Financial feasibility of lime (*Citrus aurantifolia*) farming in Tanah Datar District, West Sumatra

R Sari*, Nofialdi, A Putri

Agribusiness Field of Study, Department of Social Economic, Agriculture Faculty, Universitas Andalas, Padang-Indonesia

*rinasarizainal@gmail.com

Abstract. Lime (*Citrus aurantifolia*) farming is one of the subsystems that form the lime agribusiness system in Tanah Datar District. This business has the potency to be developed. This study aimed to determine the feasibility of lime farming in Tanah Datar District in terms of financial aspects. This study used a survey method with a sample of 30 farmers in Padang Ganting Sub District, Tanjung Emas Sub District, and Lintau Buo Sub District, West Sumatra - Indonesia. Data were analyzed using investment criteria B / C, NPV, IRR, and sensitivity analysis. The analysis shows that the interest rate is 13% and the selling price is IDR 4,300 / Kg during the productive age (15 years), the value of B / C is 1.92, NPV is IDR 51,809,117 and IRR is 37%. Sensitivity analysis shows that the selling price is IDR 500 Kg, then the business is not feasible. While the selling price of IDR 846 / kg, Break Event Point (BEP) is reached. It can be concluded that lime farming is feasible. However, policies in trade and product use are needed so that the selling price does not fluctuate, and farmers do not experience losses.

Keywords: small scale farming, horticulture, agricultural development

1. Introduction

Lime is a plant that is widely cultivated in various regions in Indonesia. This plant has many benefits, such as for herbal medicine industry, chemical medicines, cosmetics, beverages, food, glassware, and others [1]. The demand for the production of lime and processed products also increases every year, along with population growth, changes in people’s tastes and habits.

In West Sumatra Province of Indonesia, there are some areas for the Development of Village Fruit Seeds (KBBN) for citrus seedling, including lime farming. The fields are Tanah Datar District, Padang Pariaman Regency, and Sijunjung Regency [2] (Office of Food Crop Agriculture, West Sumatra Province, 2014). In Tanah Datar District there are several lime-producing regions such as Padang Ganting Regency (102 Ha), Tanjung Emas Regency (15 Ha), Batipuh Regency (10 Ha), South Batipuh Regency (10 Ha), Tarab River District (8 Ha) and Sungayang District with a land area of 7 hectares [3].

This condition shows that lime agribusiness has the potency to be developed in Tanah Datar District. The results of previous research on the potential for agribusiness development in Tanah Datar...
District in 2017 show potential indicators of the development of these commodities are land availability and suitability (topographic and agro-climate aspects), easy cultivation, significant market demand, wide marketing area, and non-physical supporting facilities – infrastructure [4].

However, the potential for lime development in Tanah Datar District is not only seen from the regional suitability, but also from all aspects that will support the success of agriculture. According to Gittinger [5], several elements need to be considered in developing business (projects) such as technical aspects, institutional-organizational-managerial aspects, social aspects, commercial aspects, financial aspects, and economic aspects.

The financial aspect is one of the critical elements that must be considered in business activities. By conducting financial analysis, it can be seen how much costs are needed, and the potential benefits (income) obtained. These are economic indicators in considering the development of long-term lime farming to improve people's welfare, especially farmers in Tanah Datar District.

The purpose of this study was to analyze the feasibility of lime farming in Tanah Datar District in terms of financial aspects.

2. Method
This study was conducted in Tanah Datar District as one of the areas for The Development of Nagari Fruit Seeds (KBBN) in West Sumatra. The method used is the survey method. The survey method is a method of dissecting and screening and recognizing problems and getting justification for ongoing situations and practices [6].

The data collected was primary data on 30 lime farmers through interviews. Respondents were from three sub-districts, namely Padang Ganting Sub District, Tanjung Emas Sub District, and Lintau Buo Sub District. Data were analyzed quantitatively using an analysis of investment feasibility criteria: Benefit-Cost Ratio (B / C), Net Present Value (NPV), Internal Rate of Return (IRR), and sensitivity analysis.

NPV is the addition of net income received by a project over a certain period with a specific discount rate. B / C is the investment level of the costs used. IRR is an internal rate of return, which is a discount rate that makes the project NPV equal to zero. The formula for analyzing investment feasibility criteria [5]:

\[
B / C = \frac{\sum_{t=0}^{n} \frac{B_t}{(1+i)^t}}{\sum_{t=0}^{n} \frac{C_t}{(1+i)^t}}
\]

\[
NPV = -I_0 + \frac{\sum_{t=1}^{n} \frac{B - C}{1 + r^2}}{1 + r^2}
\]

\[
IRR = i_1 + \frac{(i_2 - i_1) \cdot NPV_1}{NPV_1 - NPV_2}
\]

NPV = Net Present Value
B / C = Benefit comparison with ratio
IRR = Internal Return Rate
Bt = benefits obtained in year t
Ct = costs incurred in year t
i = interest rate (required rate of return)
n = productive age of lime business

3. Result and Discussion
3.1 Lime farming in Tanah Datar District
Tanah Datar Sub District is one of the largest lime-producing areas in West Sumatra, in addition to Pasaman and Dharmasraya Regencies. Lime farming in this area is found in almost all districts with the broadest land in Padang Ganting Sub District. Lime farming in Padang Ganting has been practiced since the 1970s, but there has not developed. Luckily, in the year 2000s, this farming was promoted again. This activity is carried out by almost all households throughout villages by utilizing their gardens and home yards. The topography and agroclimatic conditions in this area are suitable for lime farming. Lime plants can be planted at an altitude of 1 m - 1,000 m asl with ideal temperatures 25 - 30 °C, dry months 3-5 months per year, air humidity 60% - 80%, the slope of the land ranges from 5 - 20 °C and its place open [1]. Generally, farmers use gardens and yards that were previously unproductive or neglected [4].

Lime farming activities start from land preparation, planting, maintenance (weeding, pruning, fertilizing and controlling pests and diseases), and harvesting. The cultivation practiced is still simple and does not require special skills. The spacing used is 5 x 5 m and 6 x 6 m. Weeding and pruning activities need to be done in lime farming. Fertilizers are usually given every six months in the form of NPK with a dose of + 3 kilograms per 50 sticks. However, not all farmers provide these fertilizers because they think that chemical fertilizers are not suitable for their plants, with no chemical fertilization; the productive age of lime is up to 20 years. Plants that are 3-4 years old can be harvested every one or two weeks. Lime harvested is the one that is ripe in green or yellowish-green.

| Year | Production (kg) | Price (Rp) | Revenues (Rp) |
|------|----------------|------------|---------------|
| 1    | -              | 4.300      | -             |
| 2    | -              | 4.300      | -             |
| 3    | 2.400          | 4.300      | 10.320.000    |
| 4    | 4.776          | 4.300      | 20.536.800    |
| 5    | 5.316          | 4.300      | 22.858.800    |
| 6    | 8.000          | 4.300      | 34.400.000    |
| 7    | 12.000         | 4.300      | 51.600.000    |
| 8    | 7.160          | 4.300      | 30.788.000    |
| 9    | 5.000          | 4.300      | 21.500.000    |
| 10   | 4.640          | 4.300      | 19.952.000    |
| 11   | 4.000          | 4.300      | 17.200.000    |
| 12   | 3.160          | 4.300      | 13.588.000    |
| 13   | 2.680          | 4.300      | 11.524.000    |
| 14   | 2.400          | 4.300      | 10.320.000    |
| 15   | 1.700          | 4.300      | 7.310.000     |

Based on Table 1, lime plants have produced at the age of 3 years. There is an increase in production every year. This condition is in line with increasing land productivity. The highest production occurs in the seventh year, after which the production of lime will decrease according to the economic age of the plant.

Lime plants can produce optimally after the age of six, where 1 hectare of lime can produce as much as 3-4 tons of lime for one harvest [7]. This condition also occurs in the study site, the highest production occurs in the seventh year.

| Revenues (Rp)Total | CostIncome (Rp) |
|-------------------|-----------------|
|                   |                 |
From Table 2, it can be seen in the third year that farmers began to receive benefits from lime plants. The highest farmer income in the seventh year reaches IDR 46,524,667. The average farmer earns IDR 3,887,055 per month. Most farmers who process lime have a side business because the maintenance of lime plants is not difficult.

For lime plants that have been producing, usually, the costs incurred by farmers are reduced. This is because farmers only pay for maintenance costs starting from fertilization, herbicides, and pruning.

The results of research by Sinaga et al.[8], the lime business in Serdang Bedagai Regency has provided Break-Even Point (BEP) to farmers in the 5th year. This condition shows that when the production of lime increases every year until the highest production, the farmers benefit

### 3.2 Feasibility of lime farming in Tanah Datar District

Assessing the feasibility of lime farming uses the criteria B / C, NPV, and IRR. All costs and income from agriculture are recorded and arranged in a table. The data is used to calculate the criteria. In calculating this financial feasibility, the average selling price of IDR 4,300 / Kg. This selling price is known from the results of interviews with respondent farmers. The discount factor level is 13 percent. The use of this discount rate aims to anticipate price changes. In addition, this technique is used to adjust the value of money against time.

At a discount rate of 13 percent, the results of the feasibility analysis show that lime farming is feasible. The NPV value at each positive discount rate, more than one B / C and the IRR obtained are higher than the discount rate used.

| Years | (Rp)          |
|-------|---------------|
| 1     | 32,430,000    |
| 2     | 4,943,333     |
| 3     | 10,320,000    |
| 4     | 20,536,800    |
| 5     | 22,858,800    |
| 6     | 34,400,000    |
| 7     | 51,600,000    |
| 8     | 30,788,000    |
| 9     | 21,500,000    |
| 10    | 19,952,000    |
| 11    | 17,200,000    |
| 12    | 13,588,000    |
| 13    | 11,524,000    |
| 14    | 10,320,000    |
| 15    | 7,310,000     |

| Df 13% | B/C    | NPV (Rp)       | IRR (%) |
|--------|--------|----------------|---------|
| DF 13% | 1.92   | 51,809,117,874 | 37%     |
| Sensitivity (price IDR500) | 0.22 | (43,837,479) | 10% |
| Sensitivity (price IDR 846) | 0 | 0 | 13% |

Table 3. Financial Analysis of Lime Farming in Tanah Datar District
3.3 Benefit-Cost Ratio (B/C)

Based on Table 3, it can be seen that B / C from lime farming is 1.92 at df 13%. This shows that every additional fee is IDR 1.00 will produce additional benefits of IDR 1.92 from lime farming. According to Rahim and Diah (2008), if the B / C ratio is greater than one, then the business can be said to be feasible. That is, the investment made has provided benefits. The B / C value generated from the analysis of the financial feasibility of lime in the study area shows a number greater than one so that the lime farming in the area is feasible because it has provided benefits to the respondents.

3.3.1 Net Present Value (NPV). NPV calculations are performed to determine the present value of the net benefits obtained during the lime farming period. The NPV value of lime juice with a discount rate of 13% is IDR 51,809,117. This value indicates that lime farming in Tanah Datar District will provide additional net benefits of IDR 51,809,117. According to Suliyanto [9], if the NPV value is positive, it means that the investment gives higher results than the minimum desired rate of return. This condition indicates that the investment is feasible. The results of research on lime farming in Tanah Datar District are feasible because they have a large NPV value from zero (NPV > 0).

3.3.2 Internal Rate Returns (IRR). The use of IRR on business feasibility is done by comparing the opportunity value of capital (OCC). The OCC value used as a comparison, and the feasibility indicator based on the IRR criteria in this analysis is 13%. Based on the calculation results, the IRR value of lime farming in Tanah Datar District is 37%. This value indicates that the rate of return on lime farming for the investment invested is 37%. The IRR value obtained based on the results of this calculation is higher than the specified OCC level. Thus it can be concluded that lime farming in Tanah Datar District is feasible.

3.3.3 Sensitivity Analysis. Sensitivity analysis of lime farming is carried out at a price. Price becomes a variable that will determine the income obtained by farmers. If there is a price change, there will be a change in farmer's income. The data shows whether farming is still feasible if a price decline occurs. Based on the results of the field survey, the price of lime purchased by collectors from farmers varies greatly in recent years. This has resulted in uncertainty about the income received by farmers. The lowest price ever received by farmers is IDR 500. Sensitivity analysis at a price level of IDR 500 gets an IRR of 10%. Lime farming is not feasible at a price level of IDR 500 per kg, where there was no farmer harvest their lime fruits and left rotten on the land. Lime farming can break even at a price level of IDR 846, where at the price level, lime farming is not profitable and does not lose.

4. Conclusion

The results of the analysis show that at an interest rate is 13%, and a selling price is IDR 4,300/kg at the plant's economic age (15 years), this farm obtained a B/C value of 1.92, NPV is IDR 51,809,117, and IRR is 37%. From the sensitivity analysis, it is known that at the selling price of IDR 500/kg, this farming is not feasible, and at the selling price is IDR 846/kg achieved by BEP. It can be concluded that financially this farming is feasible. Trading policies, utilization and further processing of products are needed so that the selling price is not too volatile at certain times.

5. Acknowledgments

The authors would like to thank the respondents, Head of Horticulture Crops Office of Agriculture, Plantation and Forestry of Tanah Datar District and Staff, Head of BPP Padang Ganting and Staff, Head of Padang Ganting and TanjungEmasSubdistrict and Staff, and Institute of Research and Community Service (LPPM).

6. References
[1] R. Rukmana, *Jeruk Nipis Prospek Agribisnis, Budidaya dan Pasca Panen*. Yogyakarta: Kanisius, 2003.
[2] Anonimous, “Pengembangan Buah-buahan Sumatera Barat. Dinas Pertanian Tanaman Pangan Provinsi Sumatera Barat,” Padang-Indonesia, 2014.
[3] R. Mansur, “Analisis Tatanaga Jeruk Nipis yang Berasal dari Nagari Padang Gantiang Kecamatan Padang Gantiang Kabupaten Tanah Datar,” Universitas Andalas, 2016.
[4] R. Sari, R. Syahyana, L. Triana, and A. Putri, “Kajian Potensi Pengembangan Agribisnis Jeruk Nipis (Citrus aurantifolia) di Kabupaten Tanah Datar Sumatera Barat,” Padang-Indonesia, 2017.
[5] J. Gittinger, *Economic Analysis of Agricultural Prroeject (2nd Ed.)*. Jakarta: UI Press, 1986.
[6] M. Nazir, *MetodePenelitian*. Bogor: Ghalia Indonesia, 2011.
[7] L. Gaol and P. Edison, “Respon Pertumbuhan Stek Jeruk Nipis (Citrusaurantifolia Swingle) pada Berbagai Bahan Tanaman dan Kosentrasi IBA (Indole Butyric Acid),” *Agroekoteknologi*, vol. 4, no. 1, pp. 1815–1821, 2015.
[8] S. Sinaga and Jufri, “Analisis Finansial Usahatani Jeruk Nipis,” *J. Soc. Econ. Agric. Agribinis*, vol. 4, no. 8, 2015.
[9] Suliyanto, *Studi Kelayakan Bisnis*. Pendekatan Praktis Yogyakarta: Penerbit Andi, 2012.