

Cost Efficiency and Farmers' Profit in Using Certified Rice Seeds and Non-Certified Rice Seeds in Rainfed Rice Field

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Abstract. The use of non-certified seeds in rice farming in rainfed rice fields is still relatively high, around 60%. The objectives of this study (1) to analyze the comparison between the use of certified and non-certified rice seeds, (2) to measure the increase in the efficiency of input use and increase of profits with the use of certified seeds. The study was carried out in Semarang Regency, Central Java Province, Indonesian with a survey method. The data collected were analyzed descriptively using a comparison method between farmers who used certificated and non-certified seeds. The study's findings showed that the average productivity of rice using certified seeds was 5.41 tons/ha of dry milled grain, while the average productivity of rice using the non-certified seeds was 4.91 tons/ha. The profit obtained in rice farming using certified seeds was as much as 16,154,000.00 IDR per hectare, while the profit using the non-certified seeds was as much as 14,626,000.00 IDR per hectare. In rice farming using certified seeds, an R/C ratio of 2.81 was obtained, while those using non-certified seeds obtained an R/C ratio of 2.71. The study results showed that the use of certified seeds had increased the efficiency of input use and profits in rice farming

1 Introduction

The rice planting area in rainfed rice fields in Indonesia is 3,559,122 hectares. Rainfed rice fields have a limited planting period due to the very high dependence on the climate, especially the rainfall element. Rainfed rice fields can collect rainwater because the land is made flat or terraced and surrounded by a barrier so that water can be accommodated and stagnant in the processed field. It can be utilized optimally for the needs of *gogo* rice farming [1]. *Gogo* rice farming in rainfed land is classified as high-risk, relatively low in productivity, and less efficient, causing farmers to hesitate in applying intensive technology [2,3]. The high risk of *gogo* rice farming in rainfed rice fields causes most *gogo* rice to be planted in the first rainy season (RS I) as "*gogo rancah*." To obtain maximum production, farmers always consider how to allocate inputs as efficiently as possible to obtain high production. Such a way of thinking is natural. In economics, it is called the profit maximization approach [4].

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In rice farming, production inputs are land, fertilizers, seeds, pesticides, labor wages, and agricultural equipment. These inputs are used from planning and implementation to obtaining results. Smallholders' production inputs have always been a limiting factor in rice farming, so farmers try to minimize production costs but still expect high profits. One of the financings of rice farming that is often minimized is seeds [5]. Consumers can demand rice seeds when the seeds planted are superior and quality seeds (original, pure, vigor, clean and healthy). Superior seeds are certified seeds that can meet or exceed the needs and expectations of their customers. The use of certified rice seeds is still considered low at only about 60% of the total planting area, even in rainfed rice fields suspected to be lower [6,7].

2 Methodology

The research was conducted in Pucung Village, Bancak District, Semarang Regency, Central Java Province, in 2020. The site selection is based on the enormous contribution of rainfed land in Central Java. The land used for the study was 2.5 ha, which was controlled by nine cooperative farmers, consisting of farmers who planted rice with certified seeds, as many as five people covering an area of 1.25 ha, and those who used non-certified seeds as many as four people, covering an area of 1.25 ha. Planting is carried out in the second rainy season (MH 2), beginning in March. The seeds used are certified *Inpago* 8 varieties; the number of seeds used is 3-5 seedlings per hole or 30 kg/ha, planting distance 40 cm X 20 cm. The fertilizers used are Urea (125 kg/ha), *Phonska* (275 kg/ha), and organic fertilizer (2 tons/ha). Pest and disease control depends on planting conditions based on the principle of integrated pest control. As a comparison, cooperative farmers use non-certified seeds, known as local *Umbul* seeds. The number of seeds used is 7-10 seeds/planting hole or about 50 kg/ha with a planting distance of 25 cm X 25 cm. The fertilizer used following farmers' habits is 200 kg/ha urea; 50 kg/h SP 36; 135 kg/ha *Phoska*; and 2.25 tons/ha manure.

The data were collected include agronomic characteristics: seed growth, plant height (age 30 and 90 days after planting), number of productive tillers (age 30 and 90 days after planting), harvested date, dry *unhilled* grain (DUG ton/ha), unhusked dry rice ready for milling yield (DMG ton/ha). The data collected were analyzed using a different test of two paired averages. In addition, input data and prices were collected, including seeds, fertilizers, medicines by type, and the labor used. Fixed costs collected consist of depreciation of work equipment, taxes, and capital interest. The advantages of upland rice farming use the following formula:

$$II = TR - TC \quad (1)$$

$$TC = TFC - TVC \quad (2)$$

While *II* was profit; *TR* was total revenue; *TC* was total cost; *TFC* was total fixed cost; and *TVC* was total variable cost.

Based on sum data and input pricing, then a financial analysis of the inputs and outputs of *gogo* rice farming is made. R/C analysis is the ratio between receipts and total costs incurred during the production process used to assess the feasibility of each technology package [4].

3 Result and discussions

3.1 Agronomic and production gaps

Seed quality is a crucial element in achieving high rice cultivation production. Certified and uncertified rice seeds in the nursery showed good growth performance, ranging between 95.32 (certified) and 99.92% (uncertified seed). The growth performance of certified seeds

was significantly lower than that of uncertified seeds. Seed germination was significantly influenced by the initial quality of the seed and the combination of the initial quality of the seed and invigoration. The cause of the low permeability of germination in certified seeds a result in the imperfect level of quality of pithy seeds

Table 1. Seed growth, plant height, number of tillers and rice productivity using certified and non-certified seeds, at the research location.

Description	Seed status	
	Certified	Non-certified
Seed growth (%)	95.32 a	99.94 b
Plant height (cm)		
• 30 DAP	85.29 a	75.33 b
• 90 DAP	145.44 a	112.08 b
Number of tillers (tiller)		
• 30 DAP	16.34 a	13.41 b
• 30 DAP	12.60 a	11.74 b
Harvest Date (day)	115 a	120 b
Productivity of DUG (ha/kg)	6.38 a	5.55 b
Productivity of DMG (ha/kg)	5.52 a	4.91 a

The number of tillers in the growth phase of 16.34 certified seeds shows a marked difference from local *Umbul* seeds, which provide some tillers of 13.4. However, saplings formed in growth stadia are usually unproductive, where each variety has a different tiller capacity [8]. In observing the number of productive tillers (90 DAP), it can be seen that in certified seeds, as much as 12.60 tillers, while the number of productive tillers in non-certified seeds is 11.74 tillers.

The initial growing conditions affect the height of the plant because of the process of adapting to the growing environment. Plant height gap in the growth phase 30 DAP is considered good, although at the beginning of plant growth (7-10 DAP) experiences drought. The results of field observations show that both certified seeds and non-certified rice provide a reasonably good level of drought resistance. In a subsequent development, the state of the plant shows a reasonably good degree of growth adaptation. The observations showed that the height of the reproductive phase plants, certified seeds at the age of 90 DAP, was 145.4 cm, while non-certified seeds were 112.08 cm. Plant height is one of the growth indicators used to measure the condition of plants by environmental influences, which in turn will affect productivity [9].

It can be seen that the yield of dry unhilled grain (DUG) statistically between certified and non-certified seeds shows a noticeable difference. The yield of DMG between certified and non-certified seeds statistically did not show a noticeable difference at 5%. However, it can be known that certified seeds get a higher yield of 5.52 t/ha DMG compared to non-certified 4.91 tons/ha. Genotype factors affect the plant's response. Tolerant genotypes with a reasonable degree of adaptation have a relatively high ability of photosynthetic activity, which in turn will affect productivity. The use of certified seeds indicates a better agronomic character. The advantages of certified *gogo* rice seeds are also stated [10,11]. With the same fertilization dose, certified *gogo* rice, its productivity is higher when compared to non-certified ones. However, the use of local non-certified *gogo* rice seeds turns out to have resistance to water stress compared to certified *gogo* rice seeds due to long-standing adaptation to the local environment [12].

3.2 Production cost and farming profit

The essence of an economy for most people is production. *Production* can be defined as an activity or process that can satisfy human wants directly or indirectly now or in the future.

Production will have no meaning if it is not directly related to economic activities, including agricultural production. Not all of the agricultural products produced by farmers can be enjoyed because the cost of farming production must reduce. *Production costs* are the value incurred by farmers in producing commodities in farming [13]. Funding in farming can be divided into direct (explicit) and implicit (direct costs) costs. *Farmers incur direct costs* in cash (cash), such as purchasing seeds, fertilizers, pesticides, and labor outside the family. Implicit costs are estimated costs taken into account in contests such as land and family labor.

Table 2 describes the production costs and profits of upland rice farming in the research location. The financial analysis results show that the average labor cost in farming with certified seeds is 67.34% of the total production cost. This cost is higher than farming with uncertified seeds, 66.17% of the total cost. In rice farming in irrigated rice fields, labor costs range from 56-to 60% of the total production cost per hectare [14]. The average labor cost for rice farming is 40% of the total production cost [4].

The failure of farmers in one growing season is a problem that farmers often face when farming in rainfed rice fields because there will be capital difficulties in the next growing season [15]. Therefore, farmers always expect to obtain high profits so that they can subsequently be used as the next business capital. Profit is the difference between total receipts and costs. The higher the ratio between total receipts and costs, the higher the level of farm efficiency. The efficiency of farming is related to achieving the ratio of benefits to production costs. Farmer to choose to make the farming business efficient, it is necessary to compare two business projects based on the analysis of benefits and costs. Based on Table 2, it can be seen that the profit in *gogo* rice farming businesses that use certified seeds is IDR 17,513,000.00/ha, while in farming businesses using non-certified seeds, the profit is IDR 14,489,000.00/ha.

Table 2. Average cost of production and profits of *gogo* rice farming at the research site.

Parameters	Seed Status	
	Certified	Non-certified
Production (ton)	5.52	4.91
Revenue (IDR)	26,400,000	23,520,000
Non-fixed Costs		
• Seed	300,000	496,000
• Urea	315,000	485,000
• Sp36	-	120,000
• <i>Phonska</i>	741,000	364,000
• Manure	570,000	638,000
• Medications	370,000	340,000
Labor	5,985,000	5,976,000
Total non-fixed costs	8,281,000	8,419,000
Fixed costs		
• Village dues	150,000	150,000
• PBB	85,000	85,000
• depreciation of the tool	35,000	35,000
• Capital Interest	341,000	347,000
Total Fixed costs	606,000	612,000
Total cost	8,887,000	9,031,000
R/C ratio	2.97	2.60
Profit	17,513,000	14,489,000

The average land area controlled by participating farmers at the research location is 0.39 ha, which means that the average farmer's profit from rice farming using certified seeds per

season is IDR 6,830,070.00/0.39 ha or IDR 1,707,518.00/month. The profit for each growing season when using non-certified seeds is IDR 5,650,710/0.39 ha per growing season or IDR 1,412,678.00/month. From the results of the financial calculation on rice farming, it can be seen that the R/C obtained in rice farming using certified seeds gets an R/C value of 2.97, which means every IDR 1,000,000- invested in rice farming will produce IDR 2,970,000.00, while using non-certified seeds, the R/C value is 2.61, which means that every IDR 1,000,000- invested in rice farming will generate IDR 2,610,000.00. Thus, the level of economic efficiency of the use of certified gogo rice seeds in rainfed rice fields is rated higher than that of using non-certified rice seeds.

4 Conclusions and suggestions

The yield of rice farming using certified seeds is higher than those using non-certified seeds, even though the production costs of non-certified seeds are nominally higher. The profit of rice farming using certified seeds is IDR 17,513,000.00/ha, while those who are non-certified are IDR 14,626,000.00/ha. R/C, the ratio of rice farming using certified seeds is 2.97, while those who use non-certified seeds are 2.61. The government continues to disseminate through various media to encourage certified *gogo* rice seeds, followed by providing source seeds and quality dispersed seeds at the field level through free markets and assistance programs.

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