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Case Study

Feasibility Study of Tangerines and Siamese in Dau District, Malang Regency, Indonesia

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Abstract

Oranges are favored by consumers, especially during pandemic covid-19, because they contain high vitamin C. Gadingkulon Village, located in Dau District, Indonesia, is one of the largest oranges producing villages. Mainstay plantation commodities of the village are tangerines and siamese. Agricultural commodities generally fluctuate in price and production. The study's purpose was to evaluate feasibility of farming tangerines and siamese. Data were collected from 87 farmers who grow both types of oranges. Farmers were selected by simple random sampling, where the number is determined using slovin formula. The data were analyzed using investment criteria of revenue cost ratio, benefit cost ratio, break event point for price and production, payback period, net present value and internal rate of return. The results show that tangerine and siamese farming were feasible to develop because investment criteria number exceeds some criteria. Payback period is less than five years, price and production break event point were lower than that received by farmers, net present value is relatively large and positive, rate of return on capital is higher than social opportunity cost of capital. Oranges farming was feasible yet, even though prices have fallen by 10% and production by 30%. Siamese were more profitable than tangerines.

Keywords: Feasibility, investment, tangerines, siamese**.**

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Introduction

Oranges plants have a potential to be developed because they are able to provide added value, even though their production fluctuates. The plantation commodity is widely cultivated by farmers because it is easy to plant in the lowlands and highlands, maintenance is not too elaborate, so the cost is not too expensive, and it is profitable. The fruit is consumed by almost all people.

National consumption of oranges during 2015-2019 period showed an increase from 1,968 thousand tons in 2015 to 2,562 thousand tons in 2019. The growth of oranges consumption during the period was 5.34% per year. However, domestic production has not been able to meet the needs of population, because Indonesia is just importing the commodity. Quantity of oranges imports over a five-year period tends to increase from 1,130 thousand tons in 2015 to 1,180 thousand tons in 2019. Actually, oranges imports have decreased during 2015-2018, but increased again in 2019. Growth of domestic oranges production which only reached 0.88% per year (BPS, 2021), will further widen gap between total production and consumption of oranges. It is worrying as stated (Pudjiastuti et al., 2013b)(Pudjiastuti, 2014)(Pudjiastuti & Kembauw, 2018) that financing on imports continuously will reduce country's foreign exchange reserves. There were many factors that affect number of imported oranges circulating in the country. (Rachmi et al., 2018) found that a decrease in the price of imported oranges from China would be reduce market share of local oranges in Indonesia. (Pangestika & Yuliawati, 2019) mentioned a lag in import volume and domestic orange prices as significant determinants of the fruit imports in Indonesia. (Balitbang, 2020) revealed that China is one of the largest producing countries for tangerines besides Spain, Morocco and Turkey, but the largest oranges producing countries in the world are Spain, China and United States. (Saphira & Pakpahan, 2017) also found that imports of oranges from China are considerable because the country is Indonesia's largest trading partner and Indonesia does not impose import tariffs. (Pudjiastuti et al., 2013a) said that the elimination of import tariffs on a commodity will be increase the number of commodities circulating in the country. (Hanif, 2021) represented that the types of oranges grown in Indonesia are siamese (70%), tangerines (20%) and other oranges (10%).

Citrus production in Florida is declining because many plants are dying. It requires a very large investment for replanting. The feasibility of investing in this citrus crop was evaluated by NPV (Spreen & Zansler, 2016). In India, the economic feasibility of mandarin oranges was also carried out using the B/C ratio, NPV, IRR and PP (Passah & Tripathi, 2020). By adding BEP, (Namah & Sinlae, 2012) also conducted a feasibility analysis of SoE' tangerines. Oranges as a basic sector in East Java have also been analyzed for feasibility using R/C, B/C, NPV and IRR (Retnoningsih, 2017). The potential for citrus development in Tanah Datar and Selayar, Indonesia was evaluated by B/C, NPV, IRR (Sumartono et al., 2019) and added sensitivity analysis (Armiaty, 2013)(Sari et al., 2020). These various studies reveal that citrus plants have a relatively large potential to be developed as also described by (Kristiandi et al., 2021).

Orange farmers in Indonesia are generally small farmers with 50-1000 trees or equivalent of 0.12-2.50 hectares, although there are also some entrepreneurs who manage oranges plantations up to > 200 hectares. Productivity of the plant varies greatly from 20

– 80 kg per productive tree (5-10 years old). The lack of application of recommended technology by farmers can be the main cause of the low productivity and quality of national oranges.

Tangerines and siamese are the leading commodities in Gadingkulon Village, Dau District, Malang Regency. During the pandemic covid-19, the demand for oranges in the village has increased relatively due to the high vitamin C content, because it is considered to increase endurance. Gap between production and consumption and the various problems that follow, encourage the need for attention to development of existing oranges cultivation. Evaluating the feasibility of cultivating tangerines and siamese will provide benefits, not only for farmers, but also the various parties involved in trading these commodities, including the government as a policy decision maker. The aims of the study was analysis the feasibility of tangerines dan siamese farming and their sensitivity for the decreasing of the price and production.

Research Method

The research was carried out in Gadingkulon Village, the center of the production of tangerines and Siamese oranges in Dau District. The population of this study were all farmers who cultivated both types of oranges. The number of farmers in this category is 343 people. Quantity of sample was determined using slovin formula. Based on the calculations, obtained 87 citrus farmers as a sample. Therefore, sample was selected by simple random sampling, with the consideration that the area of land cultivated by farmers was relatively homogeneous.

Data that has been collected, edited, presented in a contingency table, and analyzed descriptively quantitatively. The feasibility of farming was evaluated with parameters R/C, B/C, BEP, Payback period (PP), NPV and IRR.

1. *Revenue Cost Ratio* (*R*/C): shows the profit earned from every IDR spent in oranges cultivation. The plantations is declared to be feasible if R/C > 0. Mathematically, the formula is:

$$^R/_C \text{ Ratio} = \sum_{t=1}^{n} \frac{(R_t - C_t)}{(1+r)^2} \tag{1}$$

R_t = revenue of t-year
n = economic life
C_t = cost of t-year
t = year (0, 1, 2, 3, ...)

2. *Benefit Cost Ratio* (*B*/C): shows the profit earned from every IDR spent in oranges cultivation. The plantations is declared feasible if B/C > 0. Mathematically, the formula is:

$$^B/_C \text{ Ratio} = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^2} \tag{2}$$

B_t = profit of t-year

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3. *Break Even Point* (BEP): the minimum amount of production that must be produced in order to cover the costs incurred. There are two types of these parameters, namely the price BEP and the production BEP, which are calculated by the formula:

$$BEP_{price} = \frac{FC}{P-VC} \tag{3}$$

$$BEP_{unit} = \frac{FC}{P}$$

FC = fixed cost
P   = selling price per unit
VC = variable cost per unit

4. *Payback Period* (PP): estimated payback period for citrus cultivation. Parameters are calculated using the formula:

$$PP = \frac{Initial\ investment}{Revenue} x\ Time\ period\ (years) \tag{4}$$

Oranges farming is state to be feasible if the PP is less than or equal to the economic life of the project.

5. *Net Present Value* (NPV): is the difference between the present value of profits and costs. Mathematically, NPV is formulated as:

$$NPV = \sum_{t=1}^{n} \frac{B_t - C_t}{(1+i)^t} \tag{5}$$

i: *Compoud rate* or rate of interest (%)

Criteria: NPV > 0, the farming is feasible; NPV = 0, the farming returns equal to investment; NPV < 0, the farming is not feasible

6. *Internal Rate of Return* (IRR): the discount rate that equates the present value (NPV) with the total project investment:

$$IRR = i_1 + (i_2 - i_1) \frac{NPV_1}{(NPV_1 - NPV_2)} x\ 100\% \tag{6}$$

i_1 = interest rate that produces NPV > 0; i_2 = interest rate that produces NPV < 0; NPV_1 = NPV at interest rate i_1; NPV_2 = NPV at interest rate i_2

7. Sensitivity Analysis

Sensitivity analysis was based on the decline in the production and price of oranges at the farm level. Prices were assumed to be reduced by 10% and production by 30%. The percentage were estimated based on price and production developments over 12 years.

Results and Discussion

Farmers and Farming of Tangerines and Siamese in Gadingkulon Village

Oranges farmers have varying ages, number of family members, education, and length of the farming. Characteristics of these farmers were presented in Table 1. The villagers who cultivate oranges on dry land, mostly (73.6%) are young (20-49 years old). It is quite interesting because the current phenomenon, many people are no longer willing to work as farmers.

Table 1 Characteristics of Orange Farmers in Gadingkulon Village, 2022

No	Description	Category	Frequency (person)	Percentage (%)
1	Age (year)	20-29	22	25.3
		30-39	16	18.4
		40-49	26	29.9
		50-59	17	19.5
		60-69	6	6.9
Total			87	100
2	Family members (person)	3	28	32.2
		4	34	39.1
		5	25	28.7
Total			87	100
3	Education	Primary school	50	57.5
		Junior high school	24	27.6
		Senior high school	13	14.9
Total			87	100
4	Farming experience (year)	1-9	10	11.5
		10-19	30	34.5
		20-29	34	39.1
		30-39	12	13.8
		40-49	1	1.1
Total			87	100

According to the farmers' perception, oranges cultivation does not require special treatment like other crops, so when there is no activity on farm, they can get cash from off farm. Moreover, all farmers also have to provide for their family members, which consist of 3-5 people. It is a relatively heavy burden, especially in a pandemic situation.

Most of (85%) farmers had formal education below high school, indicating that oranges farming does not require a high level of education. Anyone can enter this field of work, as long as they have sufficient capital to own or rent suitable land for the cultivation. Knowledge and skills in developing oranges plants can be obtained from fellow farmers under the guidance of extension workers who work in this village. Moreover, most (88.5%) of farmers have more than 10 years of experience in cultivating oranges. Participation of young farmers in the farming shows that the compensation obtained is quite promising.

Currently, there are around 3090 tangerine and 3270 siamese trees planted by farmers on their own land. Siamese are more widely cultivated because they are more expensive and easier to maintain than tangerines. Age of tangerines ranges from 2-30 years, while

siamese were 7-15 years old. The orange planting distance applied by farmers in Gadingkulon Village is 4x3 meters.

The equipment used by farmers includes hoes, sprayers, water reservoirs, sickles and scissors. Farmers involve male and female workers both from inside and outside the family (paid labor) starting from land preparation (cultivating the soil and applying basic fertilizer), planting, maintenance (fertilizing, watering, pruning, spraying pesticides, weeding).

Male labor had been worked for 8 hours per day with a wage of IDR 65,000, while female for 5-6 hours per day with wages of IDR 40,000-50,000. Especially for female labors, the wages were determined by the length of working hours and their severity. Harvesting was not done by farmers because the activity is carried out by traders. The activity was done twice a year, i.e. in June and December for tangerines, January and August for siamese. It is one of the reasons farmers grow both types of oranges in the hope of getting cash more evenly throughout a year. Each oranges tree yields 16-20 kg. Farmers had been sold tangerines at a price of IDR 8,000-9,000 per kg, while siamese oranges are IDR 10,000 per kg.

Feasibility of Tangerines and Siamese Farming

Evaluation of oranges farming in Gadingkulon Village takes into account the initial investment (year 0) until the plant is 12 years old when the research is conducted. The assumptions made were: 1) land rent is determined as part of the investment even though the area for cultivation is self-owned, 2) the price of oranges is constant throughout year to year, 3) the depreciation of equipment used by farmers in cultivation is fixed on a flat basis and there is no residual value, 4) production was calculated during the main harvest or two harvest periods each year, 5) evaluation is carried out for 500 tangerine trees and 500 siam oranges (equivalent to an area of 0.6 hectares), 6) the evaluation period is set for 12 years (the age of oranges crop that they produces maximum output), where the investment was issued at the time before planting (zero year).

Cashflow of tangerines and siamese for 12 years based on the assumptions, that have been made along with the parameters that are calculated every year since the plants set to producing, can be seen in Tables 2 and 3. Investments required for the development of oranges plantations include the purchase of equipment, seeds, land rent, and wages for both male and female labor. The workforce is calculated beginning from land preparation, procurement of seeds, planting, maintenance (fertilization, control of plant pests and diseases, pruning of plants, thinning of fruit, and irrigation). Harvesting is not counted because the activity is carried out by traders who buy oranges in bulk. Cultivated oranges start producing in the third year.

Table 2 Cashflow of Tangerine Farming in Gadingkulon Village per 500 trees

Year	Production (ton)	Revenue (million IDR)	Total Cost (million IDR)	Profit (million IDR)	R/C	B/C	BEP	
							Unit (ton)	Price (IDR/kg)
0			103.060000	-103.060000				
1			26.077183	-26.077183				
2			22.659079	-22.659079				
3	8.32586	67.464460	22.659079	44.805381	2.98	1.98	2.79638	2,721
4	9.32586	75.567460	22.659079	52.908381	3.33	2.33	2.79638	2,430
5	11.32586	91.773460	22.659079	69.114381	4.05	3.05	2.79638	2,001
6	14.32586	116.082460	22.659079	93.423381	5.12	4.12	2.79638	1,582
7	17.32586	140.391460	22.659079	117.732381	6.20	5.20	2.79638	1,308
8	20.32586	164.700460	23.179079	141.521381	7.11	6.11	2.86056	1,140
9	23.32586	189.009460	23.179079	165.830381	8.15	7.15	2.86056	994
10	26.32586	213.318460	23.179079	190.139381	9.20	8.20	2.86056	880
11	29.32586	237.627460	23.179079	214.448381	10.25	9.25	2.86056	790
12	32.32586	261.936460	23.179079	238.757381	11.30	10.30	2.86056	717

Initial investment for cultivating tangerines is 103 million rupiah (Table 2). The costs incurred by farmers starting in the second year include labor costs for plant maintenance, purchase of fertilizers and pesticides, which were evenly distributed throughout the years. The increase in costs start up in the eighth year is due to an increase in the amount of pesticides. During the first two years of oranges cultivation, farmers have not received income. Since the third year, tangerines began to produce about 8.3 tons. The production continues to grow up with increasing age of oranges, so that it becomes 32.3 tons when the plant is 12 years old. Assuming the price of oranges is constant for 12 years, which is IDR 8103 per kg, then farmers' income also tends to increase to reach IDR 238.75 million in the 12th year (2021). Based on the R/C and B/C, tangerine farming was declared feasible to be developed because the value was >1. R/C figure even reaches 3-11, and B/C reaches 2-10, which indicates that the revenues and profits derived from the cultivation are multiples of the parameter number compared to the costs incurred. It is also in harmonious with the BEP price and production. Tangerine plantations is very profitable.

Likewise with siamese, the initial investment is only slightly different from tangerines (see Table 3). Since the third year, the oranges have produced 8.9 tons, slightly higher than tangerines. The oranges production also continued to increase to reach 32.9 tons in the 12th year. Tangerines price were estimated at IDR 10,000 per kg based on the wholesale price of the collectors, so that farmers' income also increased to reach IDR 306 million in the 12th year. Tangerine farming be avowed feasible to be developed because the R/C and B/C greater than 1. The R/C figures even reach 4-14, and B/C reach 3-13, which indicates that the revenues and profits derived from the cultivation are multiples of the parameter number compared to the costs incurred. It is also in conformable with the BEP price and production.

Table 3 Cashflow of Siamese Farming in Gadingkulon Village per 500 trees

Year	Prodution (ton)	Revenue (million IDR)	Total Cost (million IDR)	Profit (million IDR)	R/C	B/C	BEP	
							Unit (ton)	Price (IDR/kg)
0			103.042500	-103.042,500				
1			25.715446	-25.715,446				
2			22.362342	-22.362,342				
3	8.937	89.37	22.362342	67.007,658	4.00	3.00	2.23623	2,502
4	9.937	99.37	22.362342	77.007,658	4.44	3.44	2.23623	2,250
5	11.937	119.37	22.362342	97.007,658	5.34	4.34	2.23623	1,873
6	14.937	149.37	22.362342	127.007,658	6.68	5.68	2.23623	1,497
7	17.937	179.37	22.362342	157.007,658	8.02	7.02	2.23623	1,247
8	20.937	209.37	22.882342	186.487,658	9.15	8.15	2.28823	1,093
9	23.937	239.37	22.882342	216.487,658	10.46	9.46	2.28823	956
10	26.937	269.37	22.882342	246.487,658	11.77	10.77	2.28823	849
11	29.937	299.37	22.882342	276.487,658	13.08	12.08	2.28823	764
12	32.937	329.37	22.882342	306.487,658	14.39	13.39	2.28823	695

Based on the parameters of R/C, B/C, BEP production and price, siamese are more profitable than tangerines. Therefore, farmers grow more siamese than tangerines. In addition, farmers also said that the maintenance of tangerines is more difficult, while the price of siamese is higher. The farmers always to cultivate both types of oranges because of high demand and adjusting consumer purchasing power during pandemic. The feasibility of citrus farming based on other investment criteria (payback period, NPV and IRR) along with the sensitivity analysis is presented below.

Investment Criteria and Sensitivity Analysis

Oranges farming in Gadingkulon Village, both tangerines and siamese is feasible to be develop because when this research was conducted, farmers had already received a return on all their invested capital (see Table 4). The return on investment was achieved in a period of less than five years, where the achievement of the tangerine farming was slightly shorter than siamese. NPV of both types of oranges is positive, where the siamese reaches IDR 534 million, which is higher than the tangerine whose value is IDR 362 million. The capital interest earned from the cultivation of siamese was higher than tangerines, but the capital interest of the two businesses is much higher than the prevailing interest rate (12%). Based on these three criteria, citrus cultivation in this village is profitable.

The production and prices of oranges fluctuate as well as agricultural commodities in generally. Based on the assumption of that prices fall by 10% and production decreases by 30%, a sensitivity analysis was carried out. As a result, the dynamic will be extend payback period to a maximum of 7.5 years for tangerine farming, and 6 years for siamese. Meanwhile, the rate of return on capital also fell to 25% for tangerines and 32% for the other. The results of the analysis in Gadingkulon Village where the payback period less

than economic life of the project, NPV > 0 and IRR> bank interest rates were just better than the results of the study (Namah & Sinlae, 2012) in Kupang; (Armiaty, 2013) in Selayar; (Sumartono et al., 2019) in Gunung Omeh, (Passah & Tripathi, 2020) in Meghalaya, India; dan (Lubis & Supriana, 2021) in Langkat.

Table 4. Investment Criteria and Sensitivity Analysis of Orange Farming

Condition	Tangerines			Siamese		
	Payback Period (year)	NPV (million IDR)	IRR (%)	Payback Period (year)	NPV (million IDR)	IRR (%)
Normal	4.7	362.023499	33.92	4.9	534.118348	40.97
Price decrease 10 %	5.01	301.089287	31.59	5.2	456.166015	37.99
Production decrease 30 %	7.54	179.220865	24.88	6.19	300.261350	31.68

The investment criteria figures from sensitivity analysis reveals that oranges cultivation in the production center area in Dau District is very feasible to be developed. The entry of new players (there are young farmers with 1 year experience, see Table 1) in the cultivation of agricultural commodities favored by consumers from various groups of society is an indicator of the attractiveness of this farming. Moreover, this farming does not require high education and skills.

Conclusions

Tangerine and siamese farming in Gadingkulon Village, Dau District, Malang Regency during the COVID-19 pandemic has promising prospects. The farming is considered feasible to be developed because R/C and B/C >1, BEP production is lower than the product produced, BEP price is much lower than the price received by farmers. According to other investment criteria, payback period from cultivating the commodities were relatively concise, i.e. less than 5 years, positive NPV, and the rate of return on capital is much higher than the social opportunity cost of capital, the farming can be said to be very profitable. The decline in the oranges price by 10% and in production by 30%, shows that the commodities that are cultivated in Indonesia were feasible yet. Relatively, siamese are more profitable than tangerines.

The limitation of the study is the difficulty of obtaining information about the life of orangess plants cultivated by farmers. Farmers find it troublesome to remember in what year they carried out plant rejuvenation, so the maintenance costs which include the amount of fertilizers, pesticides and labor may be slightly different from the facts. For the reason, it is necessary to assist extension workers in recording the expenditure and receipts of oranges farmers, so that they can be more empowered, including in determining prices. It will also be useful for decision makers on oranges commodity development.

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