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# Jajar Legowo Rice Farming Business in South Sumatera Province

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**Abstract**

The aims of this research was to determine the various ways of planting Jajar Legowo in order to increase farmers' productivity and income in irrigated rice fields. The research was conducted in East OKU Regency, starting from April to August 2015. This research disseminated 2: 1; 3:1;, 4:1; Jajar Legowo planting methods and Jajar Tegel (farmer pattern). The data collected included production facilities, labor, and production. The data were obtained from interviews with farmer cooperators who were guided by a list of questions. Secondary data consisted of land area, production and productivity. The data was analyzed by revenue and income analysis, analysis of costs revenue balance (R/C). The farming business was said to be feasible if R/C> 1, followed by analysis of the break-even point of price (TIH) and the breakeven point of production (TIP). The results showed that the 2:1 Jajar Legowo planting method increased productivity by 1.6 t/ha (23.18%) and farmer income of Rp. 5,755,000 (31.67%) compared to the Jajar Tegel method that commonly used by farmers. The financial benefits from applying the Jajar Legowo planting method 2:1, 3:1, and 4:1 were Rp. 23,925,000; Rp. 21,455,000; and 20,755,000, - better than Jajar Tegel method of Rp. 18,170,000. Economically, Jajar Legowo planting method 2:1 was profitable with more profit of Rp 5.590.000 per ha with RC ratio value of 4,18 so that planting method feasible to be developed on a large scale.

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## INTRODUCTION

The development of rice plants in Indonesia continuously to be attempted in increasing agribusiness-oriented production so that farmers' income can be increased. The increased production of lowland rice intensively had been carried out for a long time but it was indicated that it had not been able to increase production and productivity, in this case was to realize food availability for the all Indonesian. The increase in rice production was performed continuously because the population continued to increase each year by around 1.38 percent (Bapennas, 2013). The approaches to increase rice production were included increasing crop productivity, increasing planting area or harvested area, and increasing planting intensity. Sembiring (2008) stated in Suhendrata (2017) that the best approach was from an increase in productivity of around 56.1 percent compared to the planted area or harvest of around 26.3 percent. Lowland rice cultivation technology had been widely applied to increase production, including technology from the Agricultural Research and Development Institution, which was Jajar Legowo planting system. This system was believed to be able to increase farmers' production and income (Agricultural Research and Development Institution, 2014). Reported by Misran (2014) this planting system can increase yields higher, which was 19.9-22.0%.

This planting system had several rows of plants followed by one blank row and this system only manipulated the planting location so that the cropping had a higher number of marginal plants. According to (Kristamtini et al. 2011) the marginal plants will provide better plant growth and development. In addition, pest attacked will decrease and the plant population will increase so that it had an impact on increasing rice productivity by 12-22% (Bobihoe, 2011). The advantages of this technology were included weed easily controlled; application of fertilizers and water management was more efficient. This was established to increase rice production (Lalla, et al. 2012). According to Suparwoto and Waluyo (2018), the 2:1 Jajar Legowo row planting method increased productivity by around 9-22% and income of Rp. 15,380,000/ha with a BC ratio of 2.0. Likewise, Mustikawati (2016) reported that the 2:1 Jajar Legowo can increase rice production by an average of 14.3%. Therefore, the Jajar Legowo plant system needs to be applied to irrigation rice farming business in East Ogan Komering Ulu Regency, South Sumatra Province. The research aims was to determine the various ways of Jajat Legowo planting (jarwo) in order to increase the productivity and income of farmers in irrigated rice fields.

## RESEARCH METHODS

### Research Scope

The research scope was included area characteristics and rice cultivation in one growing season by applying the planting method, Jajar Legowo 2:1, 3:1, 4:1 and Jajar Tegel planting method commonly used by farmers. Area characteristics included topography, climate, and soil conditions. Then the structure of rice cultivation analysis included income and feasibility analysis.

### Time and Location

The research location was in Tulus Ayu Village, Belitang Madang Raya Sub-District, Ogan Komering Ulu Regency (OKUT). The location was chosen purposively

(purposive) in accordance with strategic program of Ministry of Agriculture to support rice planting area development in South Sumatera Province by making *demfarm* display. The research was conducted from April to August 2015. The approach method used was on-farm and off-farm by applying Jajar Legowo planting with the Inpari 6 variety. On-farm approach is a rice cultivation activity of land cultivation, seedling, planting, maintenance, harvesting and processing, production and production facilities. The data were obtained from interviews with farmer cooperators who were guided by a list of questions. The off-farm approach was secondary data collection including area characteristics, production facilities price (seeds, fertilizers, pesticides). The introductory technology for irrigated lowland rice cultivation in Tulus Ayu Village was shown in table 1.

**Data Collection Method**

Data Collection method was by direct observation, observation and *demfarm* (demonstration) of an 4 ha area with the planting method consisted of Jajar Legowo 2:1, 3:1, 4: (50x25x12.5 cm distance) and Jajar Tegel planting Method (25x25 cm) which were commonly used by farmer. The type of data collected was the cost of farming including land cultivation, seeding, planting, maintenance, harvesting and post-harvest.

The quantitative analysis method used was income analysis, revenue and costs balance analysis (R/C). Whereas, a farm was said to be feasible if R/C>1, followed by break-even point price analysis (TIH) and the break-even point production (TIP) (Swastika 2004 and Malian 2004).

**Income Analysis**

Farm business income was analyzed based on the revenue structure with farm financing. The income analysis was obtained by calculating the difference between revenue and production costs, the formula used was as follows:

$$Pd = TR-TC$$

Information:
Pd = Farm business income
TR = Total income
TC = Total cost

**Return Cost Ratio Analysis (R/C)**

Farming feasibility indicators were analyzed based on the ratio of revenue to cost, with the formula:

$$R/C \text{ ratio} = \frac{TR}{TC}$$

In which:
R/C = ratio income and cost
TR = total income (Rp/ha)
TC = total cost (Rp/ha)
With conclusion:

R/C >1, farming business is economically profitable
R/C = 1, farming business is economically at the break-even point
R/C < 1, farming business is economically unfavorable (loss)

**Analysis of price break-even point (TIH) and production break-even point (TIP), with formula:**

TIP = Σ Bi/HP and TIH = Σ Bi/P

In which : TIP = Production break-even point
TIH = Price break-even point
B = Farming business costs
HP = Production costs
i = Cost component index

**Table 1. Introductory Technology for Irrigated Lowland Rice Cultivation in Tulus Ayu Village, South Sumatera**

| No | Description | Planting Method | | | |
|---|---|---|---|---|---|
| | | **Jarwo 2 : 1** | **Jarwo 3 : 1** | **Jarwo 4 : 1** | **Tegel** |
| 1 | Land Cultivation | Perfect (1xplow, 1x rake) | Perfect (1xplow,1x rake | Perfect (1xplow,1x rake | Perfect (1xplow,1x rake |
| 2 | Seed | Labelled 25 kg/ha | Labelled 25 kg/ha | Labelled 25 kg/ha | Labelled 25 kg/ha |
| 3 | Seedling | Wet | Wet | Wet | Wet |
| 4 | Seed age | 15 days | 15 days | 15 days | 15 days |
| 5 | Varieties | Inpari 6 | Inpari 6 | Inpari 6 | Ciherang |
| 6 | Manure (kg/ha) | 500 | 500 | 500 | 500 |
| 7 | Fertilizer (kg/ha) | | | | |
| | - Urea | 200 + BWD | 200 + BWD | 200 + BWD | 200 + BWD |
| | -SP 36 | 100 | 100 | 100 | 100 |
| | - KCl | 100 | 100 | 100 | 100 |
| 8 | OPT Controlled | PHT | PHT | PHT | PHT |
| 9 | Harvest/post-harvest | Sickle/Thresher | Sickle/Thresher | Sickle/Thresher | Sickle/Thresher |

Information: BWD= Leaf color outline PHT = Integrated pest control

## RESULT AND DISCUSSION

### Area Characteristics

East OKU Regency is one of the largest rice producer areas in South Sumatera. This was supported by the existence of the Perjaya Dam and an adequate irrigation network. Tulus Ayu Village is one of the transmigration settlement units located in the agricultural counseling work area (WKPP) of Buay Madang Raya Sub-District. The land used in the village was 348.61 ha for rice fields, 2% flat topography, located at an altitude of 40.3 m asl and an average rainfall of 2600 mm/year. The soil color is black gray to dark brown because the organic material had decreased, has a crumb

structure and sandy clay texture, medium nutrient content and slightly pH acidic soil. The soil conditions required an improvement to optimize rice growth and yield. The addition of organic material in the form of manure/compost can add nutrients, improved soil physical characteristic and can bind excess micro nutrients. The land was classified as land suitability class with the S1 category that very suitable for lowland rice and the S3 category that in accordance with marginal, that had a limiting factor for the availability of oxygen so that good drainage was required to obtain optimal productivity and additional input in the form of organic and inorganic fertilizers.

The research location had the potential as a rice seedling business area because it had fulfill the following requirements: 1) an overlay of technical irrigated rice fields with an area of 348.61 ha with a rice-rice planting pattern, 2) easy to reach and institutions availability to support rice seeding activities, 3) farmers and related institutions were cooperative to the VUB rice seed captivity activities. In terms of area accessibility, the location of this village was quite good and open, with characteristic that there was the availability of support for adequate transportation facilities and infrastructure (BP3K Tulus Ayu, 2014).

**Productivity**

The rice planting method showed a good growth in Jajar Legowo and Tegel in the vegetative and generative phases. The reaction of several rice planting methods to disease showed resistance to Helminthosphorium and Neck blast (Table 2). The rice productivity on Jajar Legowo 2:1 was higher than Jajar Legowo 3:1, 4:1 and Jajar Tegel, each planting method showed an increase in productivity where the *jarwo* was 2:1 (1.6 t/ha), *jarwo* 3:1 (0,9 t/ha, *jarwo* 4:1 (0.7 t/ha) compared to Jajar Tegel. The treatment of planting methods had a positive effect on rice productivity, this was because each planting method had a different number of populations where the population or clumps per ha of planting Jajar Legowo 2:1 were 213,300 clumps (an increase of 33.31%), while Jajar Legowo 4:1 contained 192,712 clumps/ha with an increase of 20.44% compared to Tegel method of only 160,000 clumps/ha (Misran, 2014). Then this *jarwo* planting system provided empty space for plants so that plants can absorb nutrients, sunlight freely, water and CO2 perfectly (Sirappa, 2011). So that the photosynthetic process can goes well. (Sesbany, 2010).

In general, in Table 2, it showed that the plant performance of each planting method was good and also to *helminthosforium* and *neck blas* diseases, was resistant. The productivity of *jarwo* 2;1, 3:1, 4:1, *Tegel*, respectively, was 8.5 t/ha, 7.8 t/ha, 7.6 t/ha and 6.9 t/ha. From the results of this research, *Jarwo* was able to increase grain production much better. This is in line with the research results of Erythrina and Zaini (2014) that the productivity of grain in jarwo cultivation was higher than the farmer's method. As stated by Donggulo et al. (2017) that Jajar Legowo can increase production due to the effect of side crops, the number of plants per hectare was higher; there was empty space so that the sun's radiation was more evenly for the photosynthesis process. Among the three ways of *jarwo* planting, the 2:1 jarwo was better because according to Witjaksono (2018) the *jarwo* 2:1 can increase grain productivity by 16.44% compared to non-Jajar Legowo.

**Table 2. Productivity of Rice Planting Method at Irrigated Rice Land Tulus Ayu Village Buay Madang Raya Sub-District East OKU Regency**

| Planting Method | Performance | | Disease Reaction | | Productivity (t/ha) |
|---|---|---|---|---|---|
| | Vegetative | Generative | Ho | NB | |
| Jarwo 2:1 | good | good | resistant | resistant | 8,5 |
| Jarwo 3:1 | good | good | resistant | resistant | 7,8 |
| Jarwo 4;1 | good | good | resistant | resistant | 7,6 |
| Tegel | good | good | resistant | resistant | 6,9 |

Source: Processed Primary Data (2015)

**Production Cost**

The cost of production facilities in the *jarwo* and Tegel planting method was basically the same, which were in the form of seeds, organic fertilizer (manure), urea, SP 36 and *phonska*, while the labor costs in the form of land cultivation, seedlings, pulling seeds, planting, until harvest/processing, can be seen in Table 3. The difference was, in the use of production facilities was in the volume for the use/purchase of pesticides so that there was a difference in the financing structure between the four planting methods, while for the use of labor the difference was planting. The labor costs of the *jarwo* planting system were higher. Tegel Planting per hectare was costs Rp. 600,000, while *jarwo* per hectare was Rp. 750,000 (an additional of Rp. 150,000). Another difference in the use of labor was harvesting/processing, the system that applied to rice harvesting was the Bawon 7:1 system (meaning 6 for the owner and 1 for the harvester). So that the labor/costs incurred depend on the rice yields obtained from each planting method.

The production cost of *jarwo* 2:1 was higher than *jarwo* 3:1, 4:1, Tegel. The labor costs for harvesting/processing were higher than Legowo 3:1, 4:1 and Tegel, but the rice yield was greater.

Seen as a whole, the use of production costs (input and labor) from the four planting methods, the highest was the *jarwo* 2:1 planting method followed by *jarwo* 3:1, 4:1, Tegel, which were Rp. 7,525,000, Rp. 7,405,000, Rp. 7,365,000, Rp. 7,360,000 (Table 3).

**Table 3. Production Cost of Rice Planting Method in Irrigated Rice Land Tulus Ayu Village East OKU Regency.**

| Production Cost | Planting Method | | | |
|---|---|---|---|---|
| | Jarwo 2 : 1 | Jarwo 3 : 1 | Jarwo 4 : 1 | Tegel |
| Production Facility | | | | |
| - Seed | 275.000 | 275.000 | 275.000 | 275.000 |
| - Organic Fertilizers | 500.000 | 500.000 | 500.000 | 500.000 |
| - Urea | 400.000 | 400.000 | 400.000 | 400.000 |
| - SP-36 | 520.000 | 520.000 | 520.000 | 520.000 |
| - Phonska | 270.000 | 270.000 | 270.000 | 270.000 |
| - Pesticide | 500.000 | 540.000 | 600.000 | 700.000 |
| Total (a) | 2.465.000 | 2.505.000 | 2.565.000 | 2.665.000 |
| Labor (Rp) | | | | |
| - Seedling | 60.000 | 60.000 | 60.000 | 60.000 |
| - Land Cultivation | 600.000 | 600.000 | 600.000 | 600.000 |

| | | | | |
|---|---|---|---|---|
| - Embankment Repair/taping | 400.000 | 400.000 | 400.000 | 400.000 |
| - Application of pre-grown herbicides | 75.000 | 75.000 | 75.000 | 75.000 |
| - Tick | 60.000 | 60.000 | 60.000 | 80.000 |
| - Seed pulling | 100.000 | 100.000 | 100.000 | 100.000 |
| - Planting | 750.000 | 750.000 | 750.000 | 600.000 |
| - Fertilization | 75.000 | 75.000 | 75.000 | 75.000 |
| - Weeding | 350.000 | 350.000 | 350.000 | 450.000 |
| -Pest/Disease Control | 200.000 | 200.000 | 200.000 | 200.000 |
| - Harvet/processing | 2.390.000 | 2.230.000 | 2.130.000 | 2.055.000 |
| Total (b) | 5.060.000 | 4.900.000 | 4.800.000 | 4.695.000 |
| Total (a + b) | 7.525.000 | 7.405.000 | 7.365.000 | 7.360.000 |

Source: Processed Primary Data (2015)

**Farming Feasibility**

Farming analysis was influenced by production, farming costs, selling prices and buying prices of production facilities which greatly affected farm income/profits. Farm yields from the four planting methods, each had a different level of production where the *jarwo* 2:1 was 8.5 tons/ha, *jarwo* 3:1 was 7.8 tons/ha, *jarwo* 4:1 was 7.6 tons/ha and Tegel was 6.9 ton/ha. Rice production was determined by the use of inputs such as seeds, fertilizers, pesticides and planting methods. Farming costs were a measure of the resource value that must be sacrificed in order to get a profit (Boediono, 1990 in Palobo et al. 2019). The amount of income can be determined by knowing in advance the total amount of income earned then reduced to the total costs incurred for farming activities. Farming income was said to be profitable if the income earned was greater than the costs incurred by the farmer. The analysis results of the cropping methods showed that the income of the four methods of rice planting was quite diverse (Table 4).

The income of Legowo planting method 2:1 was higher followed by income of Legowo planting 3:1, 4:1 and Tegel. The amount of income from the 2:1 Legowo planting method was Rp. 31,450,000 and conducted profit of Rp. 23,925,000 with 4.18 RC ratio means that every expense of Rp. 1,000 for the input given will receive Rp. 4,180 so this method was very feasible to develop. The amount of income from the 3:1 Legowo planting method was Rp. 28,860,000 and profit of Rp. 21,455,000 with 3.89 RC ratio. The amount of income from the 4:1 Legowo planting method was Rp. 28,120,000 and conducted profit was Rp. 20,755,000 with an RC ratio of 3.81. Meanwhile the amount of income from the Tegel planting method was Rp. 25,530,000 and conducted profit was Rp. 18,170,000 with 3.47 RC ratio.

**Table 4. Cost Structure and Farming Income of Rice Planting Method of Irrigated Rice Land in Tulus Ayu Village, Buay Madang Raya, OKUT**

| Description | Planting System | | | |
|---|---|---|---|---|
| | Jarwo 2:1 | Jarwo 3:1 | Jarwo 4:1 | Tegel |
| Input Cost | | | | |
| a. Input (Rp/ha) | 2.465.000 | 2.505.000 | 2.565.000 | 2.665.000 |
| b. Labor (Rp/ha) | 5.060.000 | 4.900.000 | 4.800.000 | 4.695.000 |
| Total (a+b) | 7.525.000 | 7.405.000 | 7.365.000 | 7.360.000 |
| Income | | | | |
| a. Revenue (kg GKP/ha) | 8500 | 7800 | 7600 | 6900 |
| b. GKP Price (Rp/kg) | 3700 | 3700 | 3700 | 3700 |
| Total (axb) | 31.450.000 | 28.860.000 | 28.120.000 | 25.530.000 |
| Profit (Rp) | 23.925.000 | 21.455.000 | 20.755.000 | 18.170.000 |
| R/C | 4,18 | 3,89 | 3,81 | 3,47 |

Source: Processed Primary Data (2015)

If seen from the RC ratio value of *jarwo* planting method 2:1, 3:1, 4:1, Tegel had consecutive value of 4,18; 3,89, 3,81, 3,47. These four planting methods were mutually beneficial because R/C value was more than one. In *jarwo* planting method 2:1 RC ratio value was better than the three planting methods and got additional income/profit of Rp 5.590.000 (Table 5). Then financially, rice planting with *jarwo* method 2:1 was the profitable rice planting method.

**Table 5. Marginal Analysis of Various Rice Planting Method Per Ha in Irrigated Rice Land Tulus Ayu Village Buay Madang Raya, OKUT**

| Planting Method | Production Cost (Rp) | Marginal Cost (Rp) | Income (Rp) | Marginal Income (Rp) | Additional Income (Rp) |
|---|---|---|---|---|---|
| Jarwo 2:1 | 7.525.000 | | 23.925.000 | | 5.590.000 |
| | | 165.000 | | 5.755.000 | |
| Jarwo 3:1 | 7.405.000 | | 21.455.000 | | 3.240.000 |
| | | 45.000 | | 3.285.000 | |
| Jarwo 4:1 | 7.365.000 | | 20.755.000 | | 2.580.000 |
| | | 5.000 | | 2.585.000 | |
| Tegel | 7.360.000 | | 18.170.000 | | |

Source: Processed Primary Data (2015)

**Analysis of Production Break-Even Point and Price Break-Even Point**

Analysis of the production break-even point (TIP) and price break-even point (TIH) in rice farming in irrigated rice fields was carried out to determine the correlation between farming costs, income, and production volume. The production and price break-even point were mathematically the point of intersection between income and total cost when the profit earned was zero. This intersection described the level of production and the minimum price that must be received to return the

farming capital. The results of the analysis of the production break-even point and price break-even point can be seen in Table 6.

There was a difference in the price break-even point (TIH) of the four planting methods, whereas *jarwo* 2:1 reached Rp. 885.29/kg, Legowo 3:1 reached Rp. 949.36 and Legowo 4:1 reached Rp. 969.07/kg while Tegel Rp. 1066.67/kg. This happened because of differences in the amount of production that produced. Seen from the break-even value, the four methods of planting were below the production value and the actual price means that rice farming by *jarwo* planting 2:1, 3:1, 4:1 and Tegel provided additional value and was economically feasible to develop. The production break-even point (TIP) for the four planting methods was around Rp. 1989.19/kg-Rp. 2033.78/kg because the price of grain for the four planting methods was the same.

**Table 6. Performance of TIP and TIH of Planting Method in Irrigated Rice Fields Tulus Ayu Village Buay Madang Raya OKUT**

| Description | Planting Method | | | |
|---|---|---|---|---|
| | **Jarwo 2:1** | **Jarwo 3:1** | **Jarwo4:1** | **Tegel** |
| Total Cost (Rp) | 7.525.000 | 7.405.000 | 7.365.000 | 7.360.000 |
| Production (ton gkp/ha) | 8500 | 7800 | 7600 | 6900 |
| Actual Price (Rp/kg) | 3700 | 3700 | 3700 | 3700 |
| TIP (kg/ha) | 2003,78 | 2001,35 | 1990,54 | 1989,19 |
| TIH (Rp/kg) | 885,29 | 949,36 | 969,07 | 1066,67 |

Source: Processed Primary Data (2015)

In general, it can be stated that the use of VUB Inpari 6, the application of *jarwo* planting methods 2:1, 3:1, 4:1, and integrated crops management technology in Tulus Ayu Village can consecutively increase rice production to 8.5 t/ha, 8 t/ha, 7.6 t/ha higher than Tegel (6.9 t/ha) that have been used by local farmers. The Jajar Legowo planting method and superior varieties can increase farmers' productivity and income with recommended technology (Sirappa, 2011).

## CONCLUSION

From the result description and research discussion, the 2:1 Jajar Legowo planting method can increase productivity by 1.6 t/ha (23.18%) and farmer income of Rp. 5,755,000 (31.67%) compared to the usual Tegel method that used by farmers. Meanwhile, economically, the Jajar Legowo 2:1 planting method was profitable with an additional profit of IDR 5,590,000 per hectare. The RC value was 4.18, so this planting method can be developed in the surrounding area on a wider scale.

**RECOMMENDATION**

The Jajar Legowo planting method can be disseminated to large-scale farmers because it was profitable and the jarwo planting tool was really needed to reduce planting costs.

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