

ANALYSIS OF THE USE OF COMBINE HARVESTER ON THE INCOME OF RICE FARMERS IN CINTA DAMAI VILLAGE, PERCUT SEI TUAN DISTRICT, DELI SERDANG REGENCY

Laurensius Parsaulian Sitinjak¹, Iskandarini², Rulianda P Wibowo³.

¹²³Master of Agribusiness Program, Faculty of Agriculture Universitas Sumatera Utara

Email Correspondence: 98laurensius@gmail.com

Abstract

This increase in rice productivity must also be accompanied by an increase in the quality of the rice produced, namely rice that is able to meet demands and suit consumer preferences. The use of combine harvester harvesting machines can benefit farmers, because combine harvesters make it easier for farmers to harvest rice, shorten harvest time, reduce costs during harvest and can overcome the difficulty of finding workers during the main harvest. The aim of this research is: To analyze rice production before and after using Combine Harvester technology. To analyze rice farmers' income before and after using Combine Harvester technology. The data collected in this research used quantitative data analysis with descriptive statistical techniques. For quantitative data, use the average difference test (t-test). The results of this research were that the amount of rice production after using the combine was greater because the grain was clean, not mixed with dirt from empty grain and rubbish such as grass, rice stalks and rice leaves did not enter the sack, whereas before using the combine harvester the grain was still dirty and still a lot of empty grain droppings into the sack. Farmers' income before using combine harvester technology is lower than farmers who have used combine harvester technology, this is because using a combine harvester machine can cut production costs and reduce losses during harvesting activities and the amount of labor needed before using this tool. more than after using a combine harvester, so it will have an impact on increasing rice production and the income of farmer users.

Keywords: *Production, Income, Combine Harvester*

1. INTRODUCTION

Indonesia is an agricultural sector that can be relied on for economic development. The agricultural sector can make a major contribution to national resilience in the form of increasing people's income, Gross Regional Domestic Income (GRDP), and increasing the country's foreign exchange. Agricultural development is directed at increasing agricultural production to increase food needs, domestic industrial needs, increase exports, increase farmers' income, expand employment opportunities and encourage equal distribution of business opportunities (Purba, et al., 2019). Rice is the most widely cultivated food crop commodity as the main food source in Indonesia. Efforts to increase rice production continue to be made to meet the food needs of the community in order to support food security. Improvements in cultivation technology have been proven to be able to significantly increase rice production. This increase in rice productivity must also be accompanied by an increase in the quality of the rice produced, namely rice that is able to meet demands and suit consumer preferences. In this regard, appropriate post-harvest technology will be able to improve the quality of the rice produced (Saputra, 2021).

Rice harvesting in Indonesia is currently still dominated by human labor using very high levels of labor, approximately 40% of the intensive use of human labor for paddy fields. Apart from labor problems, cultural problems are also caused by high rice harvest losses in the fields, where the post-harvest loss rate is 20% (Durroh, 2020). Harvesting activities, especially in rice cultivation, can be carried out using a combine harvester machine. The use of a combine harvester when harvesting is appropriate, because apart from making harvest time more efficient, reducing grain loss during harvesting, it can also widen the harvest area and maintain better agroecosystem

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conditions. Government policy to encourage the use of agricultural mechanization is carried out, among other things, by distributing aid for rice harvesting machines, namely combine harvesters, to various rice/ rice production center locations (Listiana & Rangga, 2020).

The combine harvester innovation will have benefits if it is widely used by farmers, making it useful for many people. The use of combine harvester harvesting machines can benefit farmers, because combine harvesters make it easier for farmers to harvest rice, shorten harvest time, reduce costs during harvest and can overcome the difficulty of finding workers during the main harvest. Apart from that, the use of combine harvester innovation can reduce rice grain loss during the harvest process (Listiana & Rangga, 2020). Cinta Damai Village is one of the villages in Percut Sei Tuan District which is in Deli Serdang Regency and is one of the areas that is very superior in terms of land area (harvest) and in terms of rice production compared to other villages in Percut Sei Tuan District so that The author chose Cinta Damai village as the research area.

Table 1. Production, Harvested Area and Productivity of Rice Fields in Cinta Village Percut Sei Tuan District

Information	2017	2018	2019	2020	2021
Production (Tons)	7.12	7.03	7.06	7.11	7.19
Harvested Area (Ha)	1,018.00	1,018.00	1,018.00	1,018.00	1,018.00
Productivity (Tons/Ha)	6.99	6.90	6.93	6.98	7.06

Source: BPP Percut Sei Tuan processed

From Table 1 it can be seen that rice production decreased in 2018 by 7.03 tons with a productivity of 6.90 tons/ha, and increased from 2019 to 2021. The harvest area is always the same every year because Cinta Damai Village, Percut Sei District Sir has never experienced Puso (crop failure). The rice harvesting process can be done in two ways, namely using traditional methods and modern methods. The modern method is to use a machine that can thresh the rice. Considering the existence of several types of land, it is felt that these two methods of harvesting are not optimal, so it is necessary to design and develop a product for a rice harvester (Combine harvester). Combine harvester technology has the ability to remove rice grains from the stems and at the same time can cut down the rice (Maksudi, et al., 2018).

One modern harvesting tool called a combine harvester is capable of harvesting cereal crops because this tool is capable of cutting, threshing and separating empty grain. During the harvesting stage, using a combine harvester is more efficient because the harvesting process is faster than manual harvesting. The price of renting a combine harvester machine is cheaper and can minimize expenses (Jannah, et al., 2019). The aim of this research is to analyze rice production before and after using Combine Harvester technology. To analyze rice farmers' income before and after using Combine Harvester technology.

2. IMPLEMENTATION METHOD

This research was carried out in Cinta Damai village, Percut Sei Tuan District, Deli Serdang Regency, with a total of 32 farmer groups. The sample from this research was 60 farmers, farmers who do not use a combine harvester and farmers who use a combine harvester. Primary data was obtained from farmers through interviews using a list of questions (questionnaire) that had been prepared in advance. Secondary data related to this research was obtained from agencies related to this research. The data collected in this research uses quantitative data analysis with descriptive statistical techniques. The quantitative approach is a data analysis technique obtained through calculations so that problem formulation and hypotheses can be answered, which is used to test hypotheses regarding whether or not there are differences between the variables or samples studied.. For quantitative data, use the average difference test (t-test) with the following formula:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{\sum x_1^2 + \sum x_2^2}{n_1 + n_2 - 2}\right) \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

Information :

- \bar{x}_1 = Average of variable 1
- \bar{x}_2 = Average of variable 2
- S1 = Standard deviation of variable 1
- S2 = Standard deviation of variable 2
- n1 = Number of samples variable 1
- n2 = Number of variable samples 2

Test criteria:

If $-t_{table} \leq t_{hit} \leq t_{table}$ then H_0 is accepted, H_1 is rejected.

t_{hit}

If $t_{hit} \leq -t_{table}$ or $t_{hit} > t_{table}$ then H_0 is rejected, H_1 is accepted.

3. RESULTS AND DISCUSSION

The results of the research that has been carried out by researchers can find out how farmers' rice production is before using a combine harvester and after using a combine harvester and farmers' income before using a combine harvester and after using a combine harvester.

Combine Harvester



Figure 1. Use of Combine Harvester Technology

A combine harvester is a rice harvesting machine that can cut standing grain, thresh and clean the grain while walking in the field. In this way, rice harvesting time is shorter compared to using human labor (manual) and does not require a large amount of human labor as in traditional harvesting (Smith in Purba et al., 2015). So the presence of a combine harvester rice harvester is considered capable of increasing harvest efficiency. The use of a combine harvester machine can reduce crop losses with a loss percentage of only 2 - 4%, whereas in traditional harvesting the percentage of yield loss is 6 - 8% (Amare, 2016). The emergence of this rice harvesting machine is certainly very useful for farmers because it can reduce harvesting time and cut large harvest costs if done manually or by using the services of farm laborers. Cinta Damai Village is familiar with and uses combine harvester machines, but not all farmers use them due to several factors including, farmers think that by using a combine harvester there is a high level of yield loss, it must be cultivated on a large area, the understanding and level of adoption of farmers' innovation regarding combine harvesters is still low, land that is not suitable for harvesting using a Combine harvester. The combine harvester used in Cinta Damai Village is the Steering type. This tool is operated by 5 people, 1 person driving the tool (Operator) 2 people in the tube section to fill the

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grain into sacks, 2 more to lift the sacks filled with grain from the rice field to the place determined by the rice field owner.

Production cost

To produce an item requires costs that will be incurred during the production process. Production costs incurred for one production process by rice farmers before and after using a combine harvester. These costs are variable costs and fixed costs, variable costs are costs incurred depending on the size of production, if the product to be produced increases then variable costs will change. Meanwhile, fixed costs will not change even if there is a decrease or increase in production/amount of goods or services produced. The average production costs of rice farmers not using combine harvester technology and using Combine Harvester technology can be seen in Table 2.

Table 2. Average/MT/Ha Production Costs for Rice Farmers Not Using and Using Combine Harvester Technology in Cinta Damai Village.

No	Fee Type	Not Using(Rp/Ha)	Using(Rp/Ha)
1	Variable Costs		
	a. Production Costs	4.529.33	4.013.333
	b. Kindergarten fees	11.486.667	7.254.000
	Total 1 (a)	16.016.000	11.267.333
2	Fixed cost		
	a. Tool Depreciation	3.231.000	4.460.000
	Total 2 (b)	3.231.000	4.460.000
	Total Production Costs (a) + (b)	19.247.000	15.727.333

Source: Primary Data Processed 2023

Based on Table 2, it shows that the average production costs that do not use a combine harvester and use a combine harvester have changed. For production costs without using a combine harvester, it is IDR 19,247,000/Ha, whereas after using a combine harvester IDR. 15,727,333/Ha. This shows that the average production cost without using a combine harvester is greater than after using a combine harvester. Because when you don't use a combine harvester, the amount of labor required is much greater than when you don't use a combine harvester, so the wages paid are also greater. There are more workers who do not use a combine harvester, namely an average of more than 25 people per hectare and to harvest after using a combine harvester only requires 5 workers.

Total depreciation costs for equipment that does not use a combine harvester Rp. 3,231,000/Ha and after using a combine harvester Rp. 4,460,000/Ha. The costs incurred are different because the cost of renting harvesting equipment without using a combine harvester is cheaper than renting equipment after using a combine harvester. For harvests that do not use a combine harvester, the costs for renting harvesting tools and labor wages are separate, namely the rental costs are the rental of a power thresher and the labor costs include cutting labor, threshing, arranging into sacks, while for harvesting using a combine harvester rental, labor and operator costs.

a. Variable Costs

Variable costs are costs incurred depending on how large or small the production is. If the product to be produced increases then the variable costs will change. To obtain variable production factors, these include seeds, fertilizer, medicines, labor outside the family, and harvest. The average cost of production facilities for rice farmers not using and using combine harvester technology can be seen in Table 3.

Table 3. Average/MT/Ha Costs of Production Facilities for Rice Farmers Not Using and Using Combine Harvester Technology in Cinta Damai Village.

No	Description	Not Using		Using	
		Amount	Value (Rp/Ha)	Amount	Value (Rp/Ha)
1	Seed	32,92	395.000	27,88	350.000
	Fertilizer				
	a. ZA	131,67	526.667	120	480.000
	b. Urea	256,67	579.333	240	528.000
	c. Phonska	395	750.000	360	750.000
	d. KCL	65,83	460.833	60	420.000
2	Drugs				
	a. Insecticide		640.909		646.154
	b. Fungicide		395.000		360.000
	c. Herbicide		395.000		360.000
	Amount		4.142.742		3.894.154

Source: Primary Data Processed 2023

Based on Table 3, the average cost of production facilities incurred by rice farmers who do not use a combine harvester is Rp. 4,142,742/MT/Ha, while the average cost of production facilities incurred by rice farmers after using a combine harvester is Rp. 3,894,154/MT/Ha. The difference between not using and using a combine harvester is due to the different amounts of land area farmers do not use and use. For the rice seeds used, they are first sown in the area provided, the average rice seeds used by farmers who do not use a combine harvester is 32.92 kg/MT/Ha with a value of Rp. 395,000/MT/Ha. The average rice seed used by farmers after using a combine harvester is 27.88 kg/MT/Ha with a value of Rp. 350,000/MT/Ha. This shows that the use of rice seeds that do not use and use a combine harvester is different because the land area of farmers who do not use a combine is larger than that of farmers after using a combine. The entire workforce from this research sample uses non-family workers (TKLK) with a piecework system and pays workers using a wage system. The average labor costs for rice farmers not using and using combine harvester technology can be seen in Table 4.

Table 4. Average/MT/Ha Labor Costs for Rice Farmers Not Using and Using Combine Harvester Technology in Cinta Damai Village

No	Description	Not Using		Using	
		Total (TK)	Value(Rp/Ha)	Total (TK)	Value(Rp/Ha)
1	Soil Cultivation	1,27	1.583.333	1,13	1.500.000
2	Seeding	2,63	316.000	2,40	288.000
3	Removal of Seedlings	6,43	646.667	5,90	590.000
4	Planting	13,17	1.316.667	12,00	1.200.000
5	Fertilization 1	5,83	700.000	5,53	664.000

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6	Fertilization 2	5,83	700.000	5,53	664.000
7	OPT 1 spraying	5,93	712.000	5,53	664.000
8	OPT 2 spraying	5,93	712.000	5,53	664.000
9	Harvesting	32	4.800.000	5,4	1.020.000
Amount			11.486.667		7.254.000

Source: Primary Data Processed 2023

Based on Table 4, it can be seen that there is a difference in labor costs incurred by farmers who do not use and use a combine harvester. Farmers who do not use a combine harvester have an average labor cost of Rp. 11,486,667/MT/Ha and the average labor cost incurred by farmers who use a combine harvester is IDR 7,254,000/MT/Ha. The difference in labor costs for farmers who do not use a combine harvester is Rp. 4,800,000/MT/Ha and using a combine harvester of Rp. 1,020,000/MT/Ha. This is because the harvesting process using a combine harvester requires minimal labor compared to not using combine technology which requires a lot of labor.

b. Fixed cost

Fixed costs will not change even if there is a decrease or increase in production/quantity of goods or services produced. The average fixed costs or depreciation costs for rice farmers who do not use and use combine harvester technology can be seen in Table 5.

Table 5. Average/MT/Ha Fixed Costs or Depreciation Costs of Equipment for Rice Farmers Not Using and Using Combine Harvester Technology in Cinta Damai Village.

No	Cost of depreciation	Not Using (Rp/MT/Hectare)	Using (Rp/MT/Hectare)
1	Tool Depreciation		
	a. Sprayer	1.266.667	1.200.000
	b. Hoe	210.667	197.333
	c. Sickle	56.000	68.000
	d. Tractor Rental	1.316.667	1.200.000
	e. Rent Harvesting Equipment	395.000	1.800.000
Amount		3.245.001	4.465.333

Source: Primary Data Processed 2023

Based on Table 5, the average fixed costs or depreciation costs incurred by rice farmers who do not use a combine harvester are IDR 3,245,001/MT/Ha and use a combine harvester IDR. 4,465,333/MT/Ha. This shows that there is a difference in depreciation costs for farmers who do not use and use a combine harvester because it is influenced by the size of the farmer's land, the larger the land area, the more tools the farmer needs. Based on the results of the research conducted, all respondent farmers in Cinta Damai Village have their own rice fields and the cost of equipment depreciation shows the biggest difference in the cost of renting harvesting equipment using a combine harvester, namely Rp. 1,800,000/Ha, much higher than renting harvesting equipment that does not use a combine harvester, Rp. 395,000/Ha.

Production

A result obtained from agricultural land in a certain time is usually measured in tons or kg, indicating the potential of an agricultural commodity. The average amount of rice production not using and using combine harvester technology can be seen in Table 6.

Table 6. Average/MT/Ha Total Rice Production Without Using and Using Combine Harvester Technology in Cinta Damai Village.

No	Description	Not Using	Using
		Quantity (Kg)	Quantity (Kg)
1	Production	8.453	8.700
Total		8.453	8.700

Source: Primary Data Processed 2023

Based on Table 6, the average amount of production without using a combine is 8,453 kg/Ha and after using a combine harvester it is 8,700 kg/Ha. The amount of rice production using a combine is greater because the grain results are clean, not mixed with empty grain waste and rubbish such as grass, rice stalks and rice leaves do not enter the sack, whereas without using a combine harvester the grain results are still dirty and there is still a lot of empty grain waste. which went into the sack. The amount of production loss is around 247 kg/Ha, from interviews with farmers that the harvesting process of not using a combine harvester reduces the yield or rice production because the open milling process causes a lot of rice to be scattered and lost, in contrast to harvesting using a combine harvester which uses a separation process. rice grains with a closed system where the rice is cut and milled at the same time and then the harvest can be directly bagged so that no rice is scattered or lost. Apart from that, yield loss is also caused by the process of cutting rice and also the accumulation of rice grain in the fields before going to the threshing process with a thresher, many grains of rice fall or are lost in this process, causing a reduction in farmers' rice production before using a combine harvester when compared with farmers' production results. after using a combine harvester. Other causes are high water content during harvesting (when it rains before harvest), rice stalks falling due to the wind, scattering during harvesting occurs because delays during harvesting result in a lot of rice being scattered on the land.

Reception

Farmers' income also affects income from harvests. Revenue is the unit of rupiah received by the farmer or each respondent or the result of the amount of paddy production which is then multiplied by the selling price applicable at the farmer level. The average total income of rice farmers not using and using combine harvester technology can be seen in Table 7.

Table 7. Average/MT/Ha Total Income of Rice Farmers Not Using and Using Combine Harvester Technology in Cinta Damai Village.

No	Description	Not Using (Rp/MT/Ha)	Using (Rp/MT/Ha)
1	Production (Kg)	8.453	8.700
2	Rice Price (Kg)	5.600	6.600
Total Receipts		47.338.667	52.200.000

Source: Primary Data Processed 2023

Based on Table 7, the average total income of rice farmers not using a combine harvester is IDR 47,338,667/MT/Ha, whereas using a combine harvester is IDR. 52,200,000/MT/Ha. This is what causes the price of Harvested Dry Grain (GKP) harvested using a combine harvester to be higher, because the quality of the grain produced is cleaner from dirt in the fields such as empty grain, rice stems and leaves and grass compared to not using a combine harvester. The grain is still

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dirty and many rice leaves and stems are still mixed with the grain that has been ground in the harvesting machine.

Income

Income is an income received by someone to meet their daily needs in return for services they have performed. Farmer income is one of the benchmarks for farmers in their farming business. The average production costs and income of rice farmers not using and using combine harvester technology can be seen in Table 8.

Table 8. Average/MT/Ha Production Costs and Income of Rice Farmers Not Using and Using Combine Harvester Technology in Cinta Damai Village.

No	Description	Not Using (Rp/MT/Ha)	Using (Rp/MT/Ha)
1	Production (Kg)	8.453	8.700
2	Rice Price (Kg)	5.600	6.600
3	Total Production Costs	19.247.000	15.727.333
4	Total Receipts	47.338.667	52.200.000
5	Total income	28.091.667	36.472.667

Source: Primary Data Processed 2023

Based on Table 8, it shows that the average income of rice farmers not using a combine harvester is IDR 28,091,667/MT/Ha, while using a combine harvester is IDR. 36,472,667/MT/Ha. The income of farmers who do not use combine harvester technology is lower than farmers who use combine harvester technology, this is because using a combine harvester machine can cut production costs and reduce yield losses during harvesting activities and the amount of labor required without using this tool is greater. much more than after using a combine harvester, so it will have an impact on increasing rice production and the income of farmer users.

Comparative Analysis

The comparative analysis technique is a quantitative analysis technique used to test hypotheses regarding whether or not there are differences between the variables or samples studied. If there is a difference, is the difference significant or is the difference just a coincidence (by chance). By knowing the production and income obtained, a comparative analysis can be carried out between production and income for rice farmers who do not use and use combine harvester technology. The income of rice farmers who do not use and use combine harvester technology is obtained from income minus production costs. This happens because there is a relationship between the income or costs incurred by farmers and production costs. The results of the comparative analysis between the amount of production and income for rice farmers not using and using combine harvester technology can be seen in Table 9 below:

Table 9. Results of t-test of rice farmer production in Cinta Damai Village.

		Paired Differences					
		Mean	Std. Deviation	Std. Error Mean	t	Df	Sig. (2-tailed)
Pair 1	Production does not use a combine harvester with production using a combine harvester	8.547.508	2.700.815	3.486.737	24.592	59	.000

Source: SPSS 22 Output Results

The SPSS output results above to prove the difference in production between farmers not using and using combine harvester technology, hypothesis testing was carried out at a level of 5%. From the results of the t-test calculation for the production of rice farmers who do not use and use combine harvester technology, the t-count value is 24.592 and the t-table is 1.671, so it can be concluded that $t\text{-count} > t\text{-table}$. The paired sample test which was carried out to test whether there were differences in the production of rice farmers not using and using combine harvester technology could determine the Sig value. (2-tailed), namely $0.000 < 0.05$, this proves that the significance value obtained is smaller than the real level value set. So it can be concluded that there is an influence of farmers using combine harvester technology on increasing rice production in Cinta Damai Village.

Table 10. Results of the t-test on the cost of income of rice farmers in Cinta Damai Village.

		Paired Differences					
		Mean	Std. Deviation	Std. Error Mean	t	Df	Sig. (2-tailed)
Pair 1	Income not Using Combine Harvester with Income Using Combine Harvester	32.282.164	11.697.844	1.510.185	21.376	59	.000

Source: SPSS 22 Output Results

From the results of the t-test calculation of income received by rice farmers who do not use and use combine harvester technology, the t-count value can be obtained, namely 21.376 and the t-table is 1.671, so it can be concluded that $t\text{-count} > t\text{-table}$. Paired sample test which was carried out to test the difference in income of farmers not using and using combine harvester technology can be determined Sig. (2-tailed), namely $0.000 < 0.05$, this proves that the significance value obtained is smaller than the real level value set. So it can be concluded that there is an influence of farmers using combine harvester technology on the increasing income of rice farmers in Cinta Damai Village.

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Implications

Implications are direct consequences that occur because of something, for example a discovery or research result. The word implication has a fairly broad meaning so its meanings are quite diverse. Implication can be defined as a result that occurs because of something. Implication means something that has been concluded in a research that is straightforward and clear. Implications in research include two things, namely theoretical and empirical implications. The theoretical implications relate to why learning is developed in the analysis of the findings, while the empirical implications relate to the contribution of the findings to the data obtained. Based on the research results above, theoretical implications can be put forward as follows:

- a. The use of a Combine Harvester has been proven to be able to increase user farmers' rice production because it can reduce yield losses and can cut production costs (labor costs).
- b. The use of a Combine Harvester has been proven to increase the income of rice farmers, can cut production costs and reduce losses during harvesting activities and the amount of labor required before using this tool is more than after using a combine harvester, so it will have an impact on increasing rice production and farmer user income.

4. CONCLUSION

1. The average production that does not use and uses a combine harvester has changed. The production amount without using a combine was 8,453 kg/Ha and after using a combine harvester it was 8,700 kg/Ha. This shows that the average amount of production that does not use a combine harvester is smaller than that that uses a combine harvester.

2. The average income of rice farmers who do not use a combine harvester is IDR. 28,091,667/MT/Ha, while those using a combine harvester are Rp. 36,472,667/MT/Ha. Where the income of farmers who do not use combine harvester technology is lower than farmers who use combine harvesters. This happens because the amount of labor required when not using a combine harvester is greater than after using a combine harvester.

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