Average Difference Test Analysis of Production and Income of Two Sweet Potato Varieties in Merauke

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ABSTRACT

This study aims to calculate the production and income derived from farming several sweet potato varieties. The research was conducted in Bersehati Village, Tanah Miring District, Merauke Regency. The Research location was chosen purposively with the consideration that Kampung Bersehati is the largest sweet potato producing area in Merauke Regency. In total there are 157 sweet potato farmer populations, the number of samples taken was 20% of the population or 31 farmers. Data analysis was conducted using the concept of cost, revenue, farm income, feasibility and analysis of the average difference test. The results showed that the yield per growing season of the Cakar variety (1,603 kg) was higher than the Local variety (1,599 kg). However, farming the Local variety yielded a higher income (IDR 4,672,140.96) than the Cakar variety (IDR 4,475,777.98) at a selling price of IDR 6,000 per kg. The feasibility analysis showed that both the Local variety (R/C Ratio 1.95) and the Cakar variety (1.87) are worth trying. The difference test analysis revealed significant differences in production and income between the two varieties.

Keywords:
 Production; Revenue; South Papua; Sweet Potato

1. Introduction

Sweet potatoes are one of the world's important sources of food security (Kwak, 2019; Aldow and Feyissa, 2023). Based on the total production of ten sweet potato producing countries in 2021, the total world sweet potato production is 73 million tons. Indonesia is one of the 7th ranked sweet potato producers in the world. Indonesia's sweet potato production was 1.6 million tons in 2021 (Figure 1). Furthermore, in the Southeast Asian region, Indonesia is the largest producer of sweet potatoes. As for being the largest producing country in Southeast Asia, the performance of sweet potato production in Indonesia fluctuates and tends to decline during the period 2017-2021 (FAO, 2023) (Figure 2).
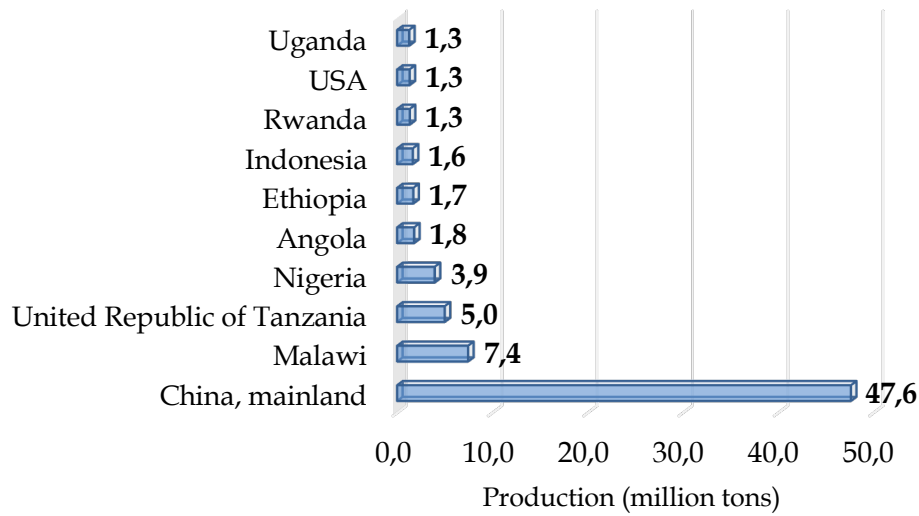
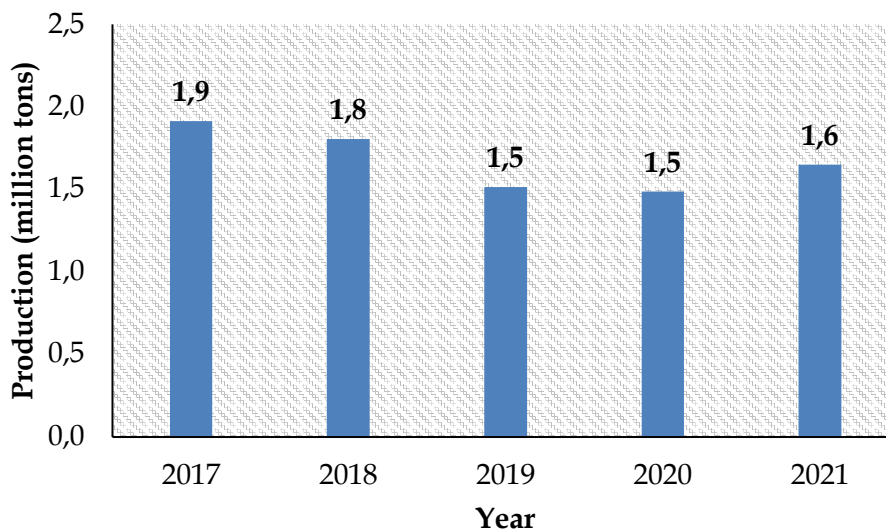**Figure 1.** Production of Ten Sweet Potato Producing Countries

Figure 2. Average Indonesian Sweet Potato Production in 2017 - 2021

Sweet potato (*Ipomoea batatas* L.) or also known as sweet potato, function as a staple food substitute for rice because it has a high nutritional content. In 100 grams of sweet potato contains 123 kkal energy, 1.80 g protein, 0.70 g fat, 27.90 g carbohydrates, 2.20 g crude fiber, 30 milligram calcium, 49 milligram phosphorus, 300 milligram potassium, 60 IU vitamin A, 22 milligram vitamin C, 0.09 milligram vitamin B1, 0.40 g sugar content, and 31.20 g beta carotene (USDA, 2023). The advantage of sweet potatoes is that they contain vitamin A and vitamin B1 higher than cassava and rice. Vitamin A serves to maintain healthy eyes, skin, and immunity. Vitamin B1 is also called thiamine which has a very important role in the metabolism of carbohydrates into energy. Besides, it was in recent studies found that sweet potatoes function as anti-inflammatory, antidiabetic, and anticancer (Mohanraj and Sivasankar, 2014; Wang et al., 2016; Kwak, 2019; Andana et al., 2021; USDA, 2023).

Based on BPS data (2022), Papua contributes 13.1% of sweet potato production in Indonesia. Sweet potato production amounted to 318,399 ton in 2022. The contribution is high because the land area and climatic conditions of the Papua region are very potential. Merauke is one of the largest sweet potato producing regions in Indonesia with a harvested area of 259 ha, productivity of 11.91 tons/ha, and production of 3,084.69 tons. With each region having different land area, productivity and production.

Table 1. Sweet Potato Harvested Area Production and Productivity by District in Merauke Regency

Subdistrict	Harvested Area (ha)	Productivity (tons/ha)	Production (tons)
Kimaam	22,00	11,00	242
Tabonji	15,00	10,00	150
Waan	35,00	11,00	385
Ilwayab	6,00	10,00	60
Okaba	10,00	13,00	130
Tubang	9,00	10,00	90
Ngguti	-	-	-
Kaptel	-	-	-
Kurik	4,00	13,00	52
Animha	3,00	11,00	33
Malind	5,45	12,00	65,4
Merauke	1,75	10,70	18.725
Naukenjerai	4,00	11,20	44,8
Semangga	9,00	12,00	108
Tanah Miring	**89,25**	**13,00**	**1.160,25**
Jagebob	21,00	13,00	273
Sota	-	-	-
Muting	20,00	11,00	225,5
Bikobel	3,30	12,00	39,6
Ulilin	0,75	11,00	8,25
Merauke Regency	259,00	11,91	3.084,69

Sources: BPS, 2020

From the Table 1, the sweet potato center in Merauke Regency is located in Tanah Miring District with a harvested area of 89.25 ha and a production of 1,160.25 tons. The second center is located in Waan District with a land area of 35 ha and a production of 385 tons and the third center is located in Kimaam District with a land area of 22 ha and a production of 242 tons. There are several varieties of sweet potatoes produced in Tanah Miring District, such as Common, Cakar, and Purple.

In Tanah Miring District there is a Village or Bersehati Village which is the base for sweet potato production. Bersehati Village has 11 farmer groups that carry out sweet potato cultivation activities. These 11 farmer groups, Bersehati Village became the largest contributor in Merauke Regency.

Initially, Bersehati Village produced sweet potatoes with purple and Japanese varieties. However, there are problems in terms of production and cultivation in purple varieties that are susceptible to pest and disease attacks. So, if there is a small defect in the tuber,

it will cause a strong sweet potato taste. Although the price of purple sweet potatoes is higher than Japanese sweet potatoes. Currently, farmers in Bersehati Village no longer cultivate the purple sweet potato to reduce the risk that occurs. Currently, there are 2 varieties cultivated by farmers in Bersehati Village, namely the Local variety and the Cakar variety. Local varieties and varieties of Cakar are more resistant to pests and scurvy. Judging by consumer demand, the Local variety and the Cakar variety are higher than the purple variety. This is because sweet potatoes of Local varieties and Cakar varieties are raw materials for flour, chips, noodles, dried sweets, medicines, pastries, sponges, and many more. That is, the varieties Local and Cakar can be increased in added value.

Sweet potatoes of the Local and Cakar varieties are suitable in gardens on moor land and rainfed rice fields. The characteristics of these two varieties are slightly different. Based on harvest age, the Cakar variety is three months, while the Local variety is longer at four months. Physiologically the Local variety has heart-shaped leaves, and tendrils are red, while the Cakar variety has *a* fingered leaf form, the green stem is rounded. Based on this, it will affect the production and income of farmers. Therefore, an efficient and effective policy is needed to increase production and income. The study in this study is production and farm income, as well as testing the difference in the average production and income of sweet potatoes of Local and Cakar varieties in Tanah Miring District, Merauke Regency.

2. Materials and Methods

2.1. Study Location

The research location is Bersehati Village, Tanah Miring District, Merauke Regency. This location was chosen with the consideration that Bersehati Village is the largest sweet potato producing area in Merauke Regency. Bersehati Village lies between latitude 8°31′53.8″ N and longitude 140°24′55.8″ E, and an approximate land area 4319.44km2 (BPS Merauke, 2020). The research has been carried out in May – June 2022.

2.2. Sampling Procedure

Determination of the number of samples using the Slovin formula with a sampling error accuracy allowance of 20%. The total population is 157 sweet potato farmers. The number of respondents sampled was 31 sweet potato farmers. Respondents were selected using a simple random sampling technique. The number of respondents who worked on Local Varieties was 15 farmers, and respondents who worked on Cakar Varieties were 16 farmers. All respondents had the same land area of 1.5 ha.

2.3. Data Collection and Analysis

This research is descriptive research with a quantitative approach. The data type uses primary data and secondary data. Primary data collection techniques are observation, interviews, and questionnaires directly with respondents. Furthermore, secondary data collection techniques are accessing data from government agencies, including BPS Merauke Regency, agricultural extension workers, and the Merauke Regency Agriculture Office. In addition, this study also uses references to literature studies accessed from the internet and libraries in the form of scientific articles, books, and other supporting data. Data was analysed using the Statistical Package for the Social Sciences

(SPSS) software using the statistical test Independent Sample 2 Test. Data analysis methods based on research objectives are:

2.3.1. Cost Analysis

Cost analysis is expressed through the following mathematical equation:

$$TC = TFC + TVC \quad \text{...(1)}$$

Information:

TC   : Total Cost (IDR)
TFC   : Total Fixed Cost (IDR)
TVC   : Total Variable Cost (IDR)

2.3.2. Revenue Analysis

The acceptance analysis is expressed through the following mathematical equation:

$$TR = P \: x \: Q \quad \text{...(2)}$$

Information:
TR   : Total Revenue
P   : Production (Kg)
Q   : Selling Price (IDR)

2.3.3. Income Analysis

Income analysis is expressed through the following mathematical equation:

$$\pi = TR - TC \quad \text{...(3)}$$

Information:
π   : Income
TR   : Total Revenue
TC   : Total Cost

2.3.4. Qualification Analysis

This method is carried out to determine whether the cultivated sweet potato farming has reached the feasibility level or not, then the following formula is used:

$$RC \: Ratio = \frac{TR}{TC} \quad \text{...(4)}$$

Information:
✓   If the RC Ratio < 1, then farming is said to be not feasible
✓   If the RC Ratio > 1, then farming is said to be feasible
✓   If the value of RC Ratio = 1, then it is said that the value of production at cost is equal or breakeven.

2.3.5. *Analysis of the Average Difference Test of Production and Income*

Analysis of the difference in production and income was carried out with the statistical test Independent Sample 2 Test. Its formulation is as follows:

$$Z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)_0}{\sqrt{\frac{\sigma_1{}^2{}_1}{n_1} + \frac{\sigma_2{}^2}{n_2}}} \quad \text{..} (5)$$

Information:

$\bar{X}_1$	= sample mean ex. 1
$\bar{X}_2$	= Average sample ex. 2
n_1	= Total group samples. 1
n_2	= Total group samples. 2
μ_1	= The default junction of the group of samples. 1
μ_2	= The default junction of the group of samples. 2

3. Results and Discussion

3.1. Results

3.1.1. *Production Cost Analysis of Cakar Varieties Sweet Potato Farming*

Table 2. Analysis of Sweet Potato Farm Production Cost

No	Cost Details	Local Variety (IDR)	Cakar Varieties (IDR)
Fixed Cost			
1	Tool depreciation	182,219.05	171,122.02
	Total Fixed Cost	**182,219.05**	**171,122.02**
			Variable Cost
2	Seedlings	213,333.33	225,000.00
3	Fertilizer	899,640.00	871,100.00
4	Labor		
	✓ Land Clearing	320,000.00	368,750.00
	✓ Land Processing	1,500,000.00	1,500,000.00
	✓ Planting	400,000.00	512,500.00
	✓ Fertilization	253,333.33	262,500.00
	✓ Maintenance	253,333.33	362,500.00
	✓ Harvesting	840,000.00	806.250,00
	Total labor costs	3,626,666.66	3,875,000.00
	Total Variable Cost	4,739,639.99	4,971,100.00
	Total Cost	4,921,859.04	5,142,222.02

Source: primary data processing results, 2022

The production cost of Local and Cakar varieties of sweet potato farming has differences from fixed costs and non-fixed costs. For tool depreciation, Local varieties are greater than Cakar varieties, namely IDR 182,219.05 for Local varieties and 171,122.02 for Cakar varieties. The tools used are hoes, sickles, sprayers, diesel engine water pump, and hoses. Non-fixed costs include seedlings, fertilizers and labor. The workforce is divided into several working groups, namely land clearing, land processing, planting, fertilizing,

maintenance, and harvesting. The total non-fixed cost of Cakar varieties is greater than that of Local varieties. The total irregular costs incurred for sweet potato farming are Cakar varieties amounting to IDR 4,971,100.00 and Local varieties amounting to IDR 4,739,639.99. Judging from the overall total fixed costs and non-fixed costs, the costs incurred by sweet potato farming are larger Cakar varieties with a land area of 0.25 ha with a total of IDR 5,142,222.02.

3.1.2. Analysis of Sweet Potato Farm Revenue

Table 3. Analysis of Sweet Potato Farm Revenue

No	Description	Local varieties	Cakar varieties
1	Average sweet potato production (Kg)	1,599 kg	1.603 kg
2	Price (IDR/Kg)	6,000.00 (IDR)	6.000,00 (IDR)
	Reception per growing season	9,594,000.00 (IDR)	9,618,000.00 (IDR)

Source: primary data processing results, 2022

The production produced by Cakar varieties is greater than Local varieties although the costs incurred are also greater. Production of Cakar varieties 1,603 kg and Local varieties 1,599 kg with the same selling price of IDR 6,000 so that the revenue per growing season is obtained Local varieties IDR 9,594,000.00 and Cakar varieties IDR 9,618,000.00 with a land area of 0.25 ha.

3.1.3. Analysis of Sweet Potato Farm Income

Table 4. Analysis of Sweet Potato Farm Income

No	Description	Local varieties	Cakar varieties
1	Revenue	9,594,000.00 (IDR)	9,618,000.00 (IDR)
2	Total cost	4,921,859.04 (IDR)	5,142,222.02 (IDR)
	Income per growing season	4,672,140.96 (IDR)	4,475,777.98 (IDR)

Source: primary data processing results, 2022

From the total costs incurred by farmers from the two sweet potato varieties minus the total revenue, the sweet potato farmers' business income is obtained (Table 4). The income of Local sweet potato farmers is greater than that of Cakar varieties with a total of IDR 4,672,140.96 while Cakar varieties are IDR 4,475,777.98. Revenue of Local varieties are smaller than Cakar varieties, but the costs incurred are also smaller, affecting income.

3.1.4. Feasibility analysis of the Sweet Potato Farming

Table 5. Feasibility analysis of the Sweet Potato Farming

No	Description	Local varieties	Cakar varieties
1	Revenue	9,594,000.00 (IDR)	9,618,000.00 (IDR)
2	Total cost	4,921,859.04 (IDR)	5,142,222.02 (IDR)
	R/C Ratio	1.95	1.87

Source: primary data processing results, 2022

Feasibility is used to see whether the farm is feasible or not to be cultivated. Sweet potato farming of both varieties has a feasibility above 1 so that both varieties are said to be feasible for cultivation. For Local varieties R/C 1.95 is said to be feasible and with the

meaning that if the costs incurred are 1 unit and will get revenue of 1.95 and income of 0.95. For Cakar varieties with an R/C of 1.87 which is said to be feasible to cultivate with the meaning that if the costs incurred are obtained 1 unit and will get revenue of 1.87 and income of 0.87.

3.1.5. Analysis of the Difference Test of Average Production and Income of Sweet Potato Farmers

Table 6. Test Results of Average Difference in Production and Income of Sweet Potatoes of Local Varieties and Cakar Varieties

Group Statistics					
	Difference	N	Mean	Std. Deviation	Std. Error Mean
Sweet potato	Production	2	1601.0000	2.82843	2.00000
	income	2	4.7035E6	7070.15564	4999.35500

Independent Samples Test									
		Levene's Test for Equality of Variances		t-test for Equality of Means					
								95% Confidence Interval of the Difference	
		F	Say.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Sweet potato	Equal variances assumed	1.631E16	.000	-940.506	2	.000	-4.70193E6	4999.35540	-4.72344E6	-4.68041E6
	Equal variances not assumed			-940.506	1.000	.001	-4.70193E6	4999.35540	-4.76545E6	-4.63840E6

Source: primary data processing results, 2022

Based on the results of the analysis above, it can be concluded that the value of sig (2 tailed) 0.000 < 0.05 then there is a significant difference between the production of Cakar variety sweet potatoes with Local varieties.

Meanwhile, in the income of the analysis above, it can be concluded that the value of sig (2 tailed) 0.001 < 0.05 then there is a significant difference between the income of sweet potato varieties of Cakar varieties with Local varieties.

3.2. Discussion

The optimal use of production inputs greatly determines the production yield of sweet potatoes. The use of production inputs and their relationship to output is a function of production. Production inputs used in sweet potato farming include seeds, fertilizers, labor, and land area (Asmarantaka and Zainuddin, 2017; Parwiti et al., 2019; Widyastuti et al., 2023). The cost allocated by sweet potato farmers is for the efficient use of production inputs. This can be seen from the average production of sweet potatoes produced. The costs incurred in the use of production factors are directly proportional

to the production of sweet potatoes, be it Local varieties or Cakar varieties. That is, the greater the costs incurred, the sweeter potato production increases. Increased sweet potato production has an impact on increasing farmers' income. This is in accordance with several research results that found that labor costs, land area, seeds, and fertilizers affect the production and income of sweet potato farming (Faidah et al., 2015; Asmarantaka and Zainuddin, 2017; Parwiti et al., 2019; Widyastuti et al., 2023).

The yield of sweet potato production is linear with the income and income of sweet potato farmers. That is, the higher the production of sweet potatoes at the same selling price will increase farmers' acceptance. It was affirmed by Faidah et al. (2015) that every increase in production yield has a tendency to increase farmers' income or income.

The results of different tests show the difference in production and income of the two sweet potato varieties cultivated by farmers. However, the results of the feasibility analysis show that farming the two varieties of sweet potatoes is feasible. That is, sweet potatoes of Local varieties and Cakar varieties are potential to continue to be developed. Development of sweet potatoes to be able to meet food needs. Sweet potatoes are a food source of carbohydrates that ranks fourth after rice, corn, and cassava (Asmarantaka and Zainuddin, 2017; Parwiti et al., 2019; Widyastuti et al., 2023). Another opinion adds that sweet potatoes have the potential to be developed because they are raw materials for the food industry, as well as animal feed (Histifarina et al., 2023; Aldow and Feyissa, 2023).

4. Conclusion

The results showed that the yield per growing season of the Cakar variety (1,603 kg) was higher than that of the Local variety (1,599 kg). The income from farming the Local variety (IDR 4,672,140.96) is greater than the Cakar variety (IDR 4,475,777.98) at a selling price of IDR 6,000 per kg. The results of the feasibility analysis show that sweet potatoes of the Local variety (R/C Ratio 1.95) and the Cakar variety (R/C Ratio 1.87) are worth trying. The results of the difference test analysis showed that there were differences in production and income between Local variety sweet potatoes and Cakar variety sweet potatoes. The results of the feasibility analysis show that the Local variety and Claw variety sweet potatoes are feasible, so that stakeholders can encourage production through training to sweet potato farmers. Increased production will have implications for farmers' incomes to increase. Furthermore, for researchers to be able to analyze the marketing channels of sweet potatoes of Local varieties and Cakar varieties.

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