Assessment on shallot farming development in North Padang Lawas Regency, North Sumatra

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Abstract. The purpose of this study was to obtain information on the existing shallot farming in North Padang Lawas Regency which includes the conditions of agricultural land for shallot, existing technology, and the income of farmers, then provides recommendations for shallot's farming technology to increase shallot' production, and to increase farmers' income. The method used in this research were survey, field observation, and soil sampling. To determine the suitability of land for shallots, the evaluation of land suitability was carried out by comparing the quality/characteristics of the land with the requirements for shallot growth. Analysis of Land evaluation was carried out computerized using the SPKL version 2.01 software. Analysis of shallot farm income was carried out by analyzing the balance between revenue and cost. The results obtained from this study were the technology used by farmers was still simple, land suitability for shallots is dominated by marginal land suitability (S3) so that additional input is needed to increase production, while shallot farming was feasible with an R/C ratio level of 2,19.

1. Introduction

North Padang Lawas Regency which consists of 12 districts, 386 villages, and 2 sub-districts is very potential as an agricultural and plantation area. This district is generally supported by the agricultural sector in its economic turnover. Both the economic contribution and the livelihoods of the people of North Padang Lawas Regency are mostly involved in the agricultural sector. However, it is estimated that the contribution to economic growth will decrease if other sectors also continue to grow. When viewed from the data published by the Statistical Office of North Padang Lawas Regency in 2017 the agricultural, forestry, and fisheries sectors are still the largest contributors to the regency's GRDP, which is 37%. However, if we look at the trend in the last 5 years, the contribution of the agricultural sector to GRDP growth tends to decline, wherein 2013 it was 5.40% to 5.36% in 2017 [4].

However, seeing the limited land area and increasing population, it is estimated that the need for food will increase, so the growth of the agricultural sector will be a challenge in itself and a necessity to be implemented. Until now, the most prominent agricultural commodities in North Padang Lawas Regency are oil palm and rubber, while other agricultural commodities are still under-cultivated. One of the commodities that have the potential to be developed in this district is the commodity of shallots. This commodity has traditionally been cultivated by farmers in several districts in this regency. Shallot (Allium cepa L.) is a spiced vegetable that is quite popular in Indonesia, has high economic value, functions as a flavor enhancer, and is usually used as an ingredient in traditional medicine.

The prospect of developing shallots is very good, which is indicated by the increasing consumption of shallots along with the increasing population. Increased consumption of shallots per capita per year
from 2013 (2.07 kg) to 2.57 kg in 2017 [13]. This will cause the need for shallots in the future to continue to increase so that it must be accompanied by an increase in production. Shallots production in 2017 was 1,470,155 tons, an increase of 9.3% from 2016 production of 1,446,859 tons [4]. However, in the shallot production process, various obstacles are still encountered, both technical and economic ones. Among them is the availability of quality seeds that are not sufficient in time, quantity, and quality. The high price of seeds as the second-highest production component after the workforce is around 30.47% [1], [3]. Every year the demand for shallots for consumption and domestic seeds continues to increase. To meet these needs, the production and quality of shallot products must.

North Sumatra is one of the producers of shallots in Indonesia. In 2017 the harvested area reached 2,090 ha with a production of 16,103 tons with a productivity of 7.70 tons/ha. Productivity achieved is still below the national average which has reached > 9.0 tons/ha. The total area of the national harvest area in 2017 was 158,172 ha with a production of 1,470,155 tons, there has been an increase in production in the last 5 years of 9.09% per year [4]. Meanwhile, the area of shallot harvest in Indonesia in 2013 was 98,937 ha, and in 2017 as much as 158,172 ha. To meet the need for seeds on the area of shallot planting, a minimum of 189,806 tons of seeds is needed per year, assuming that the need for shallot tuber seeds for 1 ha is 1.2 tons.

The development of the shallot commodity in North Padang Lawas Regency still has many problems faced by farmers as well as horticultural farmers in other areas in Indonesia. So that it has not provided optimal welfare to farmers. For this reason, the Regional Planning Agency (BAPPEDA) of North Padang Lawas Regency in collaboration with the North Sumatra AIAT conducted an assessment of the Potential Development of Red Shallots Commodities in this district, so that in the future this district can develop this commodity optimally with the hope of meeting the community's need for shallots commodities. both within the district itself and to meet the needs of the surrounding area. The purpose of this research is to identify soil conditions, existing technology, and development problems of shallot commodity in North Padang Lawas Regency and provide recommendations, directions, targets, and cultivation technology for shallot development in North Padang Lawas Regency.

2. Methodology

This study was conducted from June to November 2019. The research method used in this study was a field survey to see the agricultural conditions of shallot commodity, soil sampling with accurate sample points using GPS in seven villages that exist shallots cultivation. Complete soil analysis which includes organic C, total N, P-Bray, P-total, K-total, pH, Fe, Al, Ca, Mg, Cu, Zn, Mn, Ec, CEC, and soil texture. Evaluation of land suitability by comparing (matching) between land quality/characteristics with land use requirements. The land evaluation produces land suitability classes and limiting factors that are used as the basis for developing land management recommendations. The land evaluation was carried out computerized using the SPKL version 2.01 software [2]. The Land Suitability Assessment Criteria for Agricultural Commodities [14]. The socio-economic survey was conducted on 30 shallots farmers who were selected purposively, interviews were also conducted with PPLs, retail traders, and wholesalers in Gunung Tua City.

The objects observed are those in the research location and have a role or relationship with the place of research, then analyzed using the R / C Ratio method, to measure business feasibility by comparing the value of the revenue ratio and the value of the cost, then analyzed using the R / C Ratio method, to measure business feasibility by comparing the value of the revenue ratio and the value. cost (cost). So that a business feasibility analysis will be obtained to measure the rate of return on business in applying a technology.
3. Result and Discussion

3.1. Technology existing

Almost all shallots farmers in the ten villages surveyed still practice simple agricultural practices. They still use low-quality seeds where the source of the seeds is obtained from the shallots plants that were harvested earlier. The main complaint from shallot farmers is that farmers anticipate it by making their own seeds by setting aside a portion of the consumption production for seeds at the next planting [19]. The use of tubers of the same variety from generation to generation also causes little chance of improving the properties/quality so that the competitiveness of Indonesian shallots tends to decline. In general, farmers use shallot seed tubers that come from consumption bulbs that have experienced a breakdown of dormancy, so that their purity and resistance to disease and production capacity are still in doubt, especially diseases that previously attacked shallots plantations, so it is feared that they will be carried over to the next generation.

One of the alternative ways to overcome the shortage of planting material to increase the production and quality of shallots is by using superior and quality seeds. Vegetable Research Institute (Balitsa) Lembang has produced many national superior varieties and each of these varieties has its respective advantages depending on the growing environmental factors and the technology applied [7]. Seed technology to increase productivity that has been widely produced but has not been able to be adopted progressively by farmers. Some farmers have adopted new technology from the results of research on shallots that have been carried out including new superior varieties, because the new technology is technically superior, such as increasing productivity and yield quality, and is financially more profitable than conventional technology so that with adopting the resulting technology will increase the farmer's net income [3].

3.2 Land characteristic

3.2.1 Morang village.
Agricultural land for Shallot cultivation in this village is located in rice fields. And the rice fields can be drained when used for vegetable cultivation. Land conditions with a slope of 8-16% with a low to moderate erosion hazard. There is a source of water from irrigation available so that cultivation can be done at any time or planting can be done intensively. The only problem is that the soil organic matter content is low (1.05%). This can be overcome by providing organic material in the form of manure which is available in this area or compost. So that the land is not flooded during the rainy season, it is necessary to make drainage channels and a minimum height of 20-25 cm beds, because shallots plants do not want moist land and are very sensitive to disease attacks caused by fungi.

The degree of soil acidity (pH = 8.08) is included in the alkaline land category, to reduce soil pH it can be done through the application of inorganic fertilizers containing sulfuric acids such as ZA fertilizer (nitrogen source) or ZK fertilizer (potassium element source). The soil texture includes sandy and loose loam. The experience of some farmers in this village on growing shallots is better. Pest and main disease control must be done considering the shallots plant are very sensitive to several pests and diseases that harm plants.

3.2.2 Batu Nanggar village.
The available land is dry land and paddy field. Land conditions are quite good with a soil slope of 8-16% with a low to moderate erosion hazard. There is a water source from village irrigation so that cultivation can be done at any time or planting can be done intensively. The organic matter content of land is included in the low category (0.74%) to improve land, it can be done through the provision of organic material in the form of available livestock manure or compost. Construction of drain ditches and a minimum height of 20-25 cm beds, especially during the rainy season. The degree of soil acidity (soil pH = 8.12) is in the alkaline category to reduce the pH value of the soil, which can be done through the application of inorganic fertilizers containing sulfuric acids such as ZA fertilizer (nitrogen source) or ZK fertilizer (source of potassium element).
3.2.3. Tumbu Jati village.
Most of the land conditions have the potential to support shallot cultivation because the rice fields can be drained. The land slope is 8-16% with a low to moderate erosion hazard. There is a source of water from irrigation available so that cultivation can be carried out according to rice planting or shallot cultivation can be carried out intensively. The problem that exists is the low organic matter content of the land (1.10). This can be done through the provision of organic material in the form of available manure or compost. Making drains and beds at least 25-30 cm, especially during the rainy season. The degree of soil acidity (soil pH = 6.52) is categorized as neutral.

3.2.4. Sidongdong Village.
Agricultural land is located in valleys or watersheds so that crops adjust to the seasons. Land conditions with a land slope of 8-16% with a low to moderate erosion hazard. There is a source of water from irrigation available so that cultivation can be carried out during the dry season. The problem that exists is that the organic matter content of land is in the very low category (0.95%). To improve this condition, this can be done by providing organic material in the form of available livestock manure or compost. Construction of sewerage channels and a minimum height of 25-30 cm beds, especially during the rainy season. The degree of soil acidity (soil pH = 7.41) is in the neutral category. Pest and main disease control must be carried out considering the Red Shallots plant are very sensitive to pests and diseases.

3.2.5. Sampuran Simarloting village.
Agricultural land is located in valleys and watersheds so that crops must adjust to the season. There is a water source from village irrigation available so that cultivation can be carried out during the dry season. The problem is that the soil organic matter content is very low (0.86). This can be done by providing organic material in the form of available manure or compost. Making drains and a minimum height of 25-30 cm. The degree of soil acidity (soil pH = 5.24) is included in the acid category, so it is necessary to apply agricultural lime (kaptan) or dolomite. Pest and main disease control must be carried out considering the shallots plant is very sensitive to pests and diseases.

3.2.6. Simangambat dolok village.
Agricultural land for shallot cultivation in this village is located in rice fields and this land can be dried if it is used for vegetable cultivation. There is a source of water from irrigation available so that cultivation can be carried out at any time or planting is adjusted to rice planting. It's just that the location is in a valley so that the sunlight received by shallots plants is very limited. The problem that exists is the low organic matter content of the land (1.10). This can be done through the provision of organic material in the form of available manure or compost. Making drains and a minimum height of 25-30 cm beds, especially during the rainy season. The degree of soil acidity (soil pH = 6.75) is in the neutral category.

3.2.7. Tanjung Longat Village.
The land for shallot cultivation is generally in rice fields located in the river basin. This village has land conditions with a bumpy slope to hilly. The existing problem is that the location is in a river basin and the danger of flooding is a limiting factor. So planting is recommended in the dry season. Another limiting factor is the very low soil organic matter content (0.84%). This can be overcome by providing organic material in the form of livestock manure or compost. Construction of drainage channels and a minimum height of 20-30 cm beds, especially during the rainy season. The degree of soil acidity (soil pH = 6.34) is in the slightly acidic category, so it is necessary to apply agricultural lime (kaptan) or dolomite. Pest and main disease control must be done considering the Red Shallots plant is very sensitive to pests and diseases.
#### 3.3 The requirement for shallots growth

Shallots plants want to grow in dry climates. Shallots plants are sensitive to rainfall and high rain intensity, as well as foggy weather. This plant requires maximum sunlight (> 70% irradiation), air temperature 25-32 °C, and 50-70% relative humidity [21], [11]. Shallots plants can form tubers in areas where the average temperature is 22 °C, but tuber yields are not as good as in areas with warmer temperatures. Shallots will form larger tubers when planted in areas with more than 12 hours of exposure. Under an air temperature of 22 °C, the shallots plants will not have bulbs. Therefore, the shallot plant prefers to grow in the lowlands with a sunny climate. In Indonesia, shallots can be planted in the lowlands to an altitude of 1,000 m above sea level.

The optimal altitude for the growth and development of shallots is 0-450 m above sea level [21],[5], and the tuber yield is lower. Shallots plants require soil with a crumb structure, medium to clay texture, good drainage, and aeration, contain sufficient organic matter, and a non-acid soil reaction (soil pH: 5.6 - 6.5). The most suitable soil for shallot plants is alluvial soil or a combination thereof with Glei-Humus or Latosol soil [21]. The soil that is quite moist and water is not stagnant is preferred by shallot plants. In Java, shallots are widely planted on alluvial soil types, climate type D3 / E3, namely between (0-5) wet months and (4-6) dry months, and at an altitude of fewer than 200 m above sea level.

Besides, shallots are also widely cultivated on Andosol soil types, climate type B2 / C2, namely (5-9) wet months and (2-4) dry months and an altitude of more than 500 m above sea level [19]. A good time for planting shallots is in the dry season with sufficient irrigation water, namely in April / May after the rice harvest and in July/August. Planting shallots in the dry season are usually carried out on former paddy fields or sugar cane while planting in the rainy season is carried out on dry land. Shallots can be grown intercropping, such as with red chilies [21], [23].

#### 3.4 Land suitability for shallots

From the results of the analysis using the SPKL version 2.01 software, by comparing the land characteristics with the conditions for growing shallots, the land suitability level of the seven research villages was obtained. Where all these villages have the suitability of land for shallots is according to marginal (S3), with a limiting factor that varies for each village, as shown in Table 1.

| No | Village          | Land Suitability | Limiting Factors                                    |
|----|------------------|------------------|-----------------------------------------------------|
| 1  | Morang           | S3: wa, nr3      | Water availability, Soil acidity (pH)               |
| 2  | Batu Nanggar     | S3: wa, nr3, nr4, na1 | Water availability, Soil acidity (pH), low C-organic, Low N-total |
| 3  | Tumbu Jati       | S3: wa           | Water availability                                  |
| 4  | Sidongdog        | S3: wa, na1      | Water availability, Low N-total                     |
| 5  | Sampuran Simarloting | S3: wa, nr3       | Water availability, Soil acidity (pH)               |
| 6  | Simangambat Dolok | S3: wa          | Water availability                                  |
| 7  | Tanjung Longat   | S3: wa, na1      | Water availability, Low N-total                     |

Based on the results of the analysis of shallots farming carried out by farmers with average areas were 0.1 hectares, the R/C Ratio value in this study was 2.19, which means that every Rp. 1.00 spent will get a profit of Rp. 1.19 per period., it can be concluded that shallots farming is feasible to be cultivated or developed (Table 2.)

| No. | Items     | Cost (Rp) |
|-----|-----------|-----------|
| 1.  | Seeds     | 4,200,000 |
| 2   | ZA        | 160,000   |
3 NPK 250,000
4 Manure 460,000
5 Pesticides 640,000
6 Plastic 120,000
7 Rope 72,000
Total 5,902,500

Labor
1. Land Preparation 430,000
2. Planting 150,000
3. Weeding 210,000
4. Pest Controlling 700,000
5. Fertilization 320,000
Total 1,810,000

Harvest and Post-Harvest
1. Harvest and drying 150,000
2. Cleaning / sorting / binding 150,000
3. Transportation 70,000
Total 370,000

Miscellaneous expense
1. Land lease 500,000
2. Land Taxes 42,000
Total 542,000

I Total Cost 8,624,500
II Revenue 900 kg x Rp 21,000 18,900,000
R/C Ratio 2.19
III Profitable (B) 10,275,500
B/C Ratio 1.19

4. Conclusion
a. Shallot farmers in North Padang Lawas still doing traditional agriculture where the source of seeds is still of low quality obtained from the previous harvest.
b. Land suitability for shallots is dominated by marginal land suitability (S3) with variety of limiting factors, such as water availability, soil acidity problem, low C-organic, and low N-total.
c. Even though shallot farmers in Padang Lawas Utara regency still use traditional technology, they still get high profits, and shallot farming activities are still feasible. Where the R / C ratio of shallot farming reaches 2.19, that means is feasible.

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