Characteristics of rice agribusiness in rural areas of Serdang Bedagai regency, North Sumatra

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Abstract. This research was conducted to determine the characteristics of the rice farming system in Serdang Bedagai Regency and to recommend policies to increase the contribution of rice agribusiness to rural development. The studies carried out included the existing technology used by farmers, production, productivity, cropping index, analysis of farming system and distribution, and marketing of products. The research method used in this study is a survey method with a purposive sampling technique to 40 farmers respondents. Structured interviews were also conducted with traders, rice mill entrepreneurs, and policymakers. The data analysis used in this research is qualitative and quantitative analysis. Qualitative analysis is used to find an overview of the technology, production, productivity, cropping index, and marketing and to explain the costs and income of rice farmers which are described descriptively. The quantitative analysis used is the analysis of farm costs and income, which are the ratio of revenue and costs (R/C ratio) analysis and the cost per kg milled dry grain. The results showed that the cultivation technology used by farmers was varied, there were 23 villages whose rice productivity was still below 5 tons/h, 10 villages in 3 sub-districts had the cropping index still below 2, the R/C ratio of rice farming was 1.45, where the cost to produce 1 kg of milled dry grain in Serdang Bedagai Regency, on average are IDR 3,099. Meanwhile, the distribution and marketing of the harvest were controlled by big rice mill entrepreneurs.

1. Introduction

Rice is a strategic commodity because it is the main source of food that influences the economy and politics in Indonesia. As one of the countries with the most populous population and experiencing an increase in population growth every year, followed by an increase in national rice consumption. Based on GriSP (2013), Indonesia is the third rice producer and the first largest rice consumption in the world with a per capita calorie intake from rice of 50.7% (1,260 kcal per day) in 1995 to 47.6% (1,259 kcal per day) year 2009 [1]. Efforts to achieve sustainable food self-sufficiency are still an important agenda for Indonesia, not only related to the issue of national sovereignty but because the need for rice consumption per capita of the Indonesian population is among the highest in the world [2]. Per capita, rice consumption reaches 113 kg/year, higher than other rice consuming countries, so that every year there is an increase in consumption needs [3].

North Sumatra as the 6th national rice producer after East Java, West Java, Central Java, South Sulawesi, and South Sumatra has an important role in supporting national food self-sufficiency. The
total land area is 438,346 ha with an average production of 5.14 tonnes, and a productivity of 5.2 t / ha, which contributes 3.4% to national food [4]. The increase in rice production from 2014 to 2017 by 25.3% is better than the increase in the population of only 3.5%. As an overview, in North Sumatra five districts have contributed greatly to the success of increasing rice production, namely Langkat, Deli Serdang, Serdang Bedagai, Simalungun, and Mandailing Natal regencies with a harvest area of 92,189.1 ha each; 88,881.5 ha; 84,042.1 ha; 71,911.4 ha; 62,713 ha or about 46.3% of the total harvested area in 2017 [4]. This success is supported through 2 aspects, namely increasing planting area and increasing productivity through the paddy field printing program, special efforts (UPSUS) for food self-sufficiency in increasing IP and the spread of new superior varieties, and other important programs.

One of the biggest rice contributors in North Sumatra is Serdang Bedagai regency. Farmers are enthusiastic about planting rice well, supported by relatively fertile irrigated rice fields, farmers responsive to technology, close access to Medan City so that all the information needed can be quickly obtained [5]. This district is one of the regencies on the East Coast of North Sumatra with an area of 1,900.22 km². Geographically relatively flat, the altitude ranges from 0-500 meters above sea level. Based on the administrative area, it consists of 17 districts and 237 villages, and 6 sub-districts. The total population in 2017 was around 612,924 people with a composition of 307,722 men and 305,202 women with a population density of 323 people/km² [6]. Based on Serdang Bedagai regency potential as one of the important rice contributor in North Sumatra, this research was done to determine the characteristics of rice farming and understand the rice marketing pathway in Serdang Bedagai Regency.

2. Methodology

This study was designed as an explanatory study with a survey method. This research used quantitative and qualitative analysis. The qualitative analysis includes analysis of the general state of rice farming which includes existing technology, production, productivity, cropping index, land area, and harvest area. The quantitative analysis in the form of income analysis used the R/C ratio analysis which is widely used to see the cost effectiveness incurred and is more suitable for seasonal farming such as rice.

Types and sources of data used in this study are primary and secondary data, both quantitative and qualitative. Primary data were collected from observations and direct interviews with rice farmers, market players, and field agricultural extension workers (PPL) using survey methods [7]. Interview data were obtained by conducting interviews on 20 rice farmer respondents in each Melati and Pegajaha villages with a list of questions structured and 40 total respondents were interviewed. Respondents were collected purposively (purposive). Secondary data were obtained by collecting information through literature studies from several related government agencies and then analyzed by descriptive method [9]. Farmers’ data on rice farming were analyzed by:

\[ \text{Total Cost (TC)} = \text{Total Fix Cost (TFC)} + \text{Total Variable Cost (TVC)} \]

\[ \text{TC} = \text{Total Cost (Rp)} \]
\[ \text{TFC} = \text{Total Fix Cost (Rp)} \]
\[ \text{TVC} = \text{Total Variable Cost (Rp)} \]

\[ \text{Revenue [8]} \]

\[ \text{TR} = \text{P} \times \text{Q} \]
\[ \text{TR} = \text{Total Revenue (Rp)} \]
\[ \text{P} = \text{Price (Rp)} \]
\[ \text{Q} = \text{Quantity (kg)} \]

\[ \text{Income [10]} \]

\[ \text{I} = \text{TR} - \text{TC} \]
\[ \text{I} = \text{Income(Rp)} \]
\[ \text{TR} = \text{Total Revenue (Rp)} \]
\[ \text{TC} = \text{Total Cost (Rp)} \]
3. Results and discussions

3.1. Existing technology

In general, rice farming activities in Serdang Bedagai Regency are carried out in rainfed and irrigated rice fields, with a relatively small scale of land ownership, between 0.2 hectares to 1 hectare. The technology of rice cultivation that is carried out is also relatively varied with the common spacing is the tegel system of 25 x 25 cm by 30% of farmers, and legowo row 4:1 by 70% of farmers. According to the Badan Litbang Pertanian (2013), the plant population of the 4:1 legowo model with a spacing (20 x 10 cm) x 40 cm is 36 clumps/m2, while with a 20 x 20 cm tegel system there are 25 clumps/m2 [10]. This will affect the plant population per unit area and the number of productive tillers, and in the end, it will affect crop production. This is also related to the effect of peripheral crops, which are expected to be productive so that they will give higher yields.

The results of the study using the legowo planting system show that legowo 4:1 has a higher production compared to legowo 2:1 for both Inpari 30 and Inpari 15 [11]. The seeds used are generally labeled seeds with the majority using superior varieties, either ciherang or inpari, although some farmers also use mekongga variety. Meanwhile, land processing is generally carried out correctly. In general, most of the rice farmers in this district have implemented the recommended cultivation technology. The annual cropping pattern that is commonly applied by farmers in this regency is Rice-Rice-Palawija, or what is mostly done is the Rice-Rice-Soybean pattern. Generally, rice planting time is June-September and October-January, while February-May is the planting time for crops/soybean commodities.

3.2. Harvest area, production, and productivity

Based on the data from BPS (2018), the rice harvested area in this district is 86,316 hectares with production reaching 485,839,563 tons, with an average productivity of 5.87 tons/hectare (Table 1) [4]. From table 1, it can be seen that Sei Bamban and Perbaungan districts are districts with the largest planting and production areas, where Sei Bamban District has a rice planting area of 15,135 hectares with a production of 93,990 tons, while Perbaungan District has an area of 12,277 hectares with a production of 64,666 tons. However, if viewed from the productivity aspect, the sub-district that has the highest rice productivity is Pantai Cermin District with productivity reaching 6.11 tons/hectare followed by Perbaungan District with productivity reaching 6.08 tons/hectare. However, the average rice productivity in Serdang Bedagai Regency is relatively above the national average productivity of 5.4 tons/hectare. Meanwhile, two districts do not have rice fields, namely Dolok Merawan District and Bintang Bayu District, because these two districts are generally areas for oil palm plantations, both privately owned, government and community plantations.
| Districts           | Planting areas (hectares) | Harvesting areas (hectares) | Production (tonnes) | Produktivity (ton/hectare) |
|---------------------|---------------------------|-----------------------------|---------------------|-----------------------------|
| Dolok Masihul       | 3,418                     | 3,536                       | 20,088.43           | 5.68                        |
| Sipispis            | 375                       | 203                         | 1,139.681           | 5.61                        |
| Dolok Merawan       | 0                         | 0                           | 0                   | 0.00                        |
| Tebing Tinggi       | 4,966                     | 3,203                       | 18,535.314          | 5.79                        |
| Bandar Khalifah     | 9,689                     | 10,605                      | 59,179.688          | 5.58                        |
| Tanjung Beringin    | 9,862                     | 10,702                      | 59,834.784          | 5.59                        |
| Teluk Mengkudu      | 7,770                     | 7,554                       | 43,951.416          | 5.82                        |
| Tebing Syahbandar   | 7,080                     | 7,982                       | 45,971.663          | 5.76                        |
| Perbaungan           | 12,277                    | 10,628                      | 64,666.004          | 6.08                        |
| Pantai Cermin       | 8,450                     | 7,060                       | 43,166.875          | 6.11                        |
| Silinda              | 693                       | 458                         | 2,414.554           | 5.27                        |
| Bintang Bayu        | 0                         | 0                           | 0                   | 0.00                        |
| Serba Jadi          | 2,040                     | 2,234                       | 13,008.225          | 5.82                        |
| Tebing Syahbandar   | 1,628                     | 1,142                       | 6,453.34            | 5.65                        |
| Sei Bamban          | 15,135                    | 16,479                      | 93,989.279          | 5.70                        |
| Penggajahan         | 2,928                     | 2,243                       | 13,412.41           | 5.98                        |
| **Total**           | **86,316**                | **84,034**                  | **485,839.563**     | **5.78**                    |

If we look in more detail, there are several villages in the Serdang Bedagai Regency where the productivity of paddy farming is still far below the average rice productivity of both North Sumatra Province and the national average of Indonesia. From Table 2, it can be seen that there are 23 villages in 4 districts in this district whose average productivity is still below 5 tons/hectare. There are 6 villages in Tebing Tinggi District and 4 villages in Silinda District, the average productivity is even below 4 tons/hectare, as well as 1 village in Tebing Syahbandar District whose average productivity is still below 4 tons/hectare. Meanwhile, there are 8 villages in Pegajahan District that have an average productivity of 4.6 tons/hectare, but this average yield is also still below the provincial and national average. The low productivity of rice in some of these villages is likely due to several factors, such as the quality of the seeds used, the use of balanced fertilizers, and inadequate control of pests and diseases [12].

To simplify the distribution of the average productivity of rice in Serdang Bedagai Regency per village, it can be seen in Figure 1. regarding the map of the distribution of productivity at the village level in Serdang Bedagai Regency. The map clearly shows the distribution of villages with rice productivity below 5 tonnes/hectare and above 5 tonnes/hectare. With the map of the distribution of the cropping index, it is hoped that it can facilitate the implementation of IP enhancement activities in these districts.
Figure 1. Map of distribution of rice productivity level in Serdang Bedagai Regency

Table 2. Average Rice Productivity at Village Level in Serdang Bedagai Regency.

| Districts                | Villages         | Productivity(t/h) |
|-------------------------|------------------|-------------------|
| Tebing Tinggi           | Kuta Baru        | 3.8               |
|                         | Mariah Padang    | 3.8               |
|                         | Paya Bagas       | 3.8               |
|                         | Paya Lombang     | 3.9               |
|                         | Paya Mabar       | 3.8               |
|                         | Sei Priok        | 3.8               |
|                         | Silinda Kulasar  | 3.8               |
|                         | Pagar Manik      | 3.9               |
|                         | Pamah Sungai Buaya | 3.9         |
|                         | Tebing Syahbandar Binjai | 4.1         |
|                         | Kuta Pinang      | 4.1               |
|                         | Penggalangan     | 3.8               |
|                         | Penggalian       | 4.0               |
|                         | Paya Pinang      | 4.0               |
|                         | Pegajahan Bingkat | 4.6             |
|                         | Jati Mulyo       | 4.4               |
|                         | Karang Anyar     | 4.6               |
|                         | Lestari Dadi     | 4.6               |
|                         | Pegajahan        | 4.6               |
|                         | Petuaran Hilir   | 4.6               |
|                         | Petuaran Hulu    | 4.6               |
|                         | Sennah           | 4.6               |
3.3. Cropping index

The low productivity and production of rice in several villages in Serdang Bedagai Regency was also followed by low cropping index, there were 10 villages in 4 districts, namely Tebing Tinggi, Kotarih, Dolok Masihul, and Bandar Khalifah Districts whose cropping indexes were still below IP 200 and 2 villages in Tebing Tinggi subdistrict, apart from having a low cropping index, also has very low productivity, which is only 3.8 tonnes/hectare. Meanwhile, in the other 3 districts, although the cropping index was low, from a relative productivity aspect it was quite high because their productivity was already above the national average productivity (Table 3).

One of the efforts to increase rice production in Serdang Bedagai Regency is by introducing a program to increase the cropping index. The activity of increasing the cropping index in its implementation in the target development area uses two strategies, namely technological engineering and social engineering intending to optimize space and time so that the next maximum cropping index production and farmer income also increases [13]. The effort to introduce the increase of IP Paddy to development target areas until it can be adopted by farmers is not easy. First, several preparatory steps are needed, knowing the biophysical, socio-economic conditions, and existing technology that has been applied by farmers. This information is the basis for engineering technology and social engineering to create conducive conditions according to the requirements needed [14].

Table 3. Distribution of Villages with Rice Planting Index <200 in Serdang Bedagai Regency.

| Regency        | Village          | Cropping Index | Harvest Areas (hectare) | Productivity (ton/hectare) |
|----------------|------------------|----------------|-------------------------|---------------------------|
| Kotarih        | Durian Kondot    | 0.04           | 5                       | 5.60                      |
| Dolok Masihul | Batu 12          | 1.71           | 360                     | 5.88                      |
|                | Dolok Sagala     | 1.00           | 40                      | 5.87                      |
|                | Huta Nauli       | 1.97           | 590                     | 5.95                      |
|                | Pekan Kemis      | 1.26           | 245                     | 5.88                      |
|                | Silau Merawan    | 1.29           | 180                     | 5.78                      |
| Tebing Tinggi | Paya Mabar       | 1.67           | 500                     | 3.80                      |
|                | Sei Priok        | 1.91           | 842                     | 3.80                      |
| Bandar Khalifah| Juhar            | 1.99           | 3.892                   | 6.07                      |

Pekan Bandar Khalifah 1.85 505 6.19

In detail, the distribution of the village level cropping index in Serdang Bedagai Regency can be seen in Figure 2. regarding the map of the distribution of the village level cropping index in Serdang Bedagai Regency. In Figure 2, it can be seen that most of the villages in this district have a cropping index of 2-2.5, while a few more villages have a high cropping index and have an IP above 2.5. However, there are still several villages that have a low cropping index or are still below 2 times a year. Table 3, above also found some interesting things as follows:

- Kotarih District IP is still below 1 but productivity is already above 5 tonnes/hectare. Increasing the cropping index to 2 will increase production by 100%.
- Tebing Tinggi, Silinda, and Tebing Syahbandar Districts have a cropping index of ≥2 but their productivity is still low (<4 tonnes/hectare). It is necessary to analyze the soil and evaluate the technology applied.
- Bandar Khalifah, Teluk Mengkudu, Sei Rampah, Serba Jadi and Sei Bamban Districts have productivity> 6 tonnes/hectare. The increase in the cropping index can still be improved and cultivation technology can still be optimized.
3.4. Rice Farming analysis

The results of the analysis of rice farming in Serdang Bedagai Regency were calculated based on the average results of 30 respondents who were interviewed using purposive sampling. These results indicate that the total costs incurred by farmers for 1 hectare of land reached Rp. 15,492,687, with an average yield of 5 tonnes per hectare, rice farmers can generate a gross income of Rp. 22,500,000. If it is deducted from the total cost, each farmer can generate a net income of Rp. 7,007,313 for each hectare per season.

From Table 4, it can be seen that the cost for labor is the largest portion of the cost, namely Rp. 6,283,400 or around 41% of the total cost, while the second-largest cost after labor is the cost for land lease, which is Rp. 5,000,000 / hectare/season or up to 32% of the total cost. The third-largest cost is the cost of buying fertilizer, which is Rp. 2,716,700, or 17.5% of the total cost. Although the costs incurred by farmers are relatively large, economically, this activity is still very profitable. It can be seen from the R/C ratio that it still reaches 1.45. The ratio is still >1 which indicates that this business is still economically feasible.

More details about the cost structure of rice farming in Serdang Bedagai Regency for each 1 kg of milled dry grain production can be seen in the graph in Figure 3. It was shown that the total cost to produce 1 kg of milled dry grain in Serdang Bedagai Regency on average costs Rp. 3,099 / kg of milled dry grain. Of these costs, labor costs are the highest cost spent by farmers, reaching around Rp. 1,257 / kg milled dry grain, while the second-largest cost incurred by farmers to produce 1 kg of milled dry grain was land lease costs which reach Rp. 1,000 / kg milled dry grain, followed by fertilizer costs as the third-largest cost, reaching Rp. 543.34 / kg milled dry grain. Broadly speaking, the cost used to produce 1 kg of milled dry grain for rice in Serdang Bedagai Regency is quite high when compared to the cost of 1 kg of milled dry grain in Vietnam, which is Rp. 1,900 /kg milled dry grain [15].
Table 4. Analysis of Rice Farming in Serdang Bedadai Regency

| Item                  | Costs (Rp.) |
|-----------------------|-------------|
| Seed                  | 100,446     |
| Fertilizer            | 1,377,500   |
| Manure                | 1,339,200   |
| Pesticide             | 919,641     |
| Labor:                | 6,283,400   |
| - Sowing              | 89,000      |
| - Land preparation    | 1,246,000   |
| - Fertilization       | 854,400     |
| - Planting            | 1,246,000   |
| - Weeding             | 1,496,268   |
| - Pest Controlling    | 854,400     |
| - Harvesting          | 1,993,600   |
| Land Tax              | 150,000     |
| Land Lease            | 5,000,000   |
| Irrigation fees       | 322,500     |
| Total Cost            | 15,492,687  |
| Production (t)        | 5 ton       |
| Price MDG/Kg          | 4,500       |
| Revenue               | 22,500,000  |
| Income/season         | 7,007,313   |
| R/C                   | 1,452       |

Figure 3. Graph of Total and Cost Components of Production of 1 Kg of MDG in Serdang Bedagai Regency

3.5. Marketing
Rice marketing in Serdang Bedagai Regency starts with farmers who, on average, sell their rice in the form of harvested dry grain rice at the location of each farmer's rice farm. The produce was bought by an agent who was usually an accomplice to a large rice mill from Sei Rampah City. These crops are sold at a price range of Rp. 4,300-Rp. 5,000 depending on the size of the rice supply available at that time.
Agents usually get a fee from rice milling of around Rp. 100 / kg MDG. Rice that has been milled into rice is marketed domestically in Serdang Bedagai Regency, is also marketed to other regencies/cities outside Serdang Bedagai, and also marketed outside of North Sumatra Province. The flow of rice marketing from Serdang Bedagai Regency can be seen in Figure 8 below.

**Figure 4. Rice Marketing in Serdang Bedagai Regency**

4. **Conclusion**
   1. There are still 23 villages in four sub-districts whose rice productivity is still below 5 tonnes/hectare
   2. There are still 10 villages in four sub-districts whose crop index is still below 2 times a year.
   3. On average, rice farming activities in Serdang Bedagai Regency are still feasible because the financial R/C ratio is 1.45
   4. The cost of producing rice per kg of GKP in Serdang Bedagai Regency is relatively high, namely Rp. 3,099/kg GKP
   5. The distribution and marketing of the rice harvest in Serdang Bedagai regency were controlled by big rice mill entrepreneurs.

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