Management of agricultural tools and machinery of SERASI program to improve food self-sufficiency in Banyuasin District of South Sumatra Province

Hasbi1*, Hersyamsi2 and Ghirana Hananita Dauratri2

1Research Center for Sub-optimal Lands (PUR-PLSO), Universitas Sriwijaya, Palembang, Indonesia
2Faculty of Agriculture, Universitas Sriwijaya, Indralaya, Indonesia

Abstract. This study was carried out to find out the impact of utilized and without agricultural tools and machinery (alsintan) on farmers' income in the SERASI program to achieve its optimal goal in Banyuasin District. This research was conducted from December 2020 to March 2021 at the Food Crops and Horticulture Department, BPP (Balai Penyuluhan Pertanian-Agricultural Extension Center) Muara Telang, Tanjung Lago and Rambutan Subdistricts. The descriptive method was used in this study with the tabulated presentation. The parameters used in this study were the comparison of mechanization and conventional use, the number of available tools and machines, and the impacts of using and without using alsintan on farmers' income. The results showed that the average income of rice farming with alsintan in three study subdistrict were IDR 22,355,500, IDR 15,400,000 and IDR 13,250,000 and without alsintan were IDR 7,830,000, IDR 6,950,000 and IDR 6,528,000/ha per planting season. The SERASI program increased the Crop Index (IP 300) in Muara Telang Subdistrict, and IP 200 in Tanjung Lago and Rambutan Subdistricts. This showed that the Alsintan utilizing in agricultural processing from the soil processing until the harvesting was more effective compared to the process without alsintan.

1. Introduction
The agricultural sector is the main economic foundation of rural communities. Agricultural development policy aims to increase its role for sustainable agricultural development [1]. The increase of agricultural production in order to achieve food self-sufficiency must utilize natural resources efficiently and optimally so as to ensure the sustainability of natural resources. Therefore, the application of agricultural tools and machinery (alsintan) in agriculture must be appropriate.

The application of agricultural tools and machines is carried out to overcome the problem of lack of manpower and increase productivity and efficiency by analyzing the availability and demand for energy. There is a change in the unfavorable demographic structure, where the number of older farmers (over 55 years old) is increasing, while the number of young workers is decreasing. The crisis of young farmers in the agricultural sector and the dominance of old farmers have consequences for the sustainable development of the agricultural sector, particularly on agricultural productivity, market competitiveness, rural economic capacity, and as a result it will threaten food security and the sustainability of the agricultural sector [2].
One of the agricultural mechanization programs as a form of agricultural technology development is intended as a solution to overcome the difficulty of labor in the agricultural sector. The development of agricultural technology is directed at improving the welfare and independence of the community, especially the farmers. Agricultural tools and machinery (alsintan) as a form of agricultural technology development have a very important and strategic role in supporting the fulfillment of agricultural production which continues to increase in line with the population growth, decreasing land carrying capacity and low cropping intensity. Use of agricultural tools and machinery can reduce farming costs and provide benefits for farmers and it contributes to food self sufficiency. Agriculture mechanization has a good prospect if it is preceded by a mapping of needs and availability as well as an adequate institutional environment. Consequently, farm costs become lower and farming efficiency will improve [3].

The strategic position of agricultural mechanization has a very complex meaning for Indonesia because it contains many benefits ranging from increasing production, reducing losses in the harvest process, reducing farming costs, as well as expanding and increasing cropping intensity [4].

This Program Selamatkan Rawa Sejahterakan Petani—Program of Saving Swamp and Making Farmers Prosperous (SERASI Program) is expected to be a solution in the management of tidal swamp lowlands by optimizing the use of tidal swamp lowlands by utilizing good agricultural tools and machinery. If appropriate agricultural technology is successfully developed in Indonesia, food security or food self-sufficiency will be achieved. This study aimed to find out the impact of the use of agricultural machinery on farmers' income in the SERASI program to achieve its optimal goal of increasing production and farmers' welfare.

2. Materials and Method
The research was conducted at the Department of Agriculture, Food and Horticulture, Banyuasin District, South Sumatra Province, the Agricultural Extension Center (BPP) of Muara Telang Subdistrict, Tanjung Lago Subdistrict and Rambutan Subdistrict from December 2020 to March 2021.

The tools used in this research were 1) stationery, 2) camera, and 3) laptop. The materials used in this study were 1) questionnaires, and 2) data from the interviews.

This study used a descriptive-tabulative method, the primary data collection used survey techniques and semi-structured interviews with key informants, namely the Head of the Office of Agriculture for Food Crops and Horticulture, Banyuasin District, Division Head of Horticulture, Division Head of Food Crops and Division Head of Infrastructure. Furthermore, the existing data were checked directly in the field at each Agricultural Extension Center (BPP) office from the three research sample subdistricts, namely Muara Telang, Tanjung Lago and Rambutan Subdistrict by interviewing the BPP Agricultural Extension Coordinators of the research sample subdistricts. The data obtained were processed descriptively and analyzed by comparing the income of farming businesses that used agricultural tools and machines with those that did not use agricultural tools and machines and the data are presented in tabulated form.

The research areas were purposively determined based on the research objectives followed by several considerations.

2.1. Observation parameter
The parameters observed in the study were as follows:

2.1.1. Number of the available agricultural tools and machinery. The number and types of available agricultural tools and machines were analyzed based on the agricultural activities. The data were obtained from the Office of Agriculture, Food Crops and Horticulture, Banyuasin District and from BPP, Muara Telang, Tanjung Lago, and Rambutan Subdistrict.
2.1.2. *The Impacts of using alsintan and without using alsintan on farmers' income.* To find out the relationship between the empowerment of the use of alsintan and the income of farmers using the analysis: According [5], the income of farmers who used alsintan and those who did not use alsintan can be calculated by the formula:

\[ P_d = TR - TC \]

Remarks:
- \( P_d \) = Rice farming income
- \( TR \) = *Total Revenue* (total rice farming revenue)
- \( TC \) = *Total Cost* (total cost of rice farming)

3. **Results and Discussion**

3.1. *The availability of agriculture tools and machinery*

Agricultural development could be done by maximizing the use of agricultural tools and machinery (alsintan). Availability of machineries from each subdistrict in Banyuasin District we presented in Table 1

| No. | Subdistrict        | TR 2 (two-wheel tractor) | TR 4 (four-wheel tractor) | Combine Harvester |
|-----|--------------------|---------------------------|---------------------------|------------------|
| 1.  | Muara Telang       | 385                       | 79                        | 109              |
| 2.  | Tanjung Lago       | 299                       | 14                        | 20               |
| 3.  | Rambutan           | 117                       | 18                        | 18               |
|     | Amount             | 801                       | 111                       | 147              |

Source: Agricultural Extension Center (BPP) in Muara Telang Subdistrict, (2021)

3.2. **Cost of using agricultural tools and machinery**

3.2.1. *Muara Telang Subdistrict.* The costs required for rice production using agricultural tools and machinery were as follows:

| No. | Crop Index            | Cost per Hectare (IDR) |
|-----|-----------------------|-------------------------|
| 1.  | Crop Index 100 (IP 100) | 6,380,000               |
| 2.  | Crop Index 200 (IP 200) | 6,072,000               |
| 3.  | Crop Index 300 (IP 300) | 6,142,500               |

Source: Agricultural Extension Center (BPP) Muara Telang Subdistrict (2020)
Table 3. Rice production costs per hectare without using agricultural tools and machinery in Muara Telang subdistrict.

| No. | Component       | Needs       | Unit Cost (IDR) | Cost per hectare (IDR) |
|-----|-----------------|-------------|-----------------|------------------------|
| 1.  | Soil cultivation| labor       | 10 labors x 3 days | 100.000 | 3.000.000 |
| 2.  | Seeds           | 25 kg       | 10.000          | 250.000                |
| 3.  | Fertilizer:     | - Urea      | 300 kg          | 6.000 | 1.800.000 |
|     |                 | - NPK       | 300 kg          | 5.600 | 1.680.000 |
|     |                 | Herbicide   | 3 liter         | 50.000 | 150.000 |
| 4.  | Harvest:        | Consumption | 15 people       | 133.000 | 2.000.000 |
|     |                 | Labor       | 15 people       | 186.000 | 2.790.000 |
|     |                 | Amount      |                 | 11.670.000 |

Source: Agricultural Extension Center (BPP) Muara Telang Subdistrict (2020)

3.2.2. Tanjung Lago Subdistrict. The costs required for rice production per hectare using agricultural tools and machinery were as follows Table 4.

Table 4. Rice production costs per hectare using agricultural tools and machinery in Tanjung Lago Subdistrict.

| No. | Crop Index          | Cost per Hectare (IDR) |
|-----|---------------------|------------------------|
| 1.  | Crop Index 100 (IP 100) | 7.145.000 |
| 2.  | Crop Index 200 (IP 200) | 6.120.000 |

Source: Agricultural Extension Center (BPP) Tanjung Lago Subdistrict (2020)

Table 5. Rice production costs per hectare without using agricultural tools and machinery in Tanjung Lago Subdistrict.

| No. | Component       | Needs       | Unit Cost (IDR) | Cost per hectare (IDR) |
|-----|-----------------|-------------|-----------------|------------------------|
| 1.  | Soil cultivation| Labor       | 15 people x 2 days | 110.000 | 3.300.000 |
| 2.  | Seeds           | 25 kg       | 10.000          | 250.000                |
| 3.  | Fertilizer:     | - Urea      | 300 kg          | 6.000 | 1.800.000 |
|     |                 | - NPK       | 300 kg          | 5.600 | 1.680.000 |
|     |                 | Herbicide   | 3 liter         | 50.000 | 150.000 |
| 4.  | Harvest:        | Consumption | 15 people       | 133.000 | 2.000.000 |
|     |                 | Labor       | 15 people       | 182.000 | 2.730.000 |
|     |                 | Amount      |                 | 11.670.000 |

Source: Agricultural Extension Center (BPP) Tanjung Lago Subdistrict (2020)
3.2.3. **Rambutan Subdistrict.** The costs required for rice production per hectare using agricultural tools and machinery were as follows Table 6.

**Table 6.** Rice production costs per hectare using agricultural tools and machinery in Rambutan Subdistrict.

| No. | Crop Index | Cost per Hectare (IDR) |
|-----|------------|------------------------|
| 1.  | Crop Index 100 (IP 100) | 6.610.000 |
| 2.  | Crop Index 200 (IP 200) | 5.880.000 |

Source: Agricultural Extension Center (BPP) Rambutan Subdistrict (2020)

**Table 7.** Rice production costs per hectare without using agricultural tools and machinery in Rambutan Subdistrict.

| No. | Component | Needs | Unit Cost (IDR) | Cost per hectare (IDR) |
|-----|-----------|-------|-----------------|------------------------|
| 1.  | Land clearing: | 5 people x 2 days | 120.000 | 1.200.000 |
|     | Labor     | 2 days | 200.000 | 400.000 |
|     | Consumption | 2 days | 200.000 | 400.000 |
| 2.  | Seeds     | 25 kg | 10.000 | 250.000 |
| 3.  | Fertilize: | 300 kg | 6.000 | 1.800.000 |
|     | - Urea    | 300 kg | 5.600 | 1.680.000 |
|     | - NPK     | 3 liter | 50.000 | 150.000 |
|     | Herbicide | 3 liter | 50.000 | 150.000 |
| 4.  | Harvest:  | 15 people | 163.000 | 2.452.000 |
|     | consumption | 15 people | 163.000 | 2.452.000 |

Source: Agricultural Extension Center (BPP) Rambutan Subdistrict (2020)

3.3. **Recapitulation of paddy farmer's income per year**

Recapitulation of receipts, expenses and income is presented in Table 8.

**Table 8.** Rice farming revenue, expenditure and income in Muara Telang, Tanjung Lago dan Rambutan Subdistrict.

| Subdistrict | Reception | Expenditure | Income |
|-------------|-----------|-------------|--------|
|             | Alsintan (IDR) | Without Alsintan (IDR) | Alsintan (IDR) | Without Alsintan (IDR) | Alsintan (IDR) | Without Alsintan (IDR) |
| Muara Telang | 40.950.000 | 18.594.500 | 22.355.500 | 7.830.000 |
| Tanjung Lago | 28.665.000 | 13.265.000 | 15.400.000 | 6.950.000 |
| Rambutan   | 25.740.000 | 12.490.000 | 13.250.000 | 6.528.000 |
4. Discussion
The use of TR 2 in Muara Telang Subdistrict had the highest level of availability, which was as many as 385. The use of TR 2 was also more attractive to the farmers in Muara Telang Subdistrict because the land cultivation using TR 2 was considered neater in cultivating land cultivation in rice fields with tidal land types. In addition, the use of TR 4 for several areas in Muara Telang, Tanjung Lago, and Rambutan Subdistrict was still rare and difficult to reach, due to its position which is a swampy area with uneven topography.

The use of TR 4 for land cultivation in Tanjung Lago Subdistrict was less attractive to the farmers in several villages because the planting area per rice field did not allow using the TR 4. The area of the paddy field that was not too wide caused the farmers to prefer to use a TR 2 for the soil processing. [6] recommended that the government is expected to meet the amount of machinery gradually so that the field capacity and optimized farming could be gained.

The use of a combine harvester can reduce the number of workers and reduce work time. In the use of a combine harvester, not every village in Tanjung Lago Subdistrict used it, this is because some villages in this subdistrict did not do paddy farming, but maize farming, so the type of combine harvester used is a combine harvester particularly for maize. Proponents of mechanization argue that mechanization saves time and cost, and improves agricultural productivity. Agro-ecological characteristics of a region are said to have a significant impact on the level of mechanization [7].

In Muara Telang Subdistrict, in the harvesting process the farmers used a combine harvester, the average farmer paid the operator and worker at the same time with a combine harvester rental of IDR 1,700,000 per hectare. According to [8], Basically, all the machines are used by farmers due to the labour shortage. These machines also work faster, so the save time and completes work in proper time.

The harvesting process using a profit-sharing system between farmers and workers which was 1:8. According to [9], the most important step to take in Agricultural machinery programs is to increase the quality of agricultural education and to identify where it stands in international standards.

The cost of harvesting (consumption and labor) was the largest cost in the process of producing paddy without using alsintan in Muara Telang subdistrict with a total cost of IDR 4,790,000. According to Kalpalatha and Reddy [10], advanced agricultural technology has made farmers feel the need for the use of improved machinery and equipment in agriculture for lowering down the cost of unit production on one hand and improving the productivity per unit area at a point of time on the other.

Based on Table 8, the highest income of farmers using alsintan and without using alsintan in Muara Telang Subdistrict was IDR 22,355,500 and IDR 7,830,000 respectively, this is due to fact that the average paddy productivity of Muara Telang Subdistrict ranked the highest per year in Banyuasin Regency, namely 5 tons/ha for IP 100, 7.5 tons/ha for IP 200, and 10.5 tons/ha for IP 300. The income of farmers in Tanjung Lago Subdistrict for those who used alsintan and those who did not use alsintan was IDR 15,400,000 and IDR 6,950,000 respectively. The results have shown that the small and marginal farmers have also benefited by using new farm machines and their productivity rose up to a considerable height in spite of several constraints. The modern technology is changing the way that humans operate the machines. Modern agricultural technology has been developed with keeping two important things in mind: first thing is to obtain the highest yields possible and second thing is to get the highest economic profit possible [11].

5. Conclusions
The conclusions that can be drawn from this study are: The use of agricultural tools and machinery can reduce farming costs and increase the paddy Crop Index (IP) in Banyuasin District. The use of agricultural tools and machinery in paddy processing generated higher income than that of processing without using agricultural tools and machinery.
6. Suggestion
To overcome labor shortages and efforts to increase productivity and efficiency, it is necessary to input technology for agricultural tools and machinery, especially in land preparation, planting and harvesting activities. The use of agricultural tools and machines can reduce costs so that farming income is higher than that without using agricultural tools and machines.

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