

Impact of certified rice seed on farmers' income in Simalungun District, North Sumatra

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Abstract. This study examines how certified rice seed adoption contributes to farmers' incomes and its impact on agricultural productivity. This study aims to describe the differences between certified and non-certified rice seed adoption on farmers' income in Simalungun District, specifically in the Siantar and Panombeian Panei sub-districts. The research type was quantitative and descriptive using a survey method. The selection of respondent farmers used a simple random sampling technique, where 40 farmers used certified seeds and 20 farmers used non-certified seeds. The results showed that the average yield of rice farming using the certified seed was 5,615 kg/ha (IDR 26,651,553) with a total production cost of IDR 11,013,535 and a profit of IDR 15,638,018. Meanwhile, the average yield of rice farming using non-certified seed was 4,444 kg/ha (IDR 21,927,198) and the total cost was IDR 9,633,634, and a profit of IDR 12,293,564. The R/C ratios of using certified and non-certified seeds were 2.42 and 2.28, respectively. The analysis showed that certified seeds outperformed non-certified ones in terms of yield, income, and profit. These positive results should encourage the government to promote certified seed adoption to increase rice production and farmers' incomes.

1 Introduction

Indonesia, one of the world's largest agrarian countries, relies heavily on the agricultural sector as the main source of livelihood for the majority of its population. Rice plays a crucial role in the agricultural sector as it is a staple food for a significant portion of the Indonesian population. Increasing rice production is a priority in efforts to achieve food security and improve the well-being of farmers.

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The provision of quality seeds and a variety of superior varieties that align with consumer preferences can be considered a strategy for achieving food self-sufficiency. The availability of high-quality seeds in sufficient quantities and at the right time plays a highly significant role. The use of high-quality seeds is a key factor for enhancing rice production. Quality seeds can increase production and productivity by being responsive to fertilisation, improving production efficiency, and allowing for an increase in harvest frequency of up to three times a year. The cost efficiency of production is also enhanced because quality seeds typically exhibit resistance to specific climates, including pest and disease attacks [1,2].

In an effort to enhance agricultural yield and quality, the Indonesian government has implemented various programs and policies, including seed certification. Certified seeds are those that have undergone various trials and meet the quality standards set by the Ministry of Agriculture. The utilisation of certified seeds has several advantages such as quality assurance, uniform growth, and increased production in rice farming. However, on the other hand, non-certified seeds also have their advantages. Besides being more economical, non-certified seeds, particularly locally developed varieties, can adapt to the local environment, including compatibility with specific soil and climatic conditions.

As one of the rice producers in North Sumatra, Simalungun District ranks third after Deli Serdang and Serdang Bedagai, with an average production of 5.8 tons/ha in 2022 [3]. According to the Gyga Atlas [4], this production is still lower than the potential, which could reach 13 tons/ha. One of the factors contributing to this productivity gap is the seed. According to Girsang et al. [5], seed production in this district is imported from other areas and some still use non-certified seeds. This has an impact on farmers' production and income. Raditya et al. [1] reported that the average production and income of farmers using certified seeds were 23.36% and 33.63% higher, respectively, than those using non-certified seeds. Furthermore, Akanbi et al. [6] state that farmers' income increases to USD 263.74 per ha compared to that of farmers using non-certified seeds, which only reaches USD 212.31 per ha. Although seeds contribute only 7% to rice farming output [7], they can influence production by up to 10-23% [1,6].

The problem statement in this study addresses how the utilisation of certified rice seeds contributes to farmers' income and its influence on agricultural productivity. Are there significant income disparities between farmers using certified rice seeds and those relying on non-certified seeds? This study aims to elucidate the disparities in the adoption of certified and non-certified rice seeds on farmers' incomes in the Simalungun District. The objective is to determine whether the adoption of certified rice seeds positively impacts farmers' income. Data supporting an income boost can provide robust empirical evidence to support the efficacy of using certified seeds. Consequently, the research findings are expected to lay the groundwork for formulating or adjusting agricultural policies and developing programs for farmers to adopt certified seeds.

2 Methodology

2.1 Research location and time

This study is a quantitative descriptive study that employs a survey method. The research was conducted in June 2023 in Simalungun District, specifically in Siantar and Panombeian Panei Sub-districts. The selection of these sub-districts as the research locations is based on data recorded in the Simalungun District in Figures 2023 [8], which indicated that the district was one of the potential areas for wet rice farming endeavours.

2.2 Object and scope of the research

Respondents were randomly selected, totalling 60 individuals, comprising 40 farmers who used certified seeds and 20 farmers who used non-certified seeds. Farmer respondents were selected using simple random sampling. This research is limited to describing the use of certified superior seeds on the income of wet rice farmers in Simalungun District.

2.3 Data processing and analysis methods

The research utilised primary data collected from farmer respondents through interviews using a questionnaire. The collected data from the field were then processed using tabulation techniques, presented descriptively, and analysed with average values. The goal is to identify the differences in production and profits between wet rice farmers using certified seeds and those using non-certified seeds. The applied quantitative analysis includes cost analysis, income, revenue, and a comparison of farming income using the formulas described by Suratiah [9].

$$TC = FC + VC \quad (1)$$

where Total Cost (TC) is the overall sum of expenses incurred in farming, encompassing all types of costs, whether fixed or variable, Fixed Cost (FC) is the component of costs that remains constant regardless of the volume of production, such as land rent, and Variable Cost (VC) is the component of costs that changes with variations in the volume of production. Variable costs are directly related to the production process, including raw materials, direct labour, and production costs that fluctuate with the level of production.

$$TR = P \times Q \quad (2)$$

where Total Revenue (TR) is the total income received from sales, Price (P) is the selling price charged to consumers, and Quantity (Q) is the volume or quantity of the product sold.

$$I = TR - TC \quad (3)$$

where income (I) represents the net profit or gain obtained after subtracting the total revenue (TR) from the total cost (TC).

3 Results and discussion

3.1 Respondents' characteristics

3.1.1 Age group of labour force

According to the World Health Organization (WHO), an economically active population refers to individuals aged 15–59 years [10]. This economically active age group plays a crucial role in the economy of a region. Their presence ensures the availability of a workforce that is ready for use. The distribution of the labour force in wet rice farming in Siantar and Panombeian Panci Sub-districts, Simalungun District, based on age groups, is presented in Table 1.

Based on the data in Table 1, it can be observed that the majority of farmers fall within the economically active age range, both for those using certified and non-certified seeds. Specifically, 78.57% of the farmers using certified seeds and 61.11% of the farmers using non-certified seeds were within the economically active age range. Meanwhile, farmers classified as not economically active were relatively few, accounting for 21.43% and 38.89%,

respectively. This indicates that, on average, the surveyed farmers were in prime conditions for farming activities. Consequently, farmers can focus more on achieving agricultural outcomes. Unfortunately, among the respondents, only seven farmers were aged 40 years and below. This implies that farming as an occupation is less favoured by the younger generation in the research area. All farmers interviewed in this study were also married.

Table 1. Distribution of age groups in the labour force of wet rice farming in Siantar and Panombeian Panei Sub-districts, Simalungun District, 2023.

Age Group	Farmers using certified seeds		Farmers using non-certified seeds	
	Total	Percentage	Total	Percentage
15-59	33	78.57	11	61.11
>59	9	21.43	7	38.89
	42	100.00	18	100.00

3.1.2 Farmers' educational level

Education contributes significantly to the wet rice farming profession. This occupation requires knowledge and skills, and the level of education can affect production outcomes and quality of life. Farmers with higher education levels tend to have a better understanding of land management techniques, fertiliser use, and pest control. This can enhance agricultural productivity, leading to larger harvests, and consequently, increased family income. Education can also influence farmers' attitudes towards change and innovation. Educated farmers are more open to new ideas and modern agricultural technology. They can more easily adapt to more sustainable and environmentally friendly farming practices. This aligns with the research conducted by Mujerimin [11], where education is identified as a key factor in achieving the desired success in any field of life.

Table 2. Distribution of age groups in the labour force of wet rice farming in Siantar and Panombeian Panei Sub-districts, Simalungun District, 2023.

Educational level	Farmers using certified seeds		Farmers using non-certified seeds	
	Total	Percentage	Total	Percentage
High school	27	64.29	8	44.44
Junior high school	11	26.19	4	22.22
Elementary school	3	7.14	5	27.78
Unschooling	1	2.38	1	5.56
	42	100.00	18	100.00

Table 2 reveals that most of the educational levels of wet rice farmers in Simalungun District were relatively high. Most farmers had completed education up to the high school level, accounting for 64.29% of farmers using certified seeds and 44.44% of farmers using non-certified seeds. None of the respondents had pursued higher education. This was because a significant portion of the rural population dealt with limited financial resources and a lack of awareness of the importance of higher education. Consequently, they preferred to engage in work even with limited educational backgrounds. This situation also reflects a lack of interest in agriculture-related knowledge within the community. Therefore, encouraging the interest of young individuals in the agricultural sector is crucial.

3.2 Rice farming cost and income

Fixed costs are expenses that do not change, regardless of income level. In this study, fixed costs include land and machinery rents. On the other hand, variable costs are the expenses with their fluctuating prices depending on the level of business or production volume. The

larger the managed land area, the higher are the variable costs incurred. The variable costs in this study encompass seed costs, fertilisers, herbicides, pesticides, and labour.

Table 3 shows that the total cost of wet rice farming using certified seeds is relatively lower than that of non-certified seeds, both in terms of fixed and variable costs. The most significant expenses in wet rice farming, whether using certified or non-certified seeds, are dominated by labour (42 – 43%) and land rent (32 – 36%). Wet rice farming using certified seeds only requires a total production cost of IDR 11,013,553, whereas the production cost of using non-certified rice seeds was IDR 9,633,634. This means that farmers using certified seeds spend more on production costs than those using non-certified seeds. The difference in the range of production cost burdens between the two was substantial, i.e., to IDR 1,379,902. This contradicts the research conducted by Ramadhani [12], where the costs incurred by farmers using certified seeds were lower than those using non-certified seeds, with a difference of IDR 427,075. Puspitasari [13] also found in her research that the production cost of rice farming using certified seeds was less than that of non-certified seeds, with a difference of IDR 1,097,902.

Table 3. Production costs and income of wet rice farming using certified and non-certified seeds in Siantar and Panombeian Panei Sub-districts, Simalungun District, 2023 (per hectare).

No.	Description	Certified seed (IDR)	Percentage (%)	Non-certified seed (IDR)	Percentage (%)
1	Variable cost (IDR)				
	Seed	511,253	4.64	279,307	2.90
	• volume (kg)	37		51	
	• price (IDR/kg)	14,812		5,603	
	Fertiliser	2,167,614	19.68	4,112,091	42.68
	Herbicide	272,747	2.48	107,935	1.12
	Pesticide	719,383	6.53	334,962	3.48
	Labour	6,210,258	56.39	4,291,005	44.54
	Machine rental	1,298,605	11.79	509,446	5.29
	Total variable cost	9,881,255	89.72	9,125,301	94.72
2	Fixed cost (IDR)				
	Land rental	1,132,280	10.28	508,333	5.28
	Total fixed cost	1,132,280	10.28	508,333	5.28
	Total cost (1+2)	11,013,535	100.00	9,633,634	100.00
3	Income				
	Yield	26,651,553		21,927,198	
	• volume (kg)	5,615		4,444	
	• price (IDR/kg)	4,747		4,934	
	Profit	15,638,018		12,293,564	

The use of certified seeds is one aspect that can support the improvement of quality, production outcomes, and rice productivity [14]. Certified seeds have several advantages including (1) uniform growth, flowering, and fruit maturation, allowing simultaneous harvesting, (2) high rice yield and consistent quality, and (3) enhanced quality of the resulting rice production.

3.3 Revenue-to-cost ratio

Table 4 shows that the total production quantity in wet rice farming using certified seeds was relatively higher than that using non-certified seeds. The average production of wet rice farming using certified seeds was higher, as was the income generated. Meanwhile, the average production in wet rice farming using non-certified rice seeds was lower, resulting in lower incomes. This achievement is supported by infrastructure, including irrigation

networks. Generally, the irrigation network in Simalungun District is classified as a technical irrigation network. In this research location, the irrigation network is considered to be very good, and water is abundant throughout the year. This is because Siantar Sub-district is one of the districts involved in the Water Resources and Irrigation Sector Management Program (WISMP), which is a national program for water and irrigation resource management implemented by the government using foreign loans (from the World Bank). However, based on interviews and site visits, the planting index in this district was only once a year. The lack of cohesion at the farmer group level is one of the contributing factors. Meanwhile, with the use of certified rice seeds, farmers can engage in farming for up to three planting seasons in a year, potentially resulting in higher incomes.

Syahfid et al. [15] also found that the income obtained by farmers using certified seeds is larger than those using non-certified seeds, with an income difference reaching IDR 5,800,000 per ha per planting season. A similar statement was made by Akbar [16], where the income of farmers using certified seeds was greater than those using non-certified seeds, with a difference of IDR 5,884,400 per ha per planting season. The use of superior seeds, in this case certified seeds, can increase the harvest frequency by up to three times a year. In addition to improving the quality of the harvest, certified seeds also serve as a control tool for plant pests and diseases. The availability of certified seeds is an absolute prerequisite in agricultural activities; however, in the expenditure structure of wet rice farming, the proportion of seed costs is only 3-5% of the total expenditure.

Farm income is the difference between the income received and the total farming costs in one planting season [17]. The success of farming is measured by the profit parameter, where if income is greater than costs, farming is considered profitable.

The data in Table 4 shows that farmers using certified seeds had a higher net income (profit) per hectare per planting season. Meanwhile, farmers who use non-certified seeds earn lower profits. This is in line with research conducted by Akbar et al. [16], where farmers using certified rice seeds had a higher net income than those using non-certified seeds. Similarly, Puspitasari [13] found that farmers using certified seeds obtained greater profits than those using non-certified seeds.

Table 4. Average income of wet rice farming with certified and non-certified seeds in Siantar and Panombeian Panei Sub-districts, Simalungun District.

No	Description	Total cost (IDR/ha/planting season)	
		Certified seed	Non-certified seed
1	Total revenue (IDR)	26,651,553	21,927,198
2	Total cost (IDR)	11,013,535	9,633,634
3	Net income (profit) (IDR)	15,638,018	12,293,564
4	R/C ratio	2.42	2.28

The R/C ratio obtained by farmers using certified seeds was 2.42, meaning that every IDR 1,000 invested in farming would generate IDR 2,420 of gross income or revenue. The R/C ratio for farming using non-certified seeds was 2.28 meaning that every IDR 1,000 invested in farming will generate around IDR 2,280 of gross income.

4 Conclusions and policy recommendations

The profitability of rice farmers in the Siantar and Panombeian Panei Sub-districts, Simalungun District, whether they adopted certified or non-certified seeds, was influenced by the income obtained from the yield value and production costs incurred. There was a difference in the average yield between farmers using certified and non-certified seeds. Furthermore, analysis of production costs indicated that farmers using non-certified seeds

had higher production costs than those using certified seeds. This difference is the primary reason for the variance in average profits between the two groups of farmers. Therefore, the use of certified seeds offers substantial economic benefits to farmers in Simalungun District.

Given the positive findings of this study, it is expected that the government will continue to provide an extension on the advantages of using certified seeds, which can enhance production and agricultural profits. The government may also consider expanding subsidy programs for certified seeds to ensure that more farmers can access high-quality seeds without excessive financial burdens. Additionally, the government should ensure sufficient availability of certified seeds in Simalungun District and take action to increase both production and distribution. Regular monitoring and evaluation of the impact of certified seed use should be conducted to identify any necessary changes in existing policies or programs. Furthermore, it is essential to implement mentoring activities to maximise the benefits of certified seeds.

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