



Comparative Analysis of Hydroponic Farming Income between Pak Choy (*Brassica chinensis* L.) and Lettuce (*Lactuca sativa* L.)

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The increasingly narrow area of productive land, especially in big cities, makes cultivating plants using hydroponic techniques attractive and increasingly important. In hydroponic farming there is also a production income value that is different from the production of the types of vegetables that have been planted. This research aims to determine the hydroponic farming income. This research was carried out from November 2022 to January 2023. The sampling method was carried out purposive sampling or intentionally, namely at Graha Indah Farm. The data collected is primary data because this hydroponic cultivator built his own business. The research findings indicate that the hydroponic farming income at Graha Indah Farm varies significantly. Pak choy generated IDR 38,660,002.53 in the first planting season and IDR 463,920,030.36 annually, equivalent to IDR 5,799.00 m⁻² year⁻¹. Meanwhile, lettuce yielded IDR 16,183,000.83 in the first planting season and IDR 194,196,007.59 annually, equivalent to IDR 809.15 m⁻² year⁻¹. Pak choy contributed to 87.76% of the income, whereas lettuce accounted for 12.24%. Thus, it's evident that lettuce has a higher income and demand value.

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1. INTRODUCTION

The population continues to increase from time to time resulting in many agricultural land being converted into residential areas, so that efforts to fulfill food needs from the agricultural sector are increasingly challenging. Apart from that, an increase in population will also increase the demand for food. This change in land use occurs on a large scale from agricultural land to residential and industrial land which is difficult to avoid [1]. Land conversion resulted in increasingly limited agricultural land in urban areas, so it must be handled with an urban farming system [2]. According to the Urban Farm Business Plan Handbook issued by the US Environmental Protection Agency urban farming is part of the local food system where food is cultivated and produced in urban areas and marketed to consumers. It was also explained that urban agriculture could take various forms, i.e., nonprofit gardens or profitable businesses [3].

Horticultural crops (vegetables and fruit) currently still Indonesian urban agricultural output, because they are easy to care for, practical and quick to harvest [2]. Apart from that, vegetables have an important role because they are a source of fiber that meets body's nutritional needs while maintaining health.

Limited land is not an obstacle to cultivating vegetables, there are many alternative planting media that can be used to grow vegetables [4]. A vegetable cultivation system using hydroponic techniques is a solution to the challenges of urban farmers. Hydroponic systems can produce higher quality vegetable products continuously compared to conventional farming [5]. Hydroponic technology is a good alternative to obtain good results in terms of quality, quantity and continuity. Hydroponics is a soilless technique for cultivating vegetables and fruits, using planting media such as rockwool, burnt husks, hydroton, or sand to meet the plants' nutritional needs. Hydroponic products proved to be better quality compared to conventional products [6]. Even though hydroponic cultivation requires special precision and skills, its production costs have shown to be high [7].

The production costs required in hydroponic vegetable farming are quite high. While, sales of hydroponic vegetables are greatly influenced by

the selling price, hydroponic vegetable farming must produce selling price than the market price.

Graha Indah Farm, a pioneer hydroponic vegetable producer in Samarinda City was established in 2012 with a land area of 88 m². The hydroponic vegetable cultivation activity was carried out in a greenhouse using a hydroponic installation made of PVC pipes housing 800 planting holes, of which 200 were for lettuce and 600 holes for pak choy.

Graha Indah Farm are produce pak choy, lettuce, spinach and mustard greens. Judging from the number of enthusiasts and the number of requests, pak choy and lettuce are the types of vegetables that are much in demand. Therefore, pak choy and lettuce vegetables are predominantly cultivated. : Graha Indah Farm has made efforts to establish partnerships with other hydroponic businesses to increase the production of Pak choy and lettuce.

The aim of the research is to determine the costs and income of hydroponic pak choy and lettuce farming and to compare the income of hydroponic pak choy and lettuce farming.

2. RESEARCH METHODS

2.1 Time and Place

The research was conducted for three months, from November 2022 to January 2023. The research location is Jalan Graha Indah No. 06/08, Air Putih Village, Samarinda Ulu District, Samarinda City, East Kalimantan.

2.2 Method of Collecting Data

The data collected consisted: Primary data obtained through direct interactions and interviews with hydroponic pak choy and lettuce cultivators using a list of questions that had been prepared in accordance with the research objectives. Secondary data was data needed to support primary data obtained from literature studies through books, the Mulawarman University library, and journal.

2.3 Data Analysis Methods

2.3.1 Hydroponic farming costs

Farming costs that calculated based on the amount of money spent by farmers to finance their farming. included the costs of production

facilities, labor costs and other costs [8]. Farming formulated as follows: $TC = TFC + TVC$

Information: TC = Total Cost/total costs (IDR planting season⁻¹); TFC = Total fixed/fixed costs (IDR planting season⁻¹); and TVC = Total Variable Cost/total variable cost (IDR planting season⁻¹).

2.3.2 Acceptance of hydroponic farming

Revenue from farming was the total income received by producers or farmers from production activities that had been carried out and have generated money which had not been reduced by costs incurred during production [9]. Mathematically, revenue determined using the following formula:

$$TR = P \times Q$$

Information: TR = Total Revenue/total receipts (IDR planting season⁻¹); P = Price (IDR kg⁻¹), and Q = Quantity (IDR planting season⁻¹)

2.3.3 Hydroponic farming income

Income from pak choy and lettuce farming were determined from sales of pak choy and lettuce production with total expenditure in for harvest [10]. To analyze the income from pak choy and lettuce farming, it calculated using the formula: $I = TR - TC$

Information: I = Income/income (IDR); TR = Total Revenue/total receipts (IDR) and TC = Total Cost (IDR)

2.3.4 Comparison of income results

Financial reports does not mention any details. Need to specify what was compared, Eg: production costs, revenue, yield or quantity in a planting season

3. RESULTS AND DISCUSSION

3.1 Use of Pak Choy and Lettuce Production Inputs

In hydroponic farming, production input was very important, because it would affect the products produced. Inputs included the use of seeds, fertilizers and pesticides.

3.2 Hydroponic Farming Production Costs

Production costs were costs incurred for hydroponic farming activities. Production costs included the costs of purchasing seeds, fertilizer, pesticides, labor wages, equipment depreciation, and other costs. Hydroponic farmers grown plants in one growing season. Details of production costs for hydroponic pak choy and lettuce were presented in Table 2.

Table 1. Classification of the use of the total amount of input for hydroponic farming

No.	Input Type	Contents pack ⁻¹	Quantity used (planting season ⁻¹)
1.	Seed		
	a. Pak choy	10 g	15 packs
	b. L e t t u c e	1.000 pills	4 packs
2.	Fertilizer		
	a. Nutrition Hydroponic	5 liter	5 packs
3.	Pesticide		
	a. Naturo	10 kg	5 packs
	b. Yellow Trap	10 sheets	1 packs

Source: Primary data (processed) 2023

Table 2. Costs for hydroponic pak choy and lettuce farming

No	Description	Amount (IDR planting season ⁻¹)	
		Pak choy	Lettuce
1.	Costs		
	a. Seeds	1,800,000,00	632,000,00
	b. Fertilizers	210,000,00	105,000,00
	c. Pesticides	220,500,00	110,250,00
	d. Tool Depreciation	1,376,998,74	688,499,37
	e. Other Costs	6,237,500,00	3,118,750,00
	f. Labor	8,325,000,00	4,162,500,00
	Total Production Costs	18,169,998,74	8,816,999,37

Source: Primary data (processed) 2023

Table 3. Total production costs, peceipts and income from hydroponic pak choy and lettuce farming

No.	Description	Amount (IDR Planting Season ⁻¹)	
		Pakcoy	Lettuce
1.	Total Production Costs	18,169,998,74	8,816,999,37
2.	Revenue	56,830,001,27	25,000,000,00
3.	Income	38,660.002,53	16,183,000,63

Source: Primary data (processed) 2023

The total production costs for pak choy and lettuce plants for each crop season were IDR 18,169,998.74 and IDR 8,816,999.37, respectively.

3.3 Production and Acceptance of Hydroponic Farming

Production is the result obtained by farmers for the total results of the entire hydroponic farming business which will then be obtained from the production results of the hydroponic farming business. Revenue is obtained from the amount of production produced multiplied by the price prevailing at the research location, namely for pak choy at IDR 25,000.00 kg⁻¹ and lettuce at IDR 25,000.00 kg⁻¹. So the total revenue for hydroponic pakchoy is IDR 56,830,001.27 planting season⁻¹ or IDR 681,960,015.18 year⁻¹, while the total revenue for hydroponic lettuce is IDR 25,000,000.00 planting season⁻¹ or IDR 300,0,000 .00 year⁻¹.

3.4 Hydroponic Farming Income

Farming income is the result obtained from the difference between revenue and the total production costs that have been incurred during the hydroponic farming production period. Details of receipts and income from hydroponic pak choy and lettuce farming are presented in Table 3.

Based on the data in Table 3, it shows that the total revenue from pak choy vegetables is IDR 56,830,001.27 planting season⁻¹ or IDR 681,960,015.18 year⁻¹, after deducting production costs of IDR 8,169,998.74, the income is IDR 38,660,002.53 per planting season⁻¹ or IDR 463,920,030.36 year⁻¹ (IDR 5,799.00 m⁻² year⁻¹). Meanwhile, lettuce plants have a total income of IDR 25,000,000.00 planting season⁻¹ or IDR 300,000,000.00 year⁻¹, after deducting production costs of IDR 8,816,999.37, the income is IDR 16,183,000.63 planting season⁻¹ or IDR 194,196,007.59 year⁻¹ (IDR 809.15 m⁻² year⁻¹). Thus, there is a difference in the amount of income between pak

choy and lettuce farming. The amount of income obtained is influenced by several factors, namely first, the number of production factors owned and released during the production process. Second, the cost of production which also determines the size of the income received by farmers. As a comparative research result reported by [11] that the costs and revenues of pak choy farming in Medan Deli District, North Sumatra are fixed costs IDR 87,472,000.50 and variable costs IDR 272,747,0.00, a total of IDR 360,219,002.50 with an average IDR 12,007,300.08 and pak choy farming is profitable and worth developing. With an R/C value of 1.8. Furthermore, it was reported by [12] that the results of the R/C ratio test analysis on hydroponic lettuce farming obtained an R/C ratio value = 5.05 and earned an income of IDR 8,365,946 in planting season⁻¹. Meanwhile, the non-hydroponic lettuce farming obtained an R/C ratio = 4.33 and earned an income of IDR 3,091,787 in one planting season, which means that the hydroponic and non-hydroponic lettuce farming carried out by the respondent was feasible or provided a profit.

3.5 Comparison of Hydroponic Farming Income

Based on research that has been carried out, it is known that the size of the income from hydroponic pak choy and lettuce farming received by farmers is influenced by revenue and production costs. If the number of production requests and selling prices for hydroponic vegetables is higher, the amount of revenue will increase and if the amount of demand decreases, the amount of revenue will decrease causing losses for hydroponic farmers. There are several factors that can influence the size of the income received by farmers, including: business scale, availability of capital, output price level, availability of labor, transportation facilities and marketing system [13].

The difference in the amount of income between pak choy vegetables and lettuce vegetables is due to differences in the amount of production

demand and production selling prices. The selling price for hydroponic pak choy vegetables is IDR 25,000.00 kg⁻¹ with a total income of IDR 38,660,002.53 planting season⁻¹ or IDR 463,920,030.36 year⁻¹ or IDR 5,799.00 m⁻² year⁻¹, while lettuce has a selling price of IDR 25.000 kg⁻¹ with total income of IDR 16,183,063 planting season⁻¹ or IDR 194,196,007.59 year⁻¹ or IDR 809.15 m⁻² year⁻¹ and has an income ratio of pakchoy 87.76% while lettuce 12.24%.

Compared with research conducted by previous researchers in Warukapas Village, Tatu District, North Minahasa Regency, the amount of income from hydroponic vegetables in one 40-day production period was IDR 7,423,427.05 and the break event point (BEP) value of the S2R Farming vegetable farming business was IDR 3,388,769 [14]. It can be concluded that the Graha Indah Farm hydroponic farming business has the higher amount of income compared to the income of previous researchers, namely having a total income of IDR 38,660,002.53 planting season⁻¹ and IDR 463,920,030.36 year⁻¹ or IDR 5,799.00 m⁻² years⁻¹.

4. CONCLUSIONS

4.1 Conclusion

Based on the results of the research and discussion, the following conclusions can be drawn:

1. Maintenance is carried out with more incentives, in order to increase productivity.
2. In comparing income, it is necessary to increase lettuce production, because the opportunity to increase lettuce is still high.

4.2 Suggestion

Based on the results of the research that has been carried out, the following suggestions can be put forward.

¹ For pakchoy plants, the total production cost is IDR 18,169,998.74 planting season⁻¹. Revenue was IDR 56,830,001.27 planting season⁻¹ or IDR 681,960,015.18 year farming income was IDR 38,660,002.53 planting season⁻¹ and IDR 463,920,030.36 year⁻¹ or IDR 5,799.00 m⁻² years⁻¹.

² For lettuce plants, the total production cost is IDR 8,816,999.37 planting season⁻¹. Revenue is IDR 25,000,000.00 planting season⁻¹ or IDR 300,000,000.00 year farming income is IDR 16,183,000.63 planting season⁻¹ and IDR 194,196,007.59 year⁻¹ or IDR 809.15 m⁻² year⁻¹.

³ Hydroponic pak choy farming income is greater than lettuce, of the total income obtained 87.76% is income from pak choy plants, the remaining 12.24% comes from lettuce plants.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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