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Research Article

Feasibility Analysis of Inpari IR Nutri Zinc Rice Seed Farming in Irrigated Paddy Fields in Riau Province

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Abstract.
Rice variety Inpari IR Nutri Zinc is a type of rice that can be used to overcome stunting problems in Indonesian children, so it needs to be produced more. The production of this rice requires information on the financial feasibility of agricultural products so that it is attractive for cultivation on a more massive basis. This activity aims to determine the feasibility of farming the Inpari IR Nutri Zinc rice. A variety which is cultivated using (a) rice transplanter machine (Transplanter), (b) direct paddy planting with rice seeder (Atabela), (c) hand planting rice (Manual), as well as the level of profit from farmers' income in the form of harvested dry grain (HDG), milled dry grain (MDG), and candidate rice seeds. The research was carried out in irrigated rice fields in Bunga Raya Village, Siak Regency, Riau Province by 3 cooperators each in a plot of 1 hectare. Observations were made on plant growth, yield production, production costs, revenues, profits, andrevenue cost ratio (RCR). Farming feasibility analysis is calculated using the RCR formula. The results showed that the plant height ranged from 92.7-99.9 cm and the number of productive tillers was 16-19 stems/clump. Changes in product form from HDG to MDG, and rice seed show increased production costs, revenues, profits, and RCR. The highest revenue (IDR 34,400,000 ha^{-1}) and profit (IDR 17,750,000 ha^{-1}), with a CRC of 2.07, was obtained from the transplanter planting method with the product form of rice seed.

Keywords: Inpari IR Nutri Zinc, revenue cost ratio, production feasibility

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1. Introduction

The development of rice farming in Riau Province is still wide open, both in irrigated rice fields, tidal rice fields, peatlands, and rainfed swamplands. Riau has paddy fields covering an area of 62,689 ha [1], If one hectare of paddy field planting requires 25 kg of seeds, then 1,567,225 kgs of superior rice seeds are needed. Procurement of rice seeds must take into account the number of superior seeds used by the community [2] and community preferences [3]. Procurement of superior seeds has experienced many problems caused by the timing of the seeds being available not being by the planting season, the quality of the seeds not being guaranteed, and the price fluctuations being quite expensive [4].

The rice seed production activity aims to serve farmers in terms of seed procurement so that the scarcity of quality superior seeds at the farmer level can gradually be overcome. To increase rice production in Riau Province, it does not only rely on expanding the area but must also be balanced with technological improvements. The use of superior and quality seeds is a very important technological components in improving the quality and productivity of the production produced [5]. Rice seed production is an activity to produce standard, quality, labeled rice seeds. Good rice seeds must have good physical and physiological qualities and be free from pests and diseases. The rice seeds produced are seed production for planting on agricultural land. The rice seed production process includes several stages, including selecting superior varieties, land preparation, planting seeds, fertilizing, controlling pests and diseases, harvesting, drying, and packaging [6].

The problem that often occurs is that the seeds imported from outside the province are sometimes not of the right type, quantity, and time. As a result of this inaccuracy, many farmers return to using local varieties that have been handed down for generations, so that the level of uniformity is low as well as low productivity and long harvest time. Increasing plant productivity is carried out by engineering the land's carrying capacity and providing quality rice seeds with high productivity. Riau Province can give hope to farmers to obtain new superior varieties (NSV) of rice easily, although up to now it is still not optimal due to limited facilities and infrastructure. This is in line with the research results of Lutz [7] who stated that good cooperation between farmers and supported by adequate infrastructure will create a resilient local food system in an area.

Inpari IR Nutri Zinc is a type of rice NSV that is enriched with a fairly high zinc content. Zinc is an important nutrient for the human body and plants, which plays an important role in the growth and development of body cells [8,9]. The high zinc content in Nutri Zinc rice can increase the zinc content in the rice produced, so the consumption of this rice can help improve human health.

The development of NSV Inpari IR Nutri Zinc seeds supports the stunting alleviation program in Indonesia. Inpari IR Nutri Zinc (Ministry of Agriculture Decree 168/HK.540/C/01/2019/) [9], has many advantages compared to several other varieties in terms of Zn content. Based on descriptive data issued through the Decree of the Minister of Agriculture number 168/HK.540/C/01/2019, the Zn content in this variety is 34.51 ppm while other varieties such as Ciherang contain 24.06 ppm. It is hoped that these advantages will contribute to the success of the government's program in overcoming zinc nutritional deficiencies and minimizing stunting in Indonesia. Apart from causing a decrease in human endurance, productivity, and quality of life, Zn deficiency in the body, Zn deficiency is also a factor in stunting. It is hoped that Inpari IR Nutri Zinc rice seeds can help increase nutritional value while overcoming iron deficiency in society. Apart from being rich in nutrients, this variety also has high productivity, is resistant to WBC, Blas, and Tungro, and has a delicious rice taste [9]. Zinc intake in humans depends on the amount of zinc in the food consumed. Hafeez [10] stated that zinc plays an important role in maintaining a healthy immune system, growth, tissue formation, male sexual maturity, enzyme performance, and helping the body in fighting infections. To accelerate the adoption of technology for using Nutri Zinc rice seeds, the Government's role is highly expected in socializing the advantages of Nutri Zinc rice to all levels of society, so that public knowledge will increase. This is in accordance with the statement by Gershom [11] stated that in accelerating agricultural development, individual knowledge has an important meaning, because knowledge can increase the ability to adopt new technology in the agricultural sector. Komatsuzaki [12] added that the sustainability of agricultural businesses is not only the responsibility of farmers but also government policy.

The use of agricultural machinery such as tractors, tillage machines, transplanters, and harvesting machines can increase production efficiency and reduce production costs [13], but recalculations need to be carried out to ensure the viability of farming in the long term. This research aims to produce NSV Inpari IR Nutri Zinc rice seeds using various planting systems and analysis of farming feasibility in Bunga Raya Village, Siak Regency, Riau Province. The impact of this research is to increase nutritional value as well as overcome nutritional deficiencies in communities in Riau Province and minimize stunting in Indonesia.

2. Methodology

2.1. Time and research site

The research was conducted during the dry season (DS) in 2021 from March to August in the farmer’s paddy fields in Bunga Raya Village, Bunga Raya District, Siak Regency, Riau Province. The geographical position of the research location is between 00^{0}57’226”-00^{0}58’080” N and 102^{0}03’660”-102003’904” S.

2.2. Treatment

The rice production research tested 3 (three) treatment of planting methods, including (1) planting with a rice planting machine called a Transplanter, which uses seeds 14 days after sowing (DAS), (2) planting using the direct seed planting method or Tabela, which uses a direct seed planting tool called Atabela, (3) Planting manually is then termed Manual,which used seeds 18 days after sowing (DAS).

2.3. Research approach

The implementation of this research uses an integrated crop management approach (ICM). The rice seeds used were in new superior varieties (NSV) Inpari IR Nutri Zinc, seed class Fondation Seed (FS). ICM rice technology consists of 9 (nine) components as shown in Table 1. As many as 3 cooperator farmers were involved, each using 1.0 hectares of land. Information about cooperators is presented in Table 2.

2.4. Research implementation

Rice production goes through stages of activities including seeding, tillage, planting, fertilizing, weeding, pest and disease control, roguing, harvesting, and post-harvesting.

2.4.1. Rice seeding

Rice seeding is done in paddy fields that have been tilled and levelled. The seeding technique differs between the rice transplanter method and the manual planting system. For planting using a rice transplanter, seeding uses a plastic mat, also called dapok and

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Table 1: Integrated Crop Management Technology (ICM).

No	ICM components	Information
1	New superior varieties	Inpari IR Nutri Zinc
2	Quality and certified seeds	FS seed class
3	How to plant	Legowo 4:1 with spacing (20 cm x 10 cm) x 40 cm
4	The number of seeds per hole	1-3 stem
5	Balanced fertilization	NPK Phonska 250 kg.ha-1 and Urea 100
6	Control of pests and diseases	Integrated
7	Soil processing	Maximum tillage
8	Water management	Irrigation
9	Harvest and post-harvest handling	Right time

Table 2: Information on seed production activity cooperators in irrigated land.

No	Description	Cooperators		
		Cooperator-1	Cooperator-2	Cooperator-3
1.	Name	Tarmidi	Mantri	Mamnun
2.	Age (years)	46	46	45
3.	Education	High school	Undergraduate	High school
4.	Long Farming (years)	7	7	8
5.	Address	Bunga Raya Village, Bunga Raya Subdistrict	Bunga Raya Village, Bunga Raya Subdistrict	Bunga Raya Village, Bunga Raya Subdistrict

uses paddy field mud with a thickness of 2 cm, while for the manual system, seeding does not need a plastic mat.

Seeds that have been soaked and incubated for 36-48 hours are sown evenly in the nursery, approximately one handful per square meter. After five days, the seedbed is watered one cm high for 2 days and 5 cm the next day. Transplanting is done after the seedlings are 14 days after sowing (DAS) for the rice transplanter method and 18 DAS for the manual system.

2.4.2. Tillage

Land preparation is done twice using a tiller and tractor for perfect tillage. Rotating is done after it rains to facilitate processing. Furthermore, the land is flooded for about a week, and then processed again. Flooding after rotating the soil will speed up the decay of plant residues. The purpose of rotating is not only to clear the land of weeds but also to muddy and level the land.

2.4.3. Planting

The planting system used was Jajar Legowo 4:1 with a spacing (20 cm x 10 cm) x 40 cm. The benefits that can be obtained by farmers using this system include increasing the number of edge plants, clumps of plants on the edges which usually give higher yields (edge crop effect), and provide equal opportunities for each plant to get sunlight, as well as plant grows, better and faster. Good plant growth can increase plant productivity.

2.4.4. Fertilizing

Balanced fertilization with a dose of Phonska NPK fertilizer of 250 $kg.ha^{-1}$ and Urea 100 $kg.ha^{-1}$. The first fertilization was done when the rice was 7 day after planting (DAP), with a dose of Urea 50 $kg.ha^{-1}$ and NPK Phonska 100 $kg.ha^{-1}$. The second follow-up fertilization is given when the rice plants are 21 DAP using Urea fertilizer as much as 50 $kg.ha^{-1}$ and NPK Phonska 100 $kg.ha^{-1}$. The third follow-up fertilization when the rice was 42 DAP used 50 $kg.ha^{-1}$ of NPK Phonska.

2.4.5. Weeding

Weeding of weeds on the plants is done 2 times, when the plants are approximately 15 DAP or before the second fertilization. The second weeding is done when the plants are 30-35 DAP or before the third follow-up fertilization. Weeding is done by pulling weeds and burying them in the soil.

2.4.6. Control of pests and diseases

Pest and disease control is carried out with the concept of Integrated Pest Management (IPM). The IPM concept is carried out to prevent losses or protect plants from pests and diseases in a timely and correct manner. The concept of IPM must be healthy and environmentally friendly, known as the Integrated Pest Management (IPM) system.

2.4.7. Rouging

Roguing is an important seed management practice for maintaining the seed quality and productivity of rice plants [6]. Roguing activities take the form of removing unwanted plants or plant parts, such as plants infected with pests or diseases or those with bad genetic traits [14]. This action is taken to prevent the spread of pests and diseases to healthy plants and to improve the genetic quality of plants that will be used as seeds. Roguing is done manually by picking unwanted plants or plant parts.

2.4.8. Harvest and post harvest

Some of the activities that need to be considered before the harvest process takes place, namely (1) separating the remaining panicles of roughing from the planting area, (2) cleaning the equipment used for harvesting, (3) separating the two rows of plants that are at the very edge of the other plants. This activity is carried out to maintain the purity of the seeds so that they are not mixed with other varieties. Seed processing includes drying, cleaning, weighing, testing seed quality, and packaging.

Harvesting is done after seeing the condition and age of the plants that are suitable for harvesting. Harvesting activities are carried out mechanized using a combine harvester, which is a machine tool rented from the local Agricultural Machinery Service Unit (UPJA/AMSSU). Apart from using mechanization, several local farm workers are also assisted in collecting the grain from the combined machine and transporting the grain to the drying area. After the harvest is collected, then the harvest is weighed and put into sacks.

Drying is done after harvest using a combine harvester. Drying is an effort to dry the grain and clean grain. Drying is a process of reducing the moisture content of a material until it reached the desired moisture content, thus inhibiting the rate of deterioration of the material damage due to biological and chemical activities. Next, the cleaning process is carried out, separating the grain from impurities in the form of pieces of straw, empty grain, and other light foreign matter that will interfere with the seeds/grains when stored. In addition to cleaning the grain to remove hollow grain, dirt, and other foreign matter, it also increases the selling value per unit weight, increases the efficiency of drying and processing product, and will extend the shelf life. Seed candidates are ready for seed testing if their moisture content is at 12%.

After cleaning, the seeds are put into sacks, weighed and neatly arranged in the warehouse. To prevent rats and birds from pests, seed piles are covered with plastic sheeting prior to sampling and packaging.

2.5. Data collection and analysis

Observation of the characteristics of the land used includes irrigation network systems, water sources, and the performance of irrigation networks based on the season. While the data collected for the characteristics of farmers are age, education, experience or length of farming, and skills.

Observation/collection of research data on rice seed production in irrigated land includes data on plant growth, grain production, and production costs. Plant growth includes plant height at 55 (DAP) and the number of productive tillers per clump which is the average of 5 (five) plant clumps taken diagonally. Plant height is measured from the soil surface to the highest part of the plant, expressed in centimeters. While the number of tillers is calculated from the selected clumps and expressed in units of the number of productive tillers per clump.

Grain production is calculated in the form of harvested dry grain (HDG), milled dry grain (MDG), and rice seeds (source seeds). The calculation of HDG production results is the grain production obtained after harvest from farmers' fields with a moisture content of around 25%. MDG is HDG grain that has gone through the drying process and has a moisture content of around 14%. Meanwhile, source seeds are grain yields obtained according to the stages of rice germination.

Data collection for the analysis of the feasibility of farming on 3 (three) yield components (HDG, MDG, and source seeds) includes production costs, labor costs, yields, prices, revenues, profits, and revenue cost ratio (RCR).

Production input costs include the need for seeds, urea fertilizer, Mutiara NPK fertilizer, SP-36 fertilizer, pesticides, rodenticides, and herbicides. Meanwhile, labor costs include land preparation activities, pesticide and herbicide application, nursery development, planting, maintenance, rouging, harvesting, drying, fanning/cleaning, certification and label printing, and packaging.

Acceptance is the multiplication yields for each grain category (HDG, MDG, and source seeds) expressed in kilograms with the selling price stated in unit price per kilogram. Profit is the difference between the value of receipts with the value of production costs. While the feasibility analysis of farming is calculated based on the value of the Revenue Cost Ratio (RCR), namely the ratio between gross income or Total Revenue (TR) and net income or Net Revenue (NR). If the RCR value > 1, then the business is efficient and profitable, whereas if the RCR value = 1 and < 1, then it is inefficient or detrimental [15].

3. Result and Discussion

3.1. Land characteristics

Bunga Raya Village is in Bunga Raya District, which is one of the food storage villages in Riau Province. Bunga Raya District has an irrigation network consisting of primary channels with a width of 8 m, secondary channels with a width of 4 meters, and tertiary channels with a width of 1 m. The primary channel is directly connected to 2 rivers, namely the Buantan River and the Raya River, but in the dry season and there is no rainfall, the available water flow is very insufficient to meet water needs during the growing season. Even though water is available in secondary and tertiary channels, it cannot be channeled to the rice fields, because the elevation of the channels is lower than the rice fields. To meet water needs, farmers must raise water from channels to rice fields using portable pumps.

Farmers in Bunga Raya generally have implemented the recommended cultivation technology. Farmers are familiar with and apply the 4:1 legowo planting system. The benefits that farmers can obtain by using the 4:1 row legowo planting system include increasing the number of edge plants, clumps of plants located on the edge which usually give higher yields (edge crop effect), and providing equal opportunities for each plant to obtain sunlight [16]. Thus, plant growth is better and more simultaneous. Good plant growth can increase plant productivity [16].

3.2. Growth performance of Inpari IR Nutri Zinc Rice in various planting systems

The growth performance of Inpari IR Nutri Zinc rice in the vegetative phase is quite good, although there are still pest attacks in the form of stem borers with symptoms of white, empty panicles and caterpillars at the base of the panicle stems with light intensity. Control has been carried out by spraying the insecticides Dimahipo and Chlorfenapir.

In the generative phase, the pests that appear are grasshoppers, rats and birds with a low attack intensity that has not yet reached the threshold. This pest control is carried out using the principle of integrated pest control (IPM) [17].

Apart from observing pest attacks and plant diseases, observations were also made on maximum plant height growth, number of productive tillers, and harvested dry grain (HDG) production (Table 3). Visually, the plant growth conditions on the land look good, with plant heights ranging from 92.7 to 99.9 cm. In line with the research results of Suparwoto and Waluyo [18], the average height of Inpari IR Nutri Zinc rice plants is 92 cm and the number of productive tillers ranges from 16.4-18.8 stems/clump. According to Sution [19], plant height can influence the length of the panicle and the level of lodging which results in a decrease in grain yield. New Superior Varieties (NSV) Inpari IR Nutri Zinc plant height includes short stem criteria and is very suitable for development to reduce the level of plant lodging [20].

Table 3: Average plant height, number of productive tillers, and production results in the form of HDG, MDG, and Seeds of NSV Inpari IR Nutri Zinc.

Planting System	**Plant height (cm)**	**Number of productive tillers (stems)**	**HDG (kg)**	**MDG (kg)**	**Weight of Seed**
Transplanter	99,9 ± 9,5	17 ± 5	5.070	4.600	4.300
Atabela	113,7 ± 5,5	19 ± 4	5.100	4.696	4.200
Manual	92,7 ± 3,8	16 ± 2	4.820	4.400	4.000

The number of productive seedlings for NSV Inpari IR Nutri Zinc rice per clump is around 16-19 stems. The number of productive tillers supports high grain production, however the number of tillers is influenced by hereditary factors and the planting environment. The production results of Inpari IR Nutri Zinc respectively in Harvested Dry Grain (HDG), Milled Dry Grain (MDG) and prospective seeds range from 4.8-5.1 tonnes/ha; 4.4-4.7 tonnes/ha; and 4-4.3 tonnes/ha. The productivity of NSV Inpari IR Nutri Zinc is still very possible to be increased, because according to the Agricultural Research and Development Agency [9], the potential yield of Inpari IR Nutri Zinc in the description is 9.9 tonnes MDG/ha.

3.3. Feasibility Analysis of Inpari IR Nutri Zinc Rice Farming in various cropping systems

The success of rice farming can be seen from the farming feasibility figures. A higher farming feasibility figure means that the farming business is increasingly providing profits for farming actors and is becoming more feasible to run. There are differences in the costs of feasibility analysis for NSV Inpari IR Nutri Zinc rice farming using a transplanting system using transplanters, direct seed planting using Atabela, and manual transplanting (Table 4).

Table 4: Feasibility analysis of NSV Inpari IR Nutri Zinc rice farming using Transplanter, Atabela, and Manual.

No	Description	Selling Value (IDR.)		
		Transplanter	Atabela	Manual
	Production Costs:			
A	1. Seed	300,000	300,000	300,000
	2. Urea	320,000	320,000	320,000
	3. NPK Mutiara	1,200,000	1,200,000	1,200,000
	4. SP36	480,000	480,000	480,000
	5. Pesticide	1,500,000	1,500,000	1,500,000
	6. Herbicide	1,000,000	1,000,000	1,000,000
	Amount	4,800,000	4,800,000	4,800,000
B	Labor costs:			
	1. Land processing	1,300,000	1,300,000	1,300
	2. Pesticides and herbicides	300,000	300,000	300
	3. Nursery	100,000	100,000	100
	4. Planting:			
	- Transplanter	1,300,000		
	- Manual			1,500,000
	- Atabela		600,000	
	5. Maintenance	1,800,000	1,800,000	1,800,000
	6. Roguing			
	7. Harvest	2,250,000	2,250,000	2,250,000
	8. Drying	7,050,000	6,350,000	7,250,000
	Total (A + B)	11,850,000	11,150,000	12,050,000
C	Results (kg/Ha)	5,070	5,100	4,800
	Price (IDR/kg)	4,200	4,200	4,200
	Reception	21,294,000	21,420,000	20,244,000
	Profit	9,444,000	10,270,000	8,194,000
	Revenue cost ratio (RCR)	1.80	1.92	1.68

The planting costs required for the transplanting system using a transplanter are IDR. 1,300,000/ha, the cost of planting seeds directly using Atabela is IDR. 600,000/ha; and manual transplanting costs of IDR 1,500,000/ha (Table 4). The planting system using Atabela is more efficient in the use of labor and time, because it does not go through the stages of seeding, removing seeds and planting seeds. According to Indas [21], the tabela system is easy to implement and does not require a lot of labor. Meanwhile, research results Firdaus & Adri [22], mechanization in the rice seed breeding business saves production costs of IDR 400,000/ha/planting season, so it really helps farmers in reducing the scarcity of labor, both labor for land processing, planting, harvesting and post-harvest.

The use of machine tools aims to increase efficiency and reduce farmers' labor costs, in accordance with the opinion of Sulistianingsih [23], apart from efficiency and reducing labor costs, machine tools aim to increase effectiveness, productivity and quality of results. The results of the feasibility analysis for rice farming of the Inpari IR Nutri Zinc variety in the Transplanter, Atabela and Manual planting systems are equally profitable, because the RCR value is >1. The greater the RCR value, the greater the income obtained by farmers, meaning that this farming business is worth developing because it can provide benefits to farmers [23].

3.4. Feasibility analysis of Inpari IR Nutri Zinc rice farming in HDG, MDG, and Seeds in various planting systems

Analysis of the feasibility of Inpari IR Nutri Zinc rice farming in the form of harvested dry grain (HDG), milled dry grain (MDG), and Seeds is presented in Table 5. Additional costs incurred from HDG to MDG for the drying process amount to Rp. Rp. 1,500,000/ha. HDG results become seeds, an additional fee of IDR is required. 3,300,000/ha, which is used for roguing, drying, fanning, certification costs and packaging. Along with the increase in costs, the selling value of the harvest from HDG to MDG, or seeds also increases (Table 5).

Grain production NSV Inpari IR Nutri Zinc rice farming using a transplanter planting system in the form of HDG is 5.07 t/ha, or MDG 4.6 t/ha, or 4.3 t/ha in the form of seeds. By adding costs in the process of HDG becoming MDG or becoming seeds, the selling value of grain increases, namely Rp. 4,200,000/ha; Rp. 5,800,000/ha, and Rp. 8,000,000/ha. The consecutive profit level is IDR. 9,444,000 (RCR 1.80); Rp. 13,330,000 (RCR 2.00), and Rp. 17,750,000 (RCR 2.07). The amount of production in a farming business per unit area of land does not necessarily guarantee high income in that farming business [21].

Table 5: Level of profit from farmers' income in the form of harvested dry grain (GKP), milled dry grain (GKG), and prospective seeds in various planting systems.

No	Description	Planting System		
		Transplanter	Atabela	Manual
	Production Cost (IDR)			
1	HDG	4,800,000	4,800,000	4,800,000
	MDG	4,800,000	4,800,000	4,800,000
	Seeds	4,800,000	4,800,000	4,800,000
	Labor costs (IDR)			
2	HDG	7,050,000	6,350,000	7,250,000
	MDG	8,550,000	7,850,000	8,750,000
	Seeds	11,850,000	11,150,000	12,050,000
	Production Yield (kg/Ha)			
3	HDG	5,070	5,100	4,820
	MDG	4,600	4,696	4,400
	Seeds	4,300	4,200	4,000
	Price (Rp/kg)			
4	HDG	4,200	4,200	4,200
	MDG	5,800	5,800	5,800
	Seeds	8,000	8,000	8,000
	Revenue (Rp.)			
5	HDG	21,294,000	21,420,000	20,244,000
	MDG	26,680,000	27,236,800	25,520,000
	Seeds	34,400,000	33,600,000	32,000,000
	Profit (Rp.)			
6	HDG	9,444,000	10,270,000	8,194,000
	MDG	13,330,000	14,586,800	11,970,000
	Seeds	17,750,000	17,650,000	15,150,000
	Revenue cost ratio (RCR)			
7	HDG	1.80	1.92	1.68
	MDG	2.00	2.15	1.88
	Seeds	2.07	2.11	1.90

Analysis of the feasibility of NSV Inpari IR Nutri Zinc rice farming in the direct seed planting system (Tabela) with direct seed planting equipment (Atabela), in the form of HDG of 5.1 t/ha or MDG of 4.69 t/ha, or 4.2 t/ha in the form of seeds, providing a consecutive profit of Rp. 10,270,000 (RCR 1.92); Rp. 14,586,800 (RCR 2.15), and Rp. 17,650,000 (RCR 2.11).

Grain production of NSV Inpari IR Nutri Zinc rice farming using a manual transplanting system in the form of HDG is 4.82 t/ha, or MDG 4.40 t/ha, or 4.0 t/ha in the form of seeds, providing a consecutive profit of Rp. 8,194,000 (RCR 1.68); Rp. 11,970,000 (RCR 1.88), and Rp. 15,150,000 (RCR 1.90). Additional costs are required in processing harvested dry grain (HDG) into milled dry grain (MDG), or into seeds. This is in accordance with the statement by Jayne [24] who stated that additional capital, technology and farmer knowledge would be needed to change one product to another and Villanoa [25] added that one way to ensure the sustainability of a product is to have good market access and a price policy that does not harm farmers.

4. Conclusion

There are differences in the yield of rice farming products of the Inpari IR Nutri Zinc variety that are cultivated in irrigated rice fields from HDG to MDG, and rice seeds in each planting method increase production costs, income, profits and RCR.

The highest increase in income and profit was generated from rice farming in the form of rice seed products which were cultivated using the planting method using a rice transplanter machine, resulting in an income of IDR 34,440,000 ha^{-1} and a profit of IDR 17,750,000 ha^{-1} with an RCR of 2.07.

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