per kilogram, farmers will receive approximately 57% of that price after raffination deductions, amounting to IDR 769.50 per kilogram.

Based on Table 2, there is a significant difference in the revenue per hectare among the three cassava varieties: Adira 4 (Makan), Garuda, and Sekoci. The Adira 4 (Makan) variety has the highest revenue, amounting to IDR 23,503,814, indicating that its superior quality, characterized by higher starch content (33.6459% dry basis) and lower moisture content (56.5680% dry basis), mitigates the negative impacts of raffination and results in higher revenue. The Garuda variety, although having a reasonably high starch content (30.8684% dry basis), has a higher moisture content (58.7564% dry basis), which can affect processing efficiency and increase the likelihood of price reductions through raffination, resulting in lower revenue of IDR 17,392,218. Meanwhile, the Sekoci variety, with a starch content of approximately 32.0405% on a dry-basis, shows better revenue than Garuda at IDR 22,101,966, but is still lower than Adira 4 (Makan). The Adira 4 (Makan) variety has a revenue approximately 35.2% higher than Garuda, and 6.3% higher than Sekoci. Conversely, Sekoci has a revenue 27.1% higher than Garuda.

Table 2. Average farm revenue of cassava cultivation per one hectare

Revenue Components	Value		
	Adira 4 Variety	**Garuda Variety**	**Sekoci Variety**
Sales Revenue	IDR 23,503,814	IDR 17,392,218	IDR 22,101,966
Cash Revenue	IDR 23,503,814	IDR 17,392,218	IDR 22,101,966
Non-Cash Revenue	IDR -	IDR -	IDR -
Total Revenue	IDR 23,503,814	IDR 17,392,218	IDR 22,101,966

Source: Processed primary data (2025)

3.3 Costs of farmers based on cassava seed variety variations

Each cassava variety exhibits distinct characteristics, including production costs, which encompass expenses for seeds, fertilizers, labor, and land rental. Table 3 provides an overview of the average cassava farming costs per hectare for three different varieties: Adira 4 (Makan), Garuda, and Sekoci. Table 3 outlines the breakdown of costs incurred in cassava farming, including both cash and non-cash expenses.

Based on Table 3, the analysis of cassava farming costs reveals significant differences among the three varieties Adira 4 (Makan), Garuda, and Sekoci both in total costs and in the components of the expenses incurred. For the Adira 4 (Makan) variety, the total farming cost per hectare amounts to IDR 25,426,886. Of this, 70.47% or IDR 17,918,272 is cash expense, while 29.53% or IDR 7,508,614 is non-cash expense. The largest expense for Adira 4 (Makan) is land rental, amounting to IDR 7,021,605, or approximately 27.61% of the total cost. Other significant costs include contract labor expenses (16.55%) and organic fertilizer costs (5.69%).

The Garuda variety has a slightly higher total cost of IDR 26,196,752, with cash expenses of IDR 17,862,103 (68.18%) and non-cash expenses of IDR 8,334,649 (31.82%). A significant portion of Garuda's costs also comes from land rental, amounting to IDR 7,051,282 (26.92%). Additionally, Garuda's contract labor costs are quite high at 20.39%, indicating that external labor costs have a significant impact on this farming operation. The Sekoci variety has a total farming cost of IDR 18,239,518, consisting of cash expenses of IDR 10,865,059 (59.57%) and non-cash expenses of IDR 7,374,459 (40.43%). For the Sekoci variety, the largest expense component is contract labor from outside the family, accounting for 30.61%, followed by the cost of renting privately owned land, which represents 38.38% of the total cost.

Based on Table 3, the analysis of cassava farming costs reveals significant differences between the three varieties, namely Adira 4 (Makan), Garuda, and Sekoci, in terms of both total costs and the components of those costs. The total farming cost for Adira 4 (Makan) per hectare amounts to IDR 25,426,886, with 70.47% (IDR 17,918,272) attributed to cash costs and 29.53% (Rp 7,508,614) to non-cash costs. The largest expense for Adira 4 (Makan) is land rent, totaling Rp 7,021,605, approximately 27.61% of the total cost. Other significant expenses include contracted labor costs (16.55%) and manure costs (5.69%).

The Garuda variety has a slightly higher total cost of IDR 26,196,752, with cash costs of Rp 17,862,103 (68.18%) and non-cash costs of IDR 8,334,649 (31.82%). As with Adira 4 (Makan), the majority of Garuda's costs also come from land rent, totaling Rp 7,051,282 (26.92%). Additionally, Garuda's contracted labor costs are relatively high at 20.39%, indicating the substantial impact of outsourced labor on this farming operation. The Sekoci variety has a total farming cost of IDR 18,239,518, consisting of cash costs of IDR 10,865,059 (59.57%) and non-cash costs of IDR 7,374,459 (40.43%). For Sekoci, the largest cost component is contracted labor outside the family, which accounts for 30.61%, followed by land rent for owned land, which represents 38.38% of the total cost.

Table 3. Average cassava farming costs per one hectare

Cost Components	Adira 4 Variety (Makan)		Garuda Variety		Sekoci Variety	
	Value (IDR/Ha)	%	Value (IDR/Ha)	%	Value (IDR/Ha)	%
Seeds	IDR 1,882,330	7.40	IDR 948,819	3.62	IDR 1,317,353	7.22
Urea	IDR 424,415	1.67	IDR 619,593	2.37	IDR 381,765	2.09
NPK	IDR 994,052	3.91	IDR 1,123,845	4.29	IDR 937,500	5.14
Manure	IDR 1,445,592	5.69	IDR 1,413,678	5.40	IDR 961,971	5.27
Pesticides	IDR 433,038	1.70	IDR 425,882	1.63	IDR 425,882	2.33
Land Rent	IDR 7,021,605	27.61	IDR 7,051,282	26.92	IDR -	0.00
External Family Labor	IDR 1,509,479	5.94	IDR 938,005	3.58	IDR 1,256,882	6.89
Contract Labor	IDR 4,207,761	16.55	IDR 5,340,997	20.39	IDR 5,583,706	30.61
Total Variable Costs	IDR 17,918,272	70.47	IDR 17,862,103	68.18	IDR 10,865,059	59.57
Own Land Rent	IDR 7,051,942	27.73	IDR 7,586,138	28.96	IDR 7,000,000	38.38
Family Labor	IDR 137,068	0.54	IDR 271,742	1.04	IDR 138,382	0.76
Depreciation	IDR 319,605	1.26	IDR 476,770	1.82	IDR 236,076	1.29
Total Fix Costs	IDR 7,508,614	29.53	IDR 8,334,649	31.82	IDR 7,374,459	40.43
TOTAL COSTS	IDR 25,426,886	100.00	IDR 26,196,752	100.00	IDR 18,239,518	100.00

Source: Processed primary data (2025)

Among the three varieties, Adira 4 (Makan) has the lowest total cost, lower than Garuda and Sekoci. Garuda incurs higher costs, primarily due to outsourced family labor and significant land rent expenses. Meanwhile, although Sekoci's total costs are lower than Garuda's, it has the highest contracted labor costs among the three. Overall, Adira 4 (Makan) appears to be the most cost-efficient, primarily due to lower land rent and manure costs compared to the other varieties. However, both Sekoci and Garuda have higher contracted labor costs, suggesting that labor and processing costs are more substantial for these varieties.

3.4 Farmer income based on cassava seed variety variations and rafaksi policy

The income from cassava farming for the three varieties, Adira 4 (Makan), Garuda, and Sekoci, provides an insight into the viability of the farming operation based on revenue and costs incurred per hectare. Table 4 presents the components of both variable and fixed costs, along with their impact on farmers' income. This income is influenced not only by cassava sales revenue but also by production-related costs, such as seed, fertilizers, pesticides, and land rent. Moreover, the company's 43% rafaksi policy further reduces farmers' income, affecting the overall economic viability of the farming operation.

Based on Table 4, the analysis of costs and revenues from cassava farming for the Adira 4, Garuda, and Sekoci varieties reveals two distinct outcomes. From the perspective of variable costs those actually paid by farmers during the production process all three varieties remain cash-flow viable. However, when considering total costs, including fixed costs such as family labor, equipment depreciation, and rent for owned land, all three varieties become economically unviable, as total costs exceed revenues.

Table 4. Average farm income of cassava cultivation per one hectare

Components	Adira 4 Variety	Garuda Variety	Sekoci Variety
Total Revenue	IDR 23,503,814	IDR 22,101,966	IDR 17,392,218
Cash Costs	IDR 17,918,272	IDR 17,862,103	IDR 10,865,059
Imputed Costs (Non-Cash)	IDR 7,508,614	IDR 8,334,649	IDR 7,374,459
Total Costs	IDR 25,426,886	IDR 26,196,752	IDR 18,239,518
Net Income over Cash Costs	IDR 5,585,542	IDR 4,239,863	IDR 6,527,159
Net Income over Total Costs	- IDR 1,923,072	- IDR 4,094,786	- IDR 847,300
R/C Ratio (Cash Costs)	1.31	1.24	1.60
R/C Ratio (Total Costs)	0.92	0.84	0.95

Source: Processed primary data (2025)

For the Adira 4 variety, total revenue amounts to IDR 23,503,814. From this revenue, farmers incur cash expenses of IDR 17,918,272, or 76% of the revenue. If revenue is considered as IDR 100, approximately IDR 76 is immediately spent on actual expenses (e.g., production inputs, hired labor, and operational costs). The remaining cash surplus is about 24%, resulting in a positive income of IDR 5,585,542 from cash expenses. However, when non-cash expenses amounting to IDR 7,508,614 (32% of revenue) are included, the total costs increase to IDR 25,426,886, which is about 108% of the revenue. Consequently, the income from total costs becomes -IDR 1,923,072. This condition is reflected in the cash R/C ratio of 1.31 (indicating cash viability), but the total R/C ratio of 0.92 (indicating an economic loss). This implies that the apparent profit from Adira 4 occurs because some production factors (particularly family labor, land, and depreciation) have not been "paid" in monetary terms, but still represent costs when evaluated economically.

For the Garuda variety, total revenue amounts to IDR 22,101,966. The cash expenses incurred total IDR 17,862,103, or approximately 81% of the revenue. This indicates that Garuda’s cash costs are the highest: for every IDR 100 of revenue, about IDR 81 is spent on cash expenses, leaving only about 19% as a cash surplus. The income from cash expenses remains positive at IDR 4,239,863, but this is lower than that of Adira 4 due to the higher proportion of cash costs. When non-cash costs of IDR 8,334,649 (about 38% of revenue) are added, the total costs increase to IDR 26,196,752, or approximately 119% of the revenue. As a result, the income from total costs becomes -IDR 4,094,786, and the total R/C ratio falls to 0.84, indicating the largest economic loss among the three varieties. Garuda still generates enough cash to cover its cash expenses, but it is insufficient to cover the full economic value of all the inputs used.

Meanwhile, the Sekoci variety has the lowest total revenue at IDR 17,392,218, but also the lowest cash expenses of IDR 10,865,059, or about 62% of the revenue. This means that for every IDR 100 of revenue, only about IDR 62 is spent on cash expenses, leaving a cash surplus of around 38%, the highest among the varieties. This explains why Sekoci's income from cash expenses is the largest, at IDR 6,527,159, with a cash R/C ratio of 1.60 (the best in terms of cash). However, Sekoci has relatively high non-cash costs of IDR 7,374,459, or approximately 42% of revenue. When these non-cash costs are included, the total costs increase to IDR 18,239,518, or about 105% of revenue, resulting in a total income from total costs of -IDR 847,300, with a total R/C ratio of 0.95. This indicates that Sekoci is the variety closest to breakeven economically, but it still does not generate full economic profit.

The three varieties were compared based on cash costs, which absorb a significant portion of revenue in Adira 4 (76%) and particularly in Garuda (81%), while Sekoci has a lower cash cost proportion (62%), making it more favorable from a cash flow perspective. However, non-cash costs are relatively high across all varieties, especially for Sekoci (42%), indicating that the farming operation's sustainability is largely supported by internal household resources (family labor and the use of owned land). Although all three varieties have a cash R/C ratio greater than 1 (indicating short-term cash flow viability), all exhibit a total R/C ratio of less than 1 (indicating economic loss). Scientifically, this means the farming operation can still operate in the short term, as farmers can cover cash expenses, but from a full economic assessment, the operation does not generate adequate returns for all the production factors used.

The results of this study align with the findings of several previous empirical studies, indicating that the profitability of cassava farming is highly sensitive to cost structures and pricing mechanisms that determine the effective sale price at the farmer level [9]. Rafaksi entails a direct loss, as it reduces the effective price received by farmers and introduces inefficiencies into the marketing system [7], while output deductions in partnership schemes also depress farmers' income and weaken the economic viability of the farming operation [14].

Under rafaksi conditions, farmers' revenue declines significantly, reducing profit margins. Practically, Rafaksi also shifts greater risks related to quality and post-harvest losses to the farmers (such as weight loss, starch content, or unilateral quality assessments), while the factory continues to procure raw materials at the required physical volume but at a lower effective price. As a result, although cassava farming may still appear "profitable" from a cash flow perspective, economic calculations show that farmers are not actually receiving adequate returns once family labor, depreciation, and land rent imputation are accounted for [5]. Thus, the cash surplus reflects more of a survival strategy for the farming household rather than truly sustainable economic profit [15].

4 Conclusion

The implementation of the rafaksi system in Central Lampung Regency has led to a decline in the effective income of cassava farmers, as the price dropped from IDR 1,350 to IDR 769.50 per kilogram. This has caused economic losses across all cassava varieties, namely Adira 4, Garuda, and Sekoci. While variable costs can still be covered, the applied rafaksi system suggests that farmers are relying more on internal resources for survival rather than achieving sustainable economic profits. Starch content and moisture levels are key factors in resilience to rafaksi, where the variance in seed varieties explains the disparity in income among farmers. Adira 4, with the highest starch content and the lowest moisture level, faces smaller rafaksi cuts, resulting in the highest income. In contrast, Sekoci, with lower starch content, is more adversely affected by the rafaksi system.

Reform of the rafaksi system is necessary by integrating starch and moisture levels as pricing criteria to ensure fairness. The government should promote the use of superior varieties through seed subsidies and technical assistance, as well as strengthen partnerships between farmers and the tapioca industry to enhance farmers' bargaining power.

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