



## Comparative Analysis of Rice Farming using Combine-Harvester and Thresher in Kenagarian Kambang Barat, Lengayang Sub-District, Pesisir Selatan District

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### A B S T R A C T

The rice harvesting process has progressed a lot. Farmers used to harvest simply using a sickle and a simple thresher machine, while nowadays, they are using the latest harvest machine, called Combine Harvester. Technological developments should enable farmers to gain more significant benefits, such as higher production, a shorter processing time for harvesting, and lower costs incurred during harvesting. This study aims to describe the characteristics of farmers who use Combine Harvester technology and farmers who use Thresher harvesting technology. This study also compares the costs of rice harvesting and production of both farmers in lowland rice farming in Kenagarian Kambang Barat, Lengayang Sub-District, Pesisir Selatan District. The farmers sampling chose as many as 30 farmers purposively for each of those using a Combine Harvester and Thresher, so the total number of farmers to be interviewed was 60. The data analysis method used in this study is the analysis of the average difference test of the independent sample Z-test model. The research finds that farmers' main reasons for using the Combine Harvester were faster harvesting times and less labor. While the main reason for farmers using the Thresher was that its cost is considered the same if using a Combine Harvester machine. Moreover, the research indicates a significant difference in the cost of harvesting and producing rice using both harvesting machines. The harvesting cost of the Combine Harvester was lower than Thresher, which was Rp. 3,543,149 and Rp. 4,385,543 respectively. The difference in harvesting cost of these two harvesting machines was Rp. 842,394. Furthermore, the rice production using the Combine Harvester is higher than the thresher harvesting machine, which was 5,312 Kg/Ha/MT and 5,089 Kg/Ha/MT, respectively, with a difference of 223 kg.

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### INTRODUCTION

The crops sector is one of the leading agricultural sectors in Indonesia. One of the most widely cultivated crops in Indonesia is rice. Rice (*Oryza sativa* L) is one of the rice-producing food crops that has an important role in meeting the food needs of the people in Indonesia (Donggulo, Lapanjang, & Made, 2017).

West Sumatra Province is one of the rice producers in Indonesia. One of the largest rice-producing areas in West Sumatra is Pesisir Selatan Regency. Rice production in Pesisir Selatan Regency is 187,009 tons, with a harvested area of 37,128 ha and a productivity of 5.04 tons/ha (Badan Pusat Statistik, 2019). The largest rice-producing area in Pesisir Selatan Regency is Lengayang District. Rice productivity at each location is different.

Technology is needed to support rice farming to increase rice productivity, starting from the planting, harvesting, and post-harvest processes. Currently, farmers in Lengayang District use two types of harvesting tools: the rice harvesting machine (Combine Harvester) and the threshing machine (Thresher).

These two types of harvesting machines have differences. A thresher harvesting machine is still a simple machine used when harvesting rice because it still requires a rice fan machine to clean the grain from empty grain and requires human labor to cut rice from the stems before using this machine (Sulistiaji, 2007). A combine Harvester machine is classified as sophisticated enough to be used when harvesting rice because it harvests rice mechanically in one process that includes cutting, transporting, threshing, cleaning, sorting, and packing (Badan Litbang Pertanian Indonesia, 2019).

The use of the combined harvester has the advantage of faster processing time, cheaper operational costs, and does not use a lot of workers (Mirza, Bulan, & . 2018). In contrast, the thresher machine requires much labor and a long harvesting time. Although the combine harvester is considered economical, it is still seen in the field that farmers use threshers at harvest time because the paddy fields have deep mud, the condition of the rice plants falling due to strong winds, and improper cropping patterns (Khoiri, 2018).

Farmers who do rice farming in Lengayang District have different opinions about using harvesting machines. The first opinion states that using a Combine Harvester machine is more profitable. The benefits used by Combine-Harvester are the harvesting process, costs incurred by farmers, and the amount of rice production obtained. While the second opinion states that there is no difference in perceived benefits when using the Combine-Harvester or the Thresher machine. Based on the field review and these conditions, the purpose of this research is:

1. To describe the characteristics of farmers using the combined-harvester machine and farmers using the thresher harvesting machine.
2. To analyze the comparison between rice farming using the combined-harvester machine and the thresher harvesting machine.

## METHOD

This research was conducted in Kenagarian Kambang Barat, Lengayang District, Pesisir Selatan Regency. The determination of the research area was done purposively because this location had farmers who do farming using Combine Harvester and Thresher harvest technology. The research was conducted from September 2021 to November 2021.

The total sample used in this study was 60 farmers. A sampling of farmers in this study using the purposive sampling method. The total sample consists of 30 farmers who use a combine harvester machine and 30 sample of farmers who use a thresher machine.

The data analysis used in this research is descriptive qualitative and quantitative analysis. The data collected is data from one period of rice farming. Qualitative analysis is carried out by describing the phenomena in the field and determining the characteristics of farmers using the two harvesting technologies.

Partial analysis can be used to see differences in costs and yields in farming (Suratiah, 2019). Quantitative analysis used consisted of partial analysis of farming and statistical tests. The partial analysis of farming compares production, revenue, the total cost of harvesting, and income. This comparison is carried out on two types of harvesting technology used in rice farming. Statistical tests were carried out to test whether or not there was a difference in the cost of harvesting and the amount of production from the use of two types of harvesting technology. Some of the formulas used in the partial analysis and statistical tests are:

1. Revenue from Rice Farming

$$TR = Y \cdot P_y$$

TR = Total Revenue of Rice Farming (IDR/Ha)

Y = Total Rice Production (Kg/Ha)

P<sub>y</sub> = Price of Rice (IDR/Kg)

2. Harvest Cost Total (HCT)

THC = Labor Cost + Harvest Equipment Rental Fee

3. Rice Farming Income

$$I = TR - HCT$$

P<sub>d</sub> = Farmer's Income (IDR/Ha)

TR = Total Revenue (IDR/Ha)

HCT = Harvest Cost Total (IDR/Ha)

4. Statistical test

$$z_{test} = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\left(\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}\right)}}$$

$$S_1^2 = \frac{\sum x_1^2 - \frac{(\sum x_1)^2}{n_1}}{n_1}$$

$$S_2^2 = \frac{\sum x_2^2 - \frac{(\sum x_2)^2}{n_2}}{n_2}$$

$n_1$  = Number of samples from farmers who use Combine Harvester

$n_2$  = Number of samples from farmers who use Thresher

$\bar{x}_1$  = Average cost of harvesting and producing rice from farmers using a Combine Harvester

$\bar{x}_2$  = Average cost of harvesting and producing rice from farmers using Thresher

$S_1^2$  = Sample variance of farmers using Combine Harvester

$S_2^2$  = Sample variance of farmers using Thresher

The statistical hypothesis is:

$$H_0: \bar{x}_1 = \bar{x}_2$$

$$H_1: \bar{x}_1 \neq \bar{x}_2$$

Operational Hypothesis:

$H_0$  = There is no difference in the cost of harvesting and producing rice in lowland rice farming using Combine Harvester and Thresher harvesting technology.

$H_1$  = There is a difference in the cost of harvesting and producing rice in lowland rice farming using Combine Harvester and Thresher harvesting technology.

The statistical decision rule:

$Z_{test} < Z_{table}$  with  $\alpha = 5\%$  then  $H_0$  accepted, and  $H_1$  rejected

$Z_{test} > Z_{table}$  with  $\alpha = 5\%$  then  $H_0$  rejected, and  $H_1$  accepted

## RESULTS AND DISCUSSION

### *The characteristics of farmers using Combine-Harvester and Thresher*

The characteristics of farmers are seen from the farmer's age, education, farming experience, area of agricultural land, land ownership status, and the number of family members covered. The majority of farmers are aged 15-65 years, have an elementary school education level, the farming experience of more than 20 years, has a land area of 0.51-1 ha, have land ownership status for profit sharing, and have a number of family members borne by 4-6 people.

Tabel 1 shows that the characteristics of farmers who use a combine harvester and those who use a thresher are the same. It shows that the characteristics of farmers do not affect the decision-making use of harvesting technology.

**Table 1.** Characteristics of Farmers Using Combine Harvester and Thresher Machines

No	Characteristic	Farmers Using Combine Harvester		Farmers Using Thresher	
		Number (people)	%	Number (people)	%
1.	Farmer's age (Year)				
	a. <15	-	0	-	0
	b. 15-65	27	90	28	93,3
	c. >65	3	10	2	6,7
2.	Education				
	a. Elementary school	16	53,3	14	46,7
	b. Junior high school	5	16,7	3	10
	c. Senior high school	8	26,7	11	36,6
	d. University	1	3,3	2	6,7
3.	Farming experience (Year)				
	a. <10	2	6,7	-	0
	b. 10 - 20	3	10	2	6,7
	c. >20	25	83,3	28	93,3
4.	Area of land (Ha)				
	a. 0,1 - 0,5	-	0	-	0
	b. 0,51 - 1	30	100	30	100
	c. >1	-	0	-	0
5.	Land ownership				
	a. Owner	15	50	14	46,7
	b. Profit share	15	50	16	53,3
6.	Number of family members covered (People)				
	a. 1 - 3	7	23,3	9	30
	b. 4 - 6	21	70	19	63,3
	c. > 6	2	6,7	2	6,7

Factors that may affect farmers in using harvesting technology are the cost of harvesting, the time of harvesting, the amount of product obtained, and the amount of labor needed. Most farmers who use a combine harvester machine think that harvesting costs are less, the processing time is faster, and the amount of labor used is less. Meanwhile, most farmers who use a thresher think that the amount of product obtained using a thresher machine is more than a combined harvester machine. Another reason found is that farmers use thresher machines because their fields have deep mud and narrow roads. Also, because of the habit of using this machine, farmers do not want to try using the Combine Harvester machine.

### *Comparative Farming Analysis*

The comparative farming analysis started from harvesting activities to selling production products considering that the farming activities carried out by farmers before harvesting in both groups of farmers were the same. Harvesting activities in the two groups of farmers experienced differences due to differences in harvest technology. This difference saw in cutting, threshing, cleaning, and packaging activities. The comparative farming analysis of rice farming can saw in the Table 2.

**Table 2.** Analysis of Partial Farming on Rice Farmers Using Combine Harvester Machines with Thresher Machines of One Periode of Rice Farming

No	Uraian	Combine Harvester	Thresher
1.	Rice Production (kg/Ha)	5.312	5.089
2.	Price (IDR/Ha)	5.000	5.000
3.	Revenue (IDR/Ha)	26.560.333	25.446.167
4.	Harvest Cost (IDR/Ha)		
	a. Operator cost of <i>Combine HarvesterMachine</i>	1.181.050	-
	b. The labor cost of cutter paddy	-	2.263.333
	c. Operator cost of <i>thresher machine</i>	-	424.102
	d. The labor cost of seed cleaner paddy	-	283.301
	e. Rent cost of <i>Combine Harvester Machine</i>	2.362.099	-
	f. Rent cost of the <i>thresher machine</i>	-	848.206
	g. Rent cost of seed cleaner paddy	-	566.601
	Harvest cost total (IDR/Ha)	3.543.149	4.385.543
5.	Income (IDR/Ha)	23.017.184	21.060.623

### Production and Revenue

Farmers who use the combine harvester get a production of 5,312 Kg/Ha, while farmers who use a thresher machine get a production of 5,089 Kg/Ha. The rice production results using a combined harvester machine with a thresher machine differ by 2.14%. This shows that rice production in farms using Combine Harvester machines is higher than in farms using Thresher harvesting machines.

Farmers who use the combine harvester machine or the thresher machine cultivate IR-42 rice varieties. Farmers sell their products in the form of harvested dry grain at IDR 5000/kg.

The revenue obtained by farmers who use the Combine Harvester machine is IDR 26,560,333/Ha. Meanwhile, the acceptance of farmers who use the thresher harvesting machine is IDR 25,446,167/Ha. The difference in receipts obtained is IDR. 1,115,000/Ha or 2.14%. Here, the amount of income received by farmers using combine harvester machines is more than by farmers using thresher machines.

### Harvest Cost

Rice harvesters using Combine Harvester machines and Thresher machines incur costs in the form of labor costs and equipment rental costs. The difference in harvest costs lies in the number of machines rented and the amount of labor used at harvest. In the Combine Harvester machine, the farmer only rents one machine, while the farmer rents two types of equipment in the thresher machine. The number of workers for harvesting using a combine harvester machine is four while harvesting using a thresher is thirty.

The cost of harvesting using the Combine Harvester machine is the operator's fee and the rent cost of the combine harvester machine. The total cost of harvesting using the combine harvester machine is IDR 3,543,149/Ha consisting of machine operator fees of IDR 1.181.050/Ha, and the machine rental fee is IDR 2,362,099/Ha.

The total cost of harvesting using a Thresher machine is higher than using the combined harvester. The total cost of harvesting using a thresher is IDR 4,385,543/Ha, which consists of labor costs for cutting rice of IDR 2,263,333/Ha, thresher machine operator costs of IDR 312,833/Ha, thresher machine rental fee is IDR 848,206/Ha, labor costs for seed cleaner paddy 283,301/Ha, and rent a seed cleaner paddy machine is IDR 566,601/Ha.

The harvesting process using a thresher machine uses 30 people per hectare, consisting of 23 people/ha for cutting rice, four threshing machine operators, and three operators of the fan machine. Meanwhile, the harvesting process uses a combined harvester is four people. The difference in the use of labor is 76.47% in the two types of harvesting tools. When viewed from the cost of labor, the difference is 43.11. It shows that the amount of labor and labor costs incurred by farmers who use the combine harvester machine are smaller than farmers who use the thresher.

On the other hand, the comparison of the total equipment rental costs incurred is 25.08%. It can saw here that the amount of equipment rental costs incurred by the farmers who use combined harvesters are more than those by the farmers who use threshers.

The total cost of harvesting the difference is Rp. 842,394 or 10.62%. The total cost of harvesting using a combine harvester is smaller than the total cost of harvesting using a thresher.

### Income

The average income of farmers using the Combine Harvester harvesting machine is IDR 23.017.184/Ha. Meanwhile, the average income of farmers using Thresher harvesting machines is IDR 21,060,623/Ha. The difference in comparing the amount of income received by farmers is IDR 1,947,228 or 4.44%. It can saw here that the amount of income received by farmers who use the combine harvester machine is more than the farmers who use the thresher machine.

### Statistical Test

The statistical tests on production show that  $Z_{test} > Z$  table (3,905 > 1,645) or  $H_0$  rejected. The statistical test results of harvest costs showed that  $Z_{test} > Z$  table (27,416 > 1,645) or  $H_0$  rejected. It shows a significant difference in production and harvest costs between rice

farming using a combined harvester and a thresher machine.

## CONCLUSIONS

The characteristics of farmers who use combined harvester and thresher machines are generally the same. The reasons for choosing the harvest technology are different. Farmers use the combine harvester because the harvest time is faster and the number of workers is less. Meanwhile, the main reason for farmers to use thresher machines is rice production which farmers consider to be larger, and harvesting costs are considered the same.

Partial farming analysis shows that the total cost of harvesting using a combine harvester is smaller than in a farm using a thresher machine. Meanwhile, the amount of production, revenue, and income in farming using a combine harvester is more than farming using a thresher machine

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