Siam Madu citrus seeding in supporting the development of Sumatra citrus zone

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Abstract. The purposes of this study were to identify the potency of citrus farming and to recommend citrus seeding development policy in North Sumatra Province. The method used in this study was desk study, and secondary data was analyzing descriptively. citrus seeding is one of the keys to the success of citrus farming. North Sumatra Province is one of the centers for citrus development in Indonesia. The seed is one of the keys to the success of farming. Currently, citrus development in North Sumatra is still constrained by the availability of seeds. Only a few proportions of the seeds that are currently used by farmers were from local breeders and usually carried out if there was a government program. The shortage of citrus seeds came from outside of North Sumatra Province as the Bangkinang citrus variety which is parent stock source was not guaranteed. One of the citrus types in North Sumatra Province is called ‘siam madu’ citrus. The opportunity for siam madu citrus seeding development was feasible, considering that siam madu citrus was very popular for citrus farmers.

1. Introduction
The demand for citrus commodities continues to increase every year, this is in line with the increasing population and increasing income, as well as people's tastes or lifestyles that are more concerned with the consumption of quality fruits, as well as the development of the domestic food or beverage processing industry. The increasing need for domestic citrus consumption has not been matched by domestic production. This is one of the reasons for the entry of imported citrus into Indonesia.

The development of Indonesian citrus has fluctuated every year. In 2007, Indonesian citrus production entered the position of the 6th citrus-producing country in the world with a total production of 2,625,884 tones but has continued to decline since 2008 (2,467,632 tones) and continues to decline to 1,411,229 tons in 2013 (BPS 2014). The cause of the decline in citrus cultivation in Indonesia is due to, among others, a decrease in the raw area of land and the presence of pests that attack citrus plants, and the ability of farmers to manage their farming which is largely determined by the resources they have.

North Sumatra Province is one of the centers for producing citrus in Indonesia. The harvest area for citrus in North Sumatra has always fluctuated from 2012 to 2016 and tends to decline. Compared with the data on the harvest area of siam citrus in Indonesia, which always increases every year (table 1). The causes of the reduced harvest area for citrus in North Sumatra include the condition of many damaged crops due to natural factors of Sinabung eruption in Karo district, fruit fly attacks, viral diseases, and unstable price factors so that many farmers switch to coffee and vegetable crops (Anonymous, 2017). However, the development of citrus plants in North Sumatra has begun to be
developed in several other areas including Simalungun, Dairi, West Pakpak, and North Tapanuli which have upland dryland agroecosystems.

Figure 1. Development of citrus plants in North Sumatra

One of the successes in developing citrus plants cannot be separated from the use of quality seeds. A prime variety of citrus in North Sumatra, which is very famous for its honey siam citrus. The selection of species/varieties to be developed in an area is adjusted to the adaptation of these varieties. Besides, the selection of citrus types/varieties in North Sumatra cannot be separated from the suitability of the varieties and the interests/habits of citrus farmers and the market. The type of Brastepu tangerine is grown in the highlands of 750-1000 meters above sea level with the characteristics of sweet and fresh fruit taste and has a yellowish-citrus color, while the honey siam citrus is the superior type of citrus of North Sumatra and the National because it has a sweet taste, yellowish-green color when planted in the lowlands and citrus if planted in the highlands.

Honey siam citrus are very attractive to people/farmers in North Sumatra Province. Cirrus which is better known as Karo citrus, are quite popular with consumers because they have a sweet fruit taste, fragrant aroma, attractive appearance and is easy to peel. Seeing the interest of farmers in this type of honey siam citrus plant, the development of the citrus area in North Sumatra also has the opportunity to develop honey siam citrus seeds in North Sumatra.

2. Methodology
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\[
\text{Cost} \quad TC = TFC + TVC \\
TC = \text{Total Cost}(Rp) \\
TFC = \text{Total Fix Cost}(Rp) \\
TVC = \text{Total Variabel Cost} (Rp) \\
\text{Revenue} \quad (Rosyidi, 2001) \\
\text{TR} = P \times Q
\]
TR = Total Revenue (Rp)  
P = Price (Rp)  
Q = Quantity  
Income (Rosyidi, 2001)  
I = TR – TC  
I = Income (Rp)  
TR = Total Revenue (Rp)  
TC = Total Cost (Rp)  
Profitability (Rosyidi, 2001)  
π = TR – TC  
π = Profit (Rp)  
TC = Total Cost (Rp)  
TR = Total Revenue (Rp)  

Feasibility: To determine the feasibility of farming, the Revenue Cost Ratio (R/C ratio) is used, which is the result of the division between revenues and total costs (Soekartawi, 1995). To determine the feasibility of farming a formula is used (Soekartawi, 1995): 

\[
RCR = \frac{TR}{TC}
\]

RCR = Revenue Cost Ratio  
TR = Total Revenue (Rp)  
TC = Total Cost (Rp)  

Break-Even Point (BEP)  

\[
BEP = \frac{TC}{Q}
\]

TC = Total Cost  
Q = Quantity

3. Result and Discussion
3.1 Potential Development of Citrus Plants in North Sumatra  

One of the national citrus centers is located in North Sumatra Province and citrus is one of the leading commodities of North Sumatra. Since 1930 Karo farmers have planted the Berastagi tangerine variety and in 1979 they replaced it with Honey Siamese citrus (Citrus suhuiensis Tan.). The data on the increase in citrus planting area can be seen from the harvested area data for citrus in several urban districts in North Sumatra, as shown in table 1. Based on the citrus development table in North Sumatra, it shows that several centers of citrus plants have begun to grow in several areas other than Karo Regency. Regencies that have a large area of citrus plants apart from the Karo Regency include Simalungun Regency and Dairi Regency.

This is since the location of the two districts is adjacent to the Karo district, these two districts also have upland areas whose past ecosystem resembles that of the Karo district. The proximity of the region makes information on citrus development technology easier to accept by farmers in these two districts from Karo district. Besides, the decrease in the planting area of citrus which has been replaced by coffee plants due to the attack of fruit flies and the eruption of Mount Sinabung has caused damage to citrus plantations in Karo Regency which provides opportunities for the development of citrus areas in other districts that are not affected by exposure to Mount Sinabung eruptions.

Table 1. Data on Citrus Harvested Area per regency in 2017 and harvest area in 2012-2017 in North Sumatra Province

| N0 | Regencies/city | Harvest area (ha) | Productivity (kw/ha) | Production (Ton) |
|----|----------------|------------------|----------------------|-----------------|
| 1  | Nias           | 3,1              | 334,25               | 103,7           |
| 2  | Madina         | 27,9             | 1,005,92             | 2,810,8         |
Judging from the history of planting citrus commodities in Indonesia, citrus has grown in Indonesia, both natural and cultivated, are a legacy from the Dutch who brought tangerines and sweet citrus from America and Italy. (Anonymous, 2010). Citrus plants have growing requirements, including fertile and loose soil which is a good place to grow citrus plants. In soils that contain lots of humus the growth of this plant is very fast, while on soils that contain lots of salt, this plant grows slowly (thin). Good results with acidity degrees (pH) 5-6 (Arsyad et al, 1992). Need 6-9 wet months, rainfall 1000-2000 mm / year evenly throughout the year. The optimal temperature is between 25 - 30 °C and the optimum humidity is around 70 - 80%. The optimum height is between 1 - 1200 masl. citrus do not like places that are protected from sunlight. (Anonymous, 2007).

In the last five years, the area of citrus cultivation in Karo Regency has decreased due to the switch to coffee plants. The transition was based on the condition of old citrus plants (25-30 years old) so that they were no longer productive and there was an attack by fruit fly pests. The farmer saw that it would take time to replace it so he started planting coffee between his citrus crops. When the coffee started producing, the farmers cut down the citrus plants and focused on taking care of the coffee. The

|       | Tapanuli Selatan | 42.2 | 232.77 | 981.7 |
|-------|-----------------|------|--------|-------|
|       | Tapanuli Tengah | 1.5  | 200.00 | 30.0  |
|       | Tapanuli Utara  | 311.5| 764.56 | 23.816.0 |
|       | Toba Samosir    | 7.8  | 351.84 | 274.7 |
|       | Labuhan Batu    | -    | -      | -     |
|       | Asahan          | 3.7  | 385.15 | 142.6 |
|       | Simalungun      | 1.019.0| 1.184.28| 120.675.0 |
|       | Dairi           | 1.180.7| 512.17 | 60.473.6 |
|       | Tanah Karo      | 3.995.1| 586.22 | 234.200.2 |
|       | Deli Serdang    | 2.9   | 514.93 | 147.4 |
|       | Langkat         | 5.0   | 40.00  | 20.0  |
|       | Nias Selatan    | 0.4   | 275.32 | 10.6  |
|       | Humbang         | 45.7  | 310.90 | 1.420.1 |
|       | Pakpak Barat    | 282.8 | 485.98 | 13.741.1 |
|       | Samosir         | 0.8   | 234.67 | 17.6  |
|       | Serdang Bedagai | 1.0   | 258.65 | 25.8  |
|       | Batubara        | -     | -      | -     |
|       | Paluta          | 0.7   | 128.74 | 8.4   |
|       | Padang Lawas    | 4.6   | 257.58 | 119.0 |
|       | Labusel         | 0.5   | 160.00 | 8.0   |
|       | Labura          | -     | -      | -     |
|       | Nias Utara      | 0.7   | 125.93 | 8.5   |
|       | Nias Barat      | 1.0   | 122.37 | 11.9  |
|       | Sibolga         | -     | -      | -     |
|       | Tanjung balai   | -     | -      | -     |
|       | Pematang Siantar| -     | -      | -     |
|       | Tebing Tinggi   | 1.6   | 260.63 | 41.7  |
|       | Medan           | -     | -      | -     |
|       | Binjai          | -     | -      | -     |
|       | Padang          | 0.3   | 286.79 | 7.6   |

| Year  | Gunung Sitoli |
|-------|----------------|
| 2012  | 1.4 | 388.32 | 53.2 |
| 2013  | 7.913 | 442.78 | 350.354 |
| 2014  | 8.746 | 373.11 | 326.322 |
| 2015  | 7.875 | 635.22 | 500.243 |
| 2016  | 6.532 | 739.48 | 483.006 |
| 2017  | 6.663 | 689.15 | 459.149 |
|       | 6.383 | 682.20 | 435.454 |
transition of citrus to coffee plants can be seen in the Districts of Simpang Empat, Tiga Panah, Barus Jahe, Merek (partly), Dolat Rayat, Namateran, and Kabanjahe. The decline in planted area, which of course has an impact on the harvested area, is also evident from the data from the Karo Regency Agriculture and Plantation Office. In 2015, the citrus plantation area in Karo reached 11,131 hectares with a harvest area of around 5,308 hectares and a production of 242,779 tons. In 2016, the planted area was 10,449 hectares with a harvest area of 4,817 hectares and a production of 234,200 tons. Then in 2017, the planting area for citrus was only 8,530 hectares with a harvest area of 3,995 hectares and a production of 234,200 tons (Anonymous, 2018).

Apart from the highlands, citrus development is also carried out by people in the lowlands such as in Langkat Regency. Citrus farmers in Langkat Regency have a superior local variety of citrus called Langkat Regency called ‘Jeruk Pantai Buaya’. These citrus resemble honey siam citrus located in Karo Regency. The difference in fruit skin color for ‘Pantai buaya’ citrus is green, while Siamese honey has a yellow-citrus color, but both have citrus flesh color and a sweet taste. Local varieties are the result of the isolation of citrus plants from various regions in Indonesia. Each local variety can be said to have very beneficial characteristics, especially fruit properties, including size, taste, and color of the fruit skin and juice vesicles (Ziegler and Wolfe, 1975 in Hardiyanto et al 2007).

3.2 Flow of Citrus Seed Marketing in North Sumatra

The need for citrus seeds for the development of a citrus area cannot be separated from the type/variety of citrus to be planted. The more preferred citrus fruit in the community, the more chances are that this type of citrus will be developed. The market for honey siam citrus in North Sumatra is still very large. According to Czepiel et al., (2013) a product is the main focus in determining the market placement strategy. One of the determining factors is product competitiveness. Competitiveness can be used to assess/measure how consumer behavior sees the product. Currently, the local citrus, Siam honey karō, is still very popular and wants to be planted by farmers in citrus development areas, so the need for these citrus seeds is still very high.

![Figure 2. Flow of Citrus Seed Marketing in Sumatera Utara](image)

Sources of citrus seeds in North Sumatra come from citrus growers from North Sumatra Province as well as those from outside North Sumatra Province. With the current area of citrus development areas in North Sumatra, the number of seeds produced by the breeder groups and those that are certified does not match the needs of the seeds needed. Most of the farmers who planted citrus in the citrus development areas in Karo and Simalungun regencies used citrus seeds from their citrus plantations which were taken from trees which the farmers considered quite healthy. Besides, farmers also buy from breeder groups that are trusted by farmers who have a source of cashew that has been registered by BPSB. Farmers generally buy uncertified seed only with the trust capital of the breeder. The selling price of certified and non-certified seed from the group of breeders in Karo is Rp. 22,500 - Rp. 25,000 with the criteria for a plant height of 30 cm from the grafting bud.

| Regency | Breeder’ name | Varieties | Number of trees |
|---------|---------------|-----------|----------------|
| Karo    | Pelawi        | Honey Siam| 8,000          |
|         | UD Kevin      | Honey Siam| 5,000          |

Table 2. Data on Citrus Breeding Activities in North Sumatra Province, FY 2017
Table 1: Siam Madu Seed Development in North Sumatra (2017)

| Source                  | Variety     | Price  |
|-------------------------|-------------|--------|
| CV Nica garden          | Honey Siam  | 7.500  |
| CV Karya Saginta        | Honey Siam  | 7.500  |
| Gung mbelin             | Honey Siam  | 25.000 |
| BraskaRimba Simalem     | Honey Siam  | 25.000 |
| KT Kubu Colia           | Honey Siam  | 1.000  |
| Ud Rika Herti           | Honey Siam  | 1.000  |
| Simalungun              | UD Marsiurupan | 40.000 |
| Darwis Sipayung         | Honey Siam  | 1.000  |
| Tapsel                  | UPT BBI Hortikulutura Arse | 5.000  |
| **Total**               |             | **96.000** |

Source: BPSB TPH Sumut Th 2017

Apart from buying from breeders available in North Sumatra, farmers who lack the capital buy citrus seeds from seed sellers from Medan. The origin of the seeds sold by plant sellers in Medan comes from Riau Province, known as Bangkinang citrus. The price of Bangkinang citrus in the market in Medan is quite cheap compared to citrus seeds from official breeder groups in North Sumatra Province. The selling price of Bangkinang citrus seeds is priced at only Rp. 10,000 - Rp. 12,000. The price difference that is quite far has affected farmers to buy citrus seeds without this certificate which has resulted in the decreasing number of citrus breeding in North Sumatra Province.

Based on the number of citrus seeds produced from citrus seed breeding activities in North Sumatra Province in 2017 (Table 2), assuming 1 ha of citrus plants requires 500 trees, then with 96,000 seed stems, the area of citrus plants that can be planted is only 192 ha for the entire North Sumatra Province. Meanwhile, the development area for several districts exceeds the availability of citrus seeds in the province. North Sumatra, for example, for the planting area of citrus in 2017 in Karo Regency covering an area of 8,530 ha (Anonymous, 2018)

3.3 Policy Implications of Siam Madu Seed Development in North Sumatra

The development of citrus areas in North Sumatra cannot be separated from the use of quality seeds. Quality seeds mean that the seeds must be original to reflect the characteristics of the variety described, grow when planted, do not cause seed-borne disease, and are clean (Nugraha, 2004). Plant material requires certain requirements, namely taken from healthy plants free from pests and diseases and high productivity. Seed selection is the key to success in the citrus cultivation process, so it is necessary to pay attention to seed sources that have certain requirements. Provision of citrus seeds is obtained from purchasing seeds from seed captivity that have received certificates to produce high-quality citrus fruits.

Requirements for good seed sources are seeds purchased from clear and trustworthy breeders, seeds must be labeled or certified, seeds come from varieties that have a clear market and have opportunities in the future, seeds must be free from pests and diseases, and seeds have good vigor (Adam 2013). According to Soelarso (1996) that disease control in nurseries is carried out in a preventive manner, namely starting from the treatment of rootstock seeds, growing media, and grafting tools such as grafting knives, pruning shears, and other tools. Before and after use in the nursery process must be sterilized with 70% alcohol to prevent disease transmission.

For quality citrus seed requirements, among others: Rootstock and scion must be following the requirements. Rootstock seeds that are ready for grafting must meet the following requirements: 1.) Free from seven kinds of systemic pathogens; 2.) Breeding/seed production according to standard procedures; 3.) Labeled/certified citrus seeds from BPSB; 4.) Clear variety / similar to the parent (BPMT); 5) Citrus seeds reach a height of approximately 50 cm/2 flas; 6.) Healthy roots are not bent. Meanwhile, the fruit tree must come from disease-free citrus parent stock trees. The parent stock was cleared of seven systemic pathogens using shoot tip grafting which was carried out in the Balitjestro tissue culture laboratory.
The rootstock seeds are sown with agar media containing minerals and vitamins. Grafting is carried out with the aid of a microscope combining 0.15 mm shoots with rootstock seedlings, then grown in a liquid medium enriched with minerals and vitamins and after growing then indexed to determine whether the plant is completely free of 7 systemic pathogens. Plants that have been declared disease-free are then maintained in the screen house as the main source tree for the foundation blocks scattered in several areas. Parent stock must be maintained optimally and must not be infested by infectious insects and periodic indexing must be carried out, each parent tree in BPMT is dismantled every three years of harvesting and rejuvenated with material originating from BPMT. Citrus seeds that have passed the inspection will be labeled free disease by the local BPSB (Balitjestro, 2015).

In procuring quality seeds, pest/disease control must be carried out. The types of pests that attack citrus seedlings include citrus leaf borer (Phyllocnistis citrella, Staint) which usually fluctuates in the vegetative growth period of the citrus plant. This main type of pest belongs to the order Lepidoptera, Family Gracilariidae, which attacks lime leaves in the dry season or season where it does not rain but the air is not hot. The lime leaves look like winding white lines. When the attack is heavy the leaves become curly, curled, brittle, and eventually dry. Severe attacks occur in plants that are germinating and young leaves wrinkle, roll up, and grow abnormally (Nurhadi and Whittle, 1998).

Another major pest that mostly attacks citrus plants in nurseries was Diaphorina citri. This pest is an insect as a vector for CVPD (Citrus Vein Phloem Degeneration). Until now, D.citri can live and develop on Rutaceae plants such as citrus and yellow (Waterhouse, 1998). The serious attack of these pests can cause the death of young branches (Nurhadi et al 1989). Plant physical factors play a role in the introduction of hosts by insects based on sight. Color is a physical factor that plays a positive role in host recognition. Plant surfaces can only reflect light relatively with a wave range between 350-650nm (Owen 1983) while D.citri is attracted to light waves with a wavelength of 450 nm which are visually seen as yellow (Nurhadi, 1988), so the color of light citrus leaves is light very liked by D.citri.

The development of honey siam citrus seedlings provides an opportunity to be carried out by seed breeders in North Sumatra because the seed market is still open. Future challenges to anticipate market demand is through the implementation of (1) creating technology capable of increasing agricultural production, both in quality and quantity, and (2) creating added value and increasing the efficiency of resource use (Adyana and Suryana, 1996). Price is one of the determining factors in citrus seedlings. With the high demand and price of citrus, it provides opportunities for farmers to cultivate citrus crops so that the need for citrus seeds is getting higher, especially honey siam citrus, which have an impact on growing honey siam citrus seeds.

Procurement of seeds will follow the six exact patterns, namely the right variety, quality, time, quantity, place, and price. In fact, in the field, this pattern has never been fully achieved (Roesmiyanto et al. 2003). The factors affecting the seeding of the Siamese honey citrus include the development of a seed system (seed performance, quality of seeds produced, and competition for seed producers). According to Agus Wahyudi and Suci Wulandari (2017) identified strategic policies that can affect seed performance are seed garden development policies, policies to increase the capacity of breeders in seed production, policies to increase the capacity of breeders in seed production, policies to develop business partnerships with suppliers of production facilities and related with a seed distribution system and a credit scheme development policy to increase electability to formal financial institutions.

Seed development by local breeders and informal institutions plays a role in the management of genetic diversity, but its development still requires guidance (Pandel et al 2015). With the development of local citrus breeders in North Sumatra, it is hoped that the local citrus varieties of North Sumatra will also be more sustainable. Currently, local breeders are limited to producing the recommended seeds of honey siam citrus by farmer groups, most of which are assisted, farmer groups. The number of seeds produced is limited and is intended to meet the seed needs of group members.

Based on observations of citrus seeds produced by seed breeders in North Sumatra are (1). The rootstock seedlings used are large, more than two years old, (2). The rooting of the seedlings is lacking, (3). The height of the seedlings is low, about 10 cm from the base of the rootstock seedlings,
(4). Only some breeders use sticks from the Multiplication Block of budding (BPMT) which are well managed, and (5) plant maintenance during the seed production process is not optimal. This greatly influences the proper pattern of seed supply and generally takes longer to supply seeds. Changing the behavior of farmers who have been making citrus seeds directly on the ground must be changed using innovations that are following citrus seed standards.

The citrus seed technology package recommendation given to breeder groups is a component of the technology package for the production of citrus seeds labeled blue in polybags recommended by Balitjestro, namely (1). Using polybags during the seed production process (Hardiyanto et al. 2011a); (2). Correct seeding of rootstock seeds with a straight taproot of the seedling and should not be bent or curved; (Hardiyanto et al. 2011a) (3). Selection of native or vegetative seedlings that guarantee the purity of the rootstock varieties (Hardiyanto et al. 2011a, Andrina, Anis 2013); (4). Ensure the purity of scion varieties and the health of the seedlings that are free from systemic pathogens including CVPD by using sticks from BPMT (Hardiyanto et al. 2011b; Supriyanto and Whittle. 1992, Supriyanto et al. 1992); (5). A minimum grafting height of 20 cm is related to optimal conditions for rootstock seedlings to be grafted and to reduce the risk of developing soil-borne diseases through rainwater splashing if the seedlings have been planted in the field; and (6). Optimal maintenance during the production process will result in tough seedlings ready to be planted in the field.

The seeds of citrus siam honey in this polybag have the following advantages: (1). The production process is easier and faster, which is only 13-16 months from the time the rootstock seedlings are planted compared to when it is produced in a raised bed which takes 24-30 months; (2). The number of deaths in seedlings in nurseries, in seedlings in polybags, and in grafting seeds is less; (3). The root system of citrus seedlings in polybags is denser; (4). It is expected that the number of dead plants after planting will be less than in previous years due to the better quality of the seeds but the costs incurred are higher than the method of seeding in beds.

One way to fix problems in the field of seedlings is to apply the six principles of correct seed, namely the right variety, the right amount, the right quality, the right time, the right location, and the right price. By paying attention to the 6 right principles of providing seeds, it will produce seeds that are efficient and easily accessible to users. Locations of citrus seed propagation outside the citrus development area cause additional seed distribution costs which have an impact on the price of seed production so that the area development location must have a main garden propagation system.

Currently, infrastructure constraints such as the availability of screen houses for planting the Budding Multiplication Block (BPMT) are still felt by farmer farmers. This affects the breeding activities of the honey siam citrus seeds because when the grafting process is going to be done, the required scion is not available. Several screen houses and orchard gardens that have been built by the government at the farmer group level are also underutilized by farmers as one of the agribusiness businesses for farmers because the use of scion seeds is still done in groups for the needs of members.

3.4 Analysis of Honey Siamese Citrus Seed Farming
Based on the results of the analysis of honey siam citrus farming carried out by farmers with total seed production of 25000 stems, the R/C Ratio value in this study was 1.97, which means that every Rp. 1.00 spent will get a profit of Rp. 0.97 per period. or for 9 months, it can be concluded that the siam honey grafting business in Karo City is feasible to be cultivated or developed. Based on the description of activities, the largest expense is the component of wages. The largest wages incurred are in the form of maintenance costs and plant grafting costs. Maintenance cost components such as watering, fertilization, and pest control must be done frequently considering that the grafted citrus plant will grow the planting material resulting from grafting so that any shoots outside the buds must be sprinkled.

The cost of grafting plants is also very high because grafting personnel must have grafting technique skills so that the grafting eyes that are attached can grow perfectly. The break-even point of the siam honey citrus nursery by grafting is if the business does not get profit or does not get a loss or
the sale of citrus seeds is equal to the total costs incurred. In this study, the break-even point for the siam honey seedling business by grafting was Rp. 11,449 (Table 3).

| No | Cost item | Cost (Rp) |
|----|-----------|-----------|
| 1  | Rootstock | 4,500,000  |
| 2  | Manure    | 4,000,000  |
| 3  | NPK       | 5,325,000  |
| 4  | Topsoil   | 8,250,000  |
| 5  | Husk      | 2,500,000  |
| 6  | Pesticide | 11,400,000 |
| 7  | Polybag   | 8,500,000  |
| 8  | Budding   | 17,500,000 |
| 9  | Herbside  | 1,400,000  |
|    | **Total** | **63,375,000** |

**Labor**

| No | Cost item | Cost (Rp) |
|----|-----------|-----------|
| 1  | Rootstock planting | 12,750,000 |
| 2  | Polybag filling | 22,500,000 |
| 3  | Maintenance (fertilizing, spraying pests / diseases, cutting of bud, cleaning weeds, watering) | 95,250,000 |
| 4  | Grafting wholesale @ Rp.2000x25.000 | 50,000,000 |
| 5  | Transfer of polybags | 7,500,000 |
|    | **Total** | **188,000,000** |

**Tools/equipment’s**

| No | Cost item | Cost (Rp) |
|----|-----------|-----------|
| 1  | Loose     | 200,000   |
| 2  | Hand Sprayer | 1,800,000 |
| 3  | Hoe       | 240,000   |
| 4  | Water pump + hose | 2,500,000 |
| 5  | Shade     | 20,000,000 |
|    | **Total** | **24,740,000** |

**Equipment depreciation per season** 4,673,000

**Miscellaneous expense**
|   | Description                        | Amount     |
|---|------------------------------------|------------|
| 1 | Certification Fee                  | 600,000    |
| 2 | Label                              | 1,500,000  |
| 3 | Land lease                         | 8,000,000  |
|   | **Total**                          | **10,100,000** |

**Cost**

|   | **286,215,000**                     |

| II | **Revenue (R)**25000 tree@Rp22500 | **562,500,000** |
|   | R/C Ratio                         | 1.97         |

| III | Profitable (B)                    | 276,285,000  |
|    | B/C ratio                         | 0.97         |

| IV  | **BEP price (Rp/tree)**           | **11,449**   |
|     | **BEP Production**                | **12,720**   |

### 4. Conclusion

- The development of citrus areas in North Sumatra cannot be separated from the use of quality seeds. The seed of honey siam citrus, which is one of the leading citruses in North Sumatra, is very much needed and has a great opportunity to support the development of the citrus area in North Sumatra.

- Until now, the price of honey siam citrus seeds is still high compared to the citrus circulating in the market of North Sumatra. Efforts that must be made to improve the development of seed systems include improving seed performance, improving the quality of seeds produced, and maintaining competition for seed producers.

- The results of the analysis of honey siam citrus seed farming in North Sumatra show that the business of honey siam citrus seedling is very feasible to be developed, namely with the production of 25,000 seeds showing an R / C Ratio value of 1.97, which means that every Rp. 1 costs incurred will get a profit of Rp. 0.97.

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