

Income Analysis of Farmers Using Rice Transplanter Technology as an Innovation for Rice Planting to Supporting Sustainability Agriculture

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ABSTRACT

Sidrap Regency is one of the food barns in South Sulawesi, which can supply the rice needs of the surrounding area. Thus, efforts are made to introduce technology and innovation in their agricultural cultivation business so that farmers can increase their income with their legalized rice cultivation business. The purpose of this study was to find out how much rice farming income was earned by farmers when introducing Rice transplanter technology in their farming. This research is a quantitative descriptive study with variables that determine income analysis in the form of total production and costs used. The results showed that the rice planter system with the Rice Transplanter machine is still not widely used by farmers because the application of technology in the agricultural sector is also not something easy, one of which is because farmers' habits and understanding of technology are still lacking, besides that agricultural activities are also a source of livelihood for farmers so that farmers do not readily change old habits that have been adopted so far. The results showed that the income earned by farmers while adopting the Rice Transplanter technology was IDR 37,295,100, which indicates that there was no significant increase in Rice Transplanter innovation. This is because some farmers do not understand more deeply about the maximum use of this technology, so they still mix conventional uses.

Keywords: Rice Transplanter, Revenue Analysis, Innovation and technology.

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INTRODUCTION

In rice cultivation, one of the activities that absorbs a lot of labor is transplanting seedlings. This activity requires a workforce of about 25% of the total workforce needed for rice cultivation, Fujiarta, 2001. Rice transplanter is an innovation in technology for transplanting seeds to rice plants. Powered rice grafting machines can speed up the planting time of rice seeds and overcome the scarcity of rice plant seeds in the regions. The use of rice transplanters in Indonesia has been around for a long time around 1986 with rice transplanter technology from Japan, which was commanded by the Rice Seed Center in several areas. The results in the field can be said technically if the SOP for soil processing, seed preparation and care is carried out really shows results that are not significantly different from planting by hand (Rudiarsyahputra, 2012). The government is always trying to get Indonesia back to self-sufficiency in food, especially rice. One of the obstacles faced is the limited workforce, especially during land preparation such as planting to harvesting. The existence of labor competition in various sectors, be it the trade, industry, and mining sectors, so that what is left for the agricultural sector are farmers of less productive age. This makes the productivity of lowland rice farming not optimal.

Entering the industrial era 4.0, the use of high-tech tools is increasing, including in agriculture. The use of agricultural tools with modern machines helps accelerate the production process in agriculture. The modern agricultural sector aims to change the traditional agricultural system to a modern agricultural system with the hope that with a modern agricultural system it can increase production, which is a paradigm that becomes a reference for all governments in developing countries. This technology must be a savior for farmers. The habit of planting in paddy fields by relying on a lot of labor and time with little results makes it increasingly difficult for the community to improve the economy and welfare of farmers, so they need help with agricultural tools that are able to work effectively and efficiently. The purpose of this study was to find out how much rice farming income earned by farmers when introducing rice transplanter technology in their farming.

The motivation of farmers as managers of rice farming in Sidrap Regency can be interpreted as a condition that encourages them to take action to increase their agricultural production. The rice transplanter innovation is carried out with the aim of making it easier for farmers in terms of planting rice and reducing labor, time and costs. Until now, the condition of farmers in Sidrap Regency is still dominated by conventional planting systems due to several obstacles in the use of rice grafting equipment, one of which is the lack of workers who are able to operate machines deftly and in accordance with the wishes of farmers. Farmers and rent to use rice planting machines is considered expensive by farmers.

Hypothesis Development

To accelerate the target of increasing production and productivity of agricultural products, it is necessary to modernize agriculture, so one way is through the application of technology 4.0 in agriculture. One of the technologies developed by the Ministry of Agriculture (Kementan) in realizing modern agriculture in the 4.0 industrial revolution to build Agriculture 4.0 is the innovation of the Rice Planting Robot (Rice Transplanting Machine). The design of the rice transplanter machine can operate on land with a mud

depth of less than 40 cm. Rice seed breeding is a critical point in using a rice transplanter because it requires different seeding methods and special seeding tools. The seedling method for rice growers uses a tool called a dapog, which is a nursery box made of plastic or wood with a size of 58 x 28 x 2.5 cm. Dapog can be modified according to the availability of materials/equipment in certain locations. Also, rice seed nurseries in dapog can be carried out with a dry seedbed system outside paddy fields and a wet seedbed system in paddy fields.

Rice transplanter is a rice planting machine that is used to plant rice seeds that have been sown until they reach a certain age in a special area, applied to paddy fields that are ready for planting, and a machine designed to work on muddy land (puddles). The machine is designed to be lightweight and equipped with a flotation device. There are currently two types of rice grafters in the Maritengngae subdistrict, namely the tile planting system and the *jajar legowo* 2:1 rice grafting system or called the Indo Jarwo Transplanter. The Indo Jarwo Transplanter was assembled by the Balitbangtan Agricultural Mechanization Development Center which is a combination of standard rice transcripser technology and a 2:1 *legowo* row planting system. Thus the application of the Indo Jarwo Transplanter is expected to increase the effectiveness, efficiency and yield of rice compared to using the standard rice transplanter and the manual 2:1 *jajar legowo* planting system.

Transplanting of paddy is very tedious job mostly done by female workers during Kharif season and by 2020 there would be 50 percent women against 42 percent at present. Manual hand transplanting consumes a lot of energy and time and full of fatigue, but the poor socio-economic condition of the farmers does not allow them to adopt power operated transplanter. Transplanting operation by different research centers have been developed as 2 row, 3 rows, 4 row paddy transplanter (Singh, Sharma, Bockhop. 1985). Rice Transplanter is one of the technological innovations to overcome the scarcity of labor to plant rice seeds and increase the efficiency of time, labor and planting costs. The application of the tile planting system, among other things, has increased rice productivity by up to 10%, because the rice planting system requires the use of young seeds (15-18 HSS). In addition, setting the spacing has also increased the number of productive tillers per clump by up to 13% compared to the manual planting method (Suhendrata and Kushartanti, 2013).

METHOD

This research was conducted for 4 months, from April to July in Maritengngae District, Sidenreng Rappang Regency, South Sulawesi Province. Consisting of villages and sub-districts, which have a food crop commodity sector, especially rice plants. The selection of research locations was carried out by purposive sampling. The location selection was carried out with the consideration that Maritengngae District, Sidenreng Rappang Regency is one of the sub-districts that received the Rice Transplanter machine assistance and has been introduced to the transplanter planting machine by agricultural extension workers. The population and sample determination method in this study used the Proportional Random Sampling technique because the population used consisted of several farmer groups in villages and sub-districts who were implementers or had carried out rice planting activities using Rice Transplanter rice planting machines spread across several villages and sub-districts in Indonesia. Maritengngae District, Sidenreng Rappang Regency. Determination of the number of samples is determined using the Slovin formula

which is based on (Farizan, Fauzi & Makmur, M. (2018) and is an international reference.
In using this formula:

$$n = N / (1 + \frac{e^2}{N})$$

Note: n = minimum number of samples

N = Population

e = error margin

Note : Margin of error is 10% or 0,

Primary data sources are the most important sources for obtaining data results. This primary data can be obtained through interviews by preparing a questionnaire and can be through observation to directly to the research location.

Interview, by asking questions directly to respondents in this case farmers. Interview is a data collection technique that is carried out through face-to-face and direct question and answer between data collectors and researchers to resource persons or data sources. Lincoln and Guba in Sanapiah Faisal, suggest that there are seven steps in using interviews to collect data, namely (Ruriawaty, 2012): (1). Determine to whom the interview will be conducted, (2). Prepare the main issues that will be discussed, (3). Initiating or opening the interview flow, (4). Continuing the interview flow, (5). Confirming the summary of the interview results and ending it, (6). Write down the results of the interview into field notes and (7). Identify follow-up interviews that have been obtained.

Patton in Molleong (2002) classifies six types of interrelated questions, namely (Sugiono, 2012): related to experiences, opinions, feelings, knowledge, senses and background or demography. Other data sources used are secondary data derived from several materials such as book libraries, journals, scientific papers, related agencies such as the Central Bureau of Statistics and the Sidenreng Rappang Regency Government Office.

Data obtained through interviews and observations were described qualitatively and quantitatively using income analysis and simple linear regression analysis. The analysis process begins at the beginning of the research until the end of the report writing. The qualitative method is taken by examining all the data obtained and then classifying it based on its category so that it is illustrated how the conditions of using the Rice Transplanter affect the socio-economic conditions of the Farmers in Sidenreng Rappang.

To find out the difference in the income of farmers who use the Rice Transplanter planting system and farmers who do not use the Rice Transplanter machine, the data is analyzed using income analysis. Income is the difference between total revenue and total costs, written by the formula : $\pi = TR - TC$,

note:

π = profit

TR = total revenue (total revenue) TC = total cost (total cost)

RESULTS AND DISCUSSION

To test the existing hypothesis, income analysis is used, namely to see the difference between the income of the respondent farmers who use a Rice Transplanter machine and farmers who use a manual planting system in the income analysis test, the formula used is:

$$\pi = TR - TC$$

note : π = Farming Income, TR = Total Income, TC = Total Cost

Revenue

In farming, especially rice plants, revenue is generated from multiplying the amount of production by the price of grain. In this study, there were results from the amount of production in one rice planting season in Watang Sidenreng District, Sidrap Regency with a total of 40 respondents. For more details, it can be seen in table 1 below.

Table 1. Average Land Area and Respondent Farmer Income in Watang Sidenreng District, Sidrap Regency.

Spesification	Land Use (Ha)	Yeald (Kg)	Price (IDR)	Revenue (IDR)
Total	54.6	279,630	4,400	790,372,000,-
Average	1.34	6,990,75	4,400	30,759,300,-

Source: Primary data after processing, 2022

Based on table 1 it can be seen that on an average land area of 1.34 hectares it has a production of 6,990.75 Kg of wet grain multiplied by the price of grain which is IDR 4,400 obtaining revenues of IDR. 30,759,300.

Income

The amount of income that can be received by farmers depends on the amount of income and expenditure during the production process. To see the income of farmers in Watang Sidenreng District, in this study there are two focuses, namely the income of farmers who use Rice Transplanters and farmers who do not use a manual system.

Income of farmers who use a manual cropping system

To see the total average income of farming using a manual planting system in the Watang Sidenreng sub-district, it can be seen in table 4 below.

Table 2. The average total income of farmers using a manual planting system in Watang Sidenreng District, Sidrap Regency.

Spesification	Total Revenue (R)	Total Cost (TC)	Income (π)
Total	885.301.200,-	174.287.760,-	771.013.440,-
Average	40.240.962,-	8.714.388,-	31.526.572,-

Source: Primary Data after processing, 2022

Based on table 4 it can be seen that on an average land area of 1.34 hectares there is a total revenue of IDR30,759,300 and the total average production cost is IDR. 30,759,300 so that the income is 31,526,572,- So the total average income of respondent farmers in Watang Sidenreng District, Sidenreng Rappang Regency using the manual cropping system is IDR 31,526,572,- The work process in using a conventional rice transplanter is very different, the work process in these two stages is whether it is more efficient in using a rice transplanter or is more efficient in using a conventional planting system.

The income of farmers who use the Rice Transplanter

To see what the total average income for farming using the manual planting system in Watang Sidenreng district is, it can be seen in table 5 below.

Table 3. Average Total Farmer Income Using Rice Transplanter in Watang Sidenreng District, Sidrap Regency.

Spesification	Total Revenue (R)	Total Cost (TC)	Income (π)
Total	930.810.000.-	184.908.000,-	745.902.000,-
Average	46.540.500,-	9.245.400,-	37.295.100

Source: Primary Data after processing, 2022

DISCUSSION

Based on table 5 it can be seen that on an average land area of 1.34 hectares there is a total revenue of IDR 46,540,500 and an average total production cost of IDR 9,245,400, - so that income of IDR 37,295,100 can be obtained. So the total average income of respondent farmers in Watang Sidenreng District, Sidenreng Rappang Regency using the Rice Transplanter planting system is IDR 37,295,100. the use of rice transplanters in rice cultivation is one of the factors that influence success in farming, due to experience previously can affect the work to be done. Farmers with experience in farming will make the work more structured. So that in completing the task can be completed quickly and get big profits in his business. Based on table 1, it can be explained that the cost of seeds incurred by farmers after using rice transplanter is relatively higher than the cost of seeds before using these technologies. This is because the number of seeds used and the price of seeds using this technology is higher than before using the technology. This is because the need for seeds in rice transplanter technology requires seeds/seedlings that are at the right planting age and in the right amount compared to before using rice transplanter technology. Fertilizer costs incurred by farmers after using rice transplanter are relatively higher than the cost of seeds before using these technologies. This is due to the fact that after using rice transcrippter technology, farms tend to apply balanced fertilization on their farms, so that the average cost of fertilizer is higher than before using rice transcrippter.

It can also be explained in table 2 and table 3 that the costs of medicines incurred by farmers after using rice transplanter are relatively higher than the cost of seeds before using these technologies. This is due to the control of plant-disturbing organisms (OPT) in farming after using rice transplanter, they tend to use more pesticides to eradicate pests and diseases Iqbal, M. (2007). Meanwhile, farmers before using rice transplanter eradicated more natural enemies. The cost of depreciation of equipment incurred by farmers after the use of rice transplanter is relatively higher than the cost of the previous seeds use the technology.

Farmers utilize rice transplanter technology so that production results are higher than farmers before using a manual planting system Ruriawati, E. N. (2020). The cost of labor outside the family incurred by farmers after using rice transcrippter technology is relatively higher than the cost of manual labor (table 3). This is because farmer farming labor costs after using rice transplanter technology can be done quickly, as well as increasing timeliness in farming activities. The use of rice transplanter technology can reduce

production costs (Rahayu, H. S. P., Risna, R., & Fahmi, F. N. (2019). Compared to farmers before using this technology, a lot of conventional or simple labor (human power) was needed to carry out rice farming so that they incur large labor costs, especially in hiding and harvesting rice.

CONCLUSSION

Rice farming with the introduction of the rice transplanter innovation when planting rice can increase farmers' income but until now it has not shown a significant effect because the use of this innovative technology is still in the rental stage which is considered expensive by farmers so not all farmers take advantage of this innovation.

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