The Effect of Rice Field Management with Rotation The Impact of Rice and Secondary Crops on Farmers' Income in Nagori Pematang Gajing

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Abstract.

This study aims to (1) determine the intensity index of rice and carp farming (IIP). (2) determine the income of rice and carp farmers in Nagori Pematang Gajing, Gunung Malela District. (3) determine the effect of cropping pattern index, fish production costs, paddy production costs, and farmer experience on farm income.This research was conducted in Pematang Gajing Village, Gunung Malela District, Simalungun Regency, North Sumatra Province. The research method used in this study was quantitative descriptive. The sampling method used was purposive sampling of 30 people. Data collection techniques used were observation, interviews, documentation, and questionnaires. Data analysis techniques used were planting intensity index analysis, income analysis, and multiple linear regression analysis. The results of the study show that (1). Rice farming and carp farming are carried out by farmers with an average age of 50 years. The average level of education is at the junior high school level. The average farmer's experience is 21 years. The average number of farmer family members is 4 people. The results of this study indicate that the largest rice production and carp farming are from rice production with an average R/C value of 3. While from carp farming with an average R/C value of 1.From the results of the determination test analysis (R2) it can be seen that variables X1, X2, X3, X4 can explain 60.4%, it is concluded that the difference of 39.6 is influenced by factors not included in the study. From the results of the simultaneous test analysis (F test) X1, X2, X3, X4 have a significant effect on (Y). with a sig value of 0.00 <0.05. From the results of the partial test analysis (t test) X1, X3, X4 have a significant effect on (Y), while X2 is not significant on the increase in (Y).

Keywords: *Crop Rotatio; Rice-Fish and Farmer Income.*

I. INTRODUCTION

Indonesia is an agrarian country, with the majority of its population working in the agricultural sector. This sector plays a crucial role in contributing to Indonesia's economic development, both directly and indirectly. The agricultural sector in Indonesia is divided into five subsectors: food crops, plantations, livestock, horticulture, and fisheries. One subsector whose availability is still being pursued is the food crops subsector, which is a key determinant of the well-being of the Indonesian population.(Barros 1989).Wetland rice is a vital commodity with economic value because it is the staple food of the Indonesian population. Rice farmers are the key players in ensuring rice availability in Indonesia. Through them, the rice needs of all Indonesians, including those needed for raw materials for the food industry, can be met. However, farmers also face various challenges, many of which often result in significant losses.(Rorong, Tumewu, and Pamandungan 2024). Managing rice fields with rice and secondary crop rotations, as well as raising carp, can have a positive impact on farmers' income. Several studies related to the management of rice and secondary crop rotation patterns have shown that this rotation system can increase productivity and farmer income economically and ecologically. Land use change is a process in which a land area experiences an increase in certain types of use from one time period to the next, accompanied by a decrease in other types of land use.

This also includes changes in the function of a land area from one period to another.(Lamsyariah, Dedi Hermon 2024).North Sumatra is a province with a significant food production capacity. One of the key food commodities produced in North Sumatra is lowland rice. The largest area of lowland rice in North Sumatra, covering 894,150.10 hectares and producing 4,669,777.50 tons in 2018, resulted in a high productivity rate of 54.09 kWh/ha. The lowest was in 2019, with a land area of 671,991.8 hectares and a production of 2,074,855.91 tons, resulting in a lower productivity rate of 49.13 kWh/ha.(Padi et al. 2024).One of the villages in the sub-district Mount Malela, RegencySimalungun, ProvinceNorth Sumatra,Indonesia namely Pematang Gajing Village,It also produces paddy rice. Besides paddy rice, this

village also produces other agricultural commodities such as palm oil, rubber, and, most popularly, langsat fruit.Specifically, in Pematang Gajing Village, rice field management with a rice and secondary crop rotation pattern, along with carp farming, has the potential to increase farmers' income by optimally utilizing planting time, reducing idle land, and increasing the economic value of fish farming in the paddy fields. In short, rice field management with rice and secondary crop rotation and carp farming contributes significantly to increasing farmers' income through business diversification and increased land productivity.

Based on the explanation above, the author conducted research with the following problem formulation:

1. How is the Rice and Goldfish Farming Intensity Index (IIP)?
2. How much do rice farmers and carp farmers earn in Pematang Gajing Village?, Gunung Malela District.
3. How do the cropping pattern index, fish production costs, paddy production costs and farmer experience influence farming business income?

The objectives of this research are:

1. To find out the Rice and Goldfish Farming Intensity Index (IIP)
2. To find out the income of rice farmers and carp farmers in Nagori Pematang Gajing, Gunung Malela District.
3. To determine the influence of cropping pattern index, fish production costs, paddy production costs and farmer experience on farming income.

Benefits of researchAs a requirement for the author to complete the final assignment in obtaining a Bachelor of Agriculture degree from Simalungun University, Pematang Siantar and as evaluation material or theoretical knowledge of the influence of rice field management with rice and secondary crop rotation and goldfish farming on farmer's income and can be useful as comparative material for further research.

Crop Rotation Concept

Crop rotation is an agricultural practice that involves alternating the types of crops grown on the same plot of land from season to season. Crop rotation can reduce pest and disease attacks, improve soil fertility, and maximize resource use.(Halawa et al., 2024). Rotation is often implemented by farmers to reduce land erosion, increase water and nutrient retention, and reduce the need for chemical fertilizers through the planting of legumes, control weeds, and improve soil structure. The water content of irrigated rice fields will reach 20–60% during rice cultivation. Soil particles begin to settle, and some water is absorbed by plant roots. Consequently, cohesion increases and the soil becomes compacted. Flooding begins to cease as the rice matures. The soil begins to dry out, changing from a muddy structure to a paste and compacting into a massive structure. During the crop maintenance phase, irrigation water is provided periodically, through flooding, then retained in plots and allowed to disappear only through evapotranspiration and infiltration. This results in alternating wet and dry conditions.(Suprihatin and Amirullah, 2020).

Fish Cultivation in Rice Fields

Aquaculture plays a crucial role in the sustainability of fish resources. The development of aquaculture is inseparable from the cultivation of superior species. Seeding is the starting point in aquaculture development efforts, as it is one of the keys to success.(Afriani 2016).Freshwater fish farming is currently advancing, driven by improved infrastructure, including fishing equipment, food and medicine, improved cultivation techniques, and improved marketing. The scope of cultivation activities includes controlling growth and mortality.(Koniyo 2020)One of the freshwater fish species most sought after by the public is carp. Carp is a popular freshwater fish commodity, leading to high demand. This high demand can influence carp production, which in turn significantly impacts farmers' income. Carp is a popular fish for consumption, alongside tilapia and mujair. Carp has high economic value due to its high demand, especially in local markets. Carp has soft, nutritious meat, high economic potential, and is easy to cultivate. The growing demand for carp can be an opportunity to increase production and farmer income. (Sudarta, 2022).
So that the community's income reflects the economic progress of a community through two factors, namely internal factors and external factors:

1 Internal Factors

Internal factors are elements that originate within an entity (individual, organization, system, etc.) and influence its performance, behavior, or characteristics. These factors are internal and can be controlled or modified by the entity.

- Production costs aretotal expenditure incurred by farmers for all activities involved in producing rice and fish in this rotation system.These costs cover all resources used, from land preparation to harvesting and marketing.
- The land area isthe size of the land area (usually expressed in hectares or square meters) used by farmers to grow rice and raise fish alternately or integrated in one agricultural cycle. How land area affects farmer income in a rice-fish rotation system. Land area has a significant influence on the potential income of farmers in a rice-fish rotation system.
- Workforce on**the quantity and quality of human resources involved in all the activities required to produce rice and fish in the rotation system.**This includes both labor employed by the farmers themselves (family labor) and labor from outside (wage workers). How does labor affect farmer income in a rice-fish rotation system? Labor is a crucial factor of production and directly impacts farmer income.

2 External Factors

External factors areany condition, event, or element that is beyond the direct control of the farmer himself, but can significantly affect the way they manage their land, their production yields, and ultimately, the income they earn.

- The selling price of rice and fish isthe monetary value received by farmers for each unit of product (rice and fish) sold in the market or to consumers**.**Selling price is a crucial factor that directly affects farmers' income. (market price)
- Good and well-targeted government policies can create a conducive environment for farmers to increase productivity, reduce production costs, access better markets, and manage risks. This ultimately improves farmers' incomes and well-being. Conversely, poor or ineffective government policies can hinder agricultural development, harm farmers, and exacerbate poverty in rural areas.

Previous Research

According to Ahmadian, Yustiati and Yuli Andriani (2021) with a study entitled Productivity of Mina Padi Cultivation System to Increase Food Security in Indonesia. With the objectives of the research, namely: (1) enabling farmers to maximize agricultural resources and therefore diversify crops that generate additional income; and, (2) providing fish protein for landlocked areas that do not have fish sources from the sea. In general, rice fish technology is developed by farmers themselves. Rice fish cultivation that is widely practiced in the irrigation areas of West Java is: minapadi, penyelang and secondary crops. local wisdom of a region. The types of fish cultivated in the mina padi system, especially in the West Java area, are Cyprinus carpio, Oreochromis mossambicus, Oreochromis niloticus, Osteochilus vittatus.According to Widyantoro (2018) with a study entitled Rice-Fish Farming Business Opportunities to Increase Additional Farmer Income. With the aim of the study is to determine the income, feasibility and reasons for farmers to undertake rice-fish farming. This study was conducted in Subang Regency. Survey methods with direct interviews with respondents were used for data collection. Farming and feasibility analysis were used in this study. The results showed that rice-fish farming is more efficient in the use of rice seeds, fertilizers, and pesticide costs compared to rice monoculture but not so in the use of labor. Rice-fish farming provides additional rice yields equivalent to fish between 1,394-1,539 kg/ha and increases total rice yields equivalent to rice between 23.72-25.76% compared to rice monoculture. In addition, rice-fish farming income is also higher by 25.20-30.14% and is more feasible when compared to rice monoculture.

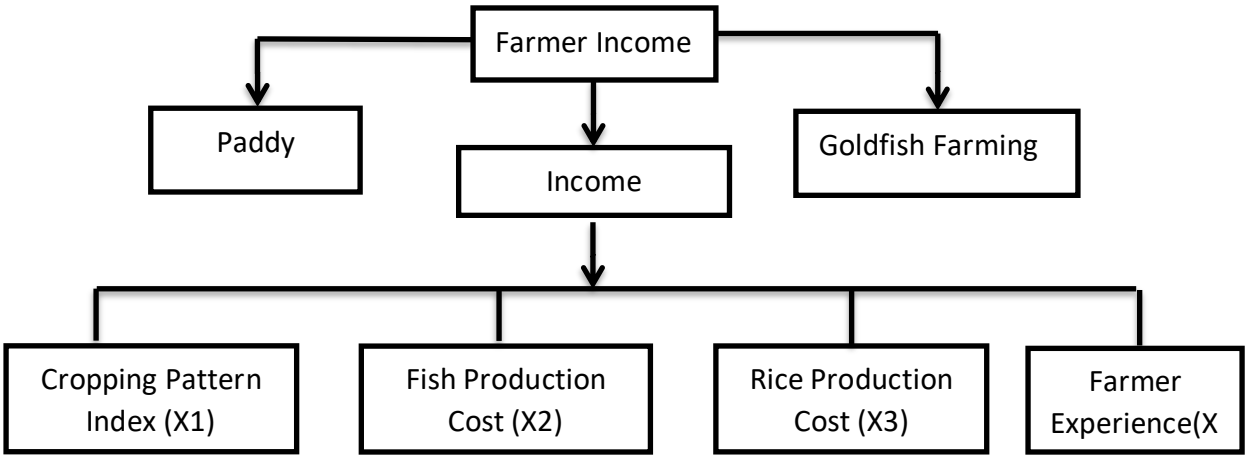
The reasons for being more profitable and joining groups are the basis for farmers to undertake rice-fish farming.According to Mahmud, Marina, Sumantri (2023) with a study entitled analysis of rice mina farming income (Case Study on the Mina Karya Bakti Cibodas Farmer Group in Kaliaren Village, Cilimus District, Kuningan Regency). With the aim of the study, this study aims to determine the costs, revenues and

income of rice mina in the Tani Mina Karya Bakti Cibodas farmer group, Kaliaren village, Cilimus district, Kuningan Regency. The determination of the research location was carried out intentionally (purposive) with the consideration that the location is one of the rice mina farming businesses. This study aims to determine the income from rice mina farming. The method used to analyze the data is a quantitative descriptive method, namely analyzing questionnaire answers based on the questions that have been asked and also the data ± data needed during the study using the cost and profit analysis formula. Meanwhile, to calculate Business Feasibility, the formula used is the Revenue Cost Ratio (R / C). The results of the study show that based on the research conducted, it can be concluded that the total cost of rice mina farming activities in Kaliaren village is Rp. 330,167,000 or Rp. 66,033,400/ha. Meanwhile, the income earned by rice-fish farmers is Rp. 240,639,000 or Rp. 48,127,800/ha. The R/C value of rice-fish farming in the Karya Bakti Cibodas Fish Farmers Group is 4.48 per season.According to Mahendra, Zuriat, Alaudin.et al (2020).

With the title of the independent research 74 "(minapadi together with local fish 7 species and 4 legowo). With the aim of the research is to increase farmer's income with high rice productivity and increase local fish production. Activities were carried out for 6 months in Pante Ceureumen District, West Aceh. The results observed included rice production and fish production in the minapadi system. The production of legowo 2: 1 planted rice had a significant effect on the parameters of rice production results, namely (16.17 kg / ha). Meanwhile, the production of cultivated fish (7 species) namely serukan fish, bileh fish, tilapia, carp, patin fish, catfish and giant prawns. The 7 species were able to develop and be cultivated well.According to Mustafa Ginting and Lilik Agustina Harahap (2022). With the title of the research analysis of farming income using rice-corn rotation patterns in paddy fields (Case Study: In Nagori Baliran Siborna, Panei District, Simalungun Regency. This study aims: (1) To determine the relationship between the Cropping Pattern Index and farming income using rice-corn rotation patterns in Nagori Baliran Siborna, Panei District, Simalungun Regency (2) To determine the feasibility of farming using rice-corn rotation patterns in Nagori Baliran Siborna, Panei District, Simalungun Regency.

This type of research is a research analysis of rice-corn rotation pattern income. The population of this study was all rice-corn farmers in Nagori Baliran Siborna, Panei District, Simalungun Regency, totaling 20 farmers. The data collection technique used interview and questionnaire techniques for farmers. The data analysis technique used was SPSS through a significant test correlation test (t-test), and analysis of farming feasibility. The results of this study indicate that income The rice-corn crop rotation pattern farming in Nagori Baliran Siborna, Panei District, Simalungun Regency can be said to be increasing and feasible to be developed and profitable for farmers. The R/C results for Rice are 2.71, the R/C for Corn are 2.76, and the R/C for the Rice-Corn rotation pattern can be seen to be 2.74, which means that the R/C is >2, which can be explained that the farming is feasible to be developed and profitable. The Pearson correlation result is -0.976, a negative value indicates the direction of the relationship, which means that the higher the income value, the lower the cropping pattern index with a large relationship of 0.976 or very strong. The significance result shows a Sig value smaller than 0.05 (Sig <0.05) with a value of 0.000, which means there is a relationship/correlation between the cropping pattern index and the income of the rice-corn rotation pattern.

Framework



A hypothesis is an assumption based on theory or initial observations that are most likely and whose truth is still being tested through research. The relationship between the variables above has a hypothesis.

1. It is suspected that the high cropping pattern index and the income of rice and fish farmers are very high.
2. It is suspected that the Cropping Pattern Index, Fish Production Costs, Rice Production Costs, and Farmer Experience can influence farmers' income levels.

II. METHODS

Type, Place and Time of Research

This research is a quantitative descriptive study. It aims to explain the causal relationship between the independent variable (rice field management with rice crop rotation and carp farming) and the dependent variable (farmer income). It also aims to understand how the rice-fish rotation process affects income.

Place and Time of Research

This research was conducted in Pematang Gajing Village, Gunung Malela District, Simalungun Regency. The location was selected based on the assumption that there are farmers in this area who implement a rice and fish crop rotation system, as well as farmers who use conventional methods (rice monoculture), and farmers who also implement this cropping pattern. This research period was conducted from MT 2024 to MT 2024/2025, covering the preparation stage, data collection, data analysis, and report preparation. This time span must cover at least one relevant rice harvest cycle or fish growth cycle to obtain representative data.

Population and Sample

The population in this study was all farmers in Pematang Gajing Village who owned rice fields and worked as farmers. The population criteria were farming businesses that implemented a rotational cropping pattern with rice paddies for at least one season and fish farming for at least one season within the period (MT 2024 to MT 2024/2025). This included any other crops (nutmeg) planted during the period.Sampling was conducted using purposive sampling (sample selection based on specific criteria). A sample of 30 respondents was taken using the snowball sampling method, a non-probability sampling technique that uses referrals from respondents to recruit new samples.

Method of collecting data

Primary Data

Primary data is data obtained through direct interviews with respondents using a questionnaire (list of questions) that has been systematically compiled, and field visits.(Akbar, 2017). Primary data will be the main focus of this research because this data will provide more specific information. Primary data is data obtained directly from the research subjects.

Secondary Data

Secondary data obtained through literature studies, the Central Bureau of Statistics Office, Agricultural Extension Center.(Akbar, 2017)This includes information collected by others, such as documents, books, articles, and census data. Secondary data is often used to complement and support primary data in research.

Interview. Interviews with farmers were conducted to gather information on land management practices, crop rotation, and incomes generated by the farmers in this study. Factors such as the interview situation may influence the success of data collection in this study.

Observation. Directly observing farmers' agricultural practices, including land preparation techniques and crop rotation, can provide more accurate data on field conditions.

Questionnaire.A questionnaire is a data collection tool consisting of a series of written questions designed to obtain information from respondents in a study. Questionnaires are often used in research to collect quantitative data in a systematic and structured manner.

Data Analysis Methods

The data analysis methods used in this study were quantitative data analysis and data obtained from questionnaires. The data collected in this study were analyzed to find useful information, draw conclusions, and support systematic decision-making. The analysis used in this study was as follows:

Cropping Pattern Intensity Index (IIP)

To calculate the cropping pattern index, it's important to understand some basic concepts and the steps involved. The cropping pattern index (IP) indicates the frequency of planting a crop within a year on the same plot of land. The general steps for calculating the cropping pattern index are:

- Identify Land Area: Determine the area of land to be used for planting. For example, if you have 1 hectare of land.
- Determine the Type of Plant and Planting Season: Note the type of plant to be planted and how many times the plant can be planted in a year. For example, rice can be planted twice a year.
- Calculate Harvested Area: Calculate the harvested area for each crop planted in a year. For example, if you plant rice twice on a 1-hectare plot, the harvested area is 1 hectare x 2 = 2 hectares.
- Calculate the Cropping Pattern Index: Use the following formula to calculate the cropping pattern index:

Interpretation of Results: A higher cropping pattern index value indicates that the land is used more intensively for agriculture. Conversely, a lower value indicates less intensive land use.Cropping patterns are the most important aspect of cropping planning. The purpose of providing a cropping pattern is to regulate the timing, location, type, and area of crops in an irrigated area. The goal of a cropping pattern is to utilize irrigation water supplies as efficiently and effectively as possible, ensuring optimal crop growth. Therefore, cropping patterns are designed based on water availability and farmer demand.

Farm Income

Farm production costs include all expenses necessary to produce agricultural products. These include everything from seeds and fertilizers to harvesting and post-harvest costs. Farm income is a method used to calculate and collect the income earned by farmers from their farming activities. Farm income is calculated using the following formula:

Revenue = Total Revenue - Cost T

Where:

Total Revenue (TR):

TR = PXQ

(P = price per unit, Q = quantity produced)

Total Cost (TC):

Total costs consist of: Land use, production facilities, labor, and equipment depreciation.

TC= Variable costs + Fixed costs

Net Income (Net Income, NI):

NI = TR-TC

Descriptive analysis

Descriptive analysis is a statistical method that aims to provide an overview or description of the research subject based on the collected data. In this context, descriptive analysis helps researchers understand the income characteristics of farmers who implement various rice field cultivation and crop rotation patterns. Therefore, descriptive analysis techniques are crucial in this research to provide a better understanding of the impact of the applied agricultural practices.

For hypothesis 1, a one-sample t-test analysis was used with the equation

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

Information :

$\bar{x}$= Sample mean

μ= Hypothesized population mean

s= Sample standard deviation
n = Sample size
For hypothesis 2, multiple linear regression is used with the equation

$$Y = a + b1\ X1 + b2X2 + b3X3 + b4X4 + \square$$

Where:
Y = Incomefarming / year (Rp)
a = Constant
X_1 =Cropping pattern index (%)
X2 = Fish production costs (Rp)
X3 =Rice production costs (Rp)
X4 = Farmer experience (years)
b1, b2, b3, b4 = Regression coefficient
□ =*Error Term*(error)

The regression equation is tested for significance by calculating the hypothesis test carried out as follows:

Coefficient of Determination (R2)

A statistical measure used to evaluate how well a regression model can explain variation in a dependent variable based on the independent variables. The coefficient of determination is defined as the proportion of variation in the dependent variable (Y) that can be explained by the independent variables (X) in the regression model. The R2 value ranges from 0 to 1. This coefficient function provides information about the model's fit. The closer the R2 value is to 1, the better the model is at explaining variation in the dependent variable. Conversely, a value closer to 0 indicates that the model is unable to explain the variation well.F Test (Simultaneous) This statistical F test is conducted to determine the extent of the influence of independent variables simultaneously on the dependent variable. This test is conducted by observing if the sig value < 0.05, then there is an influence between the independent variable and the dependent variable. Partial Test (t) To find out whether the independent variable partially gives significant results to the dependent variable, a t test is carried out. The basis for taking the t test in regression analysis is by comparing t sig with a significance level of 0.05. If t sig < 0.05, then H0 is rejected and Ha is accepted, meaning the independent variable gives significant results to the dependent variable. Conversely, if t sig > 0.05, then H0 is accepted and Ha is rejected, meaning the independent variable does not give significant results to the dependent variable. If t is calculated > t table with dk = n-2 and α 0.05, then H0 is rejected. Conversely, Ha is accepted.

H0 = H_1,H2,H3 = 0, each independent variable does not have a significant influence on the dependent variable.
H0 = H_1,H2,H3 ≠ 0, each independent variable has a significant influence on the dependent variable.

Operational Definition and Limitations

Operational Definition

Rice field cultivation with rice crop rotation and fish farming refers to an agricultural practice that integrates rice cultivation with fish farming within a single farming system. This system aims to improve resource efficiency, reduce the risk of crop failure, and increase farmer income. In this context, farmer income is measured as the total revenue from rice and fish sales minus the total production costs incurred.

Operational Limitations

1. Research Variables:
   a. Dependent Variable: Farmer's income measured in monetary units (e.g. Rupiah per year).
   b. Independent Variables: Land cultivation methods (rotation of rice crops with fish farming) and other factors such as production costs, selling prices, and harvest yields.
2. Scope of Research:
   The research location is limited to areas that implement the rice-fish farming system.
   a. The research time covers a certain period, for example one planting year, to obtain relevant data.

3. Methodology:
   a. Data collection was carried out through surveys and direct interviews with farmers.
   b. The analysis was conducted using descriptive statistical and regression methods to understand the relationship between variables.
4. CriteriaEfficiency:
   a. Efficiency is measured based on the comparison between production costs and the results obtained from the two types of rice-fish farming.

III. RESULT AND DISCUSSION

Overview of the Research Area

Nagori Pematang Gajing is one of the villages in Dolok Malela District, Simalngun Regency, North Sumatra Province, which is located at 2° 57′ 0.1″ N North Latitude and 99° 2′ 50.97″ E East Longitude, The temperature in Nagori Pematang Gajing is 24-30° C and has a tropical climate. Nagori Pematang Gajing has the following boundaries:

- To the north it borders on Bandar Siantar Village
- To the south it borders Nagori Margo Mulyo,
- To the west it borders on Nagori Dolok Malela and Nagori Silulu
- To the east it borders on Nagori Bangun

The area of Pematang Gajing Village is 235 hectares,29 ha divided into 4 (Four) Forests, where the forest area in Pematang Gajing can be seen in table 1.

Table1. Area of the Subdistrict inVillageGajing Embankment in 2025

No.	Ward	Area (Ha)
1	Huta I	54.82
2	Huta II	95.62
3	Huta III	68.09
4	Huta IV	106.76
	Amount	235.29

Source: Pangulu Nagori officeGajing Embankment 2025

Demographic Conditions of Pematang Gajing Village

Population Number and Growth

Population size and growth are very important to know for the growth of a region, because this aspect is related to the provision of socio-economic services and infrastructure, and can be used to estimate current and future needs. Population development in Nagori Pematang Gajing for the last three (3) years is shown in Table 2.

Table 2. Population Growth Data According toGender inPematang Gajing Village in 2023 - 2025

No.	Year		
	2023/Soul	2024/Soul	2025/Soul
Man	876	903	1,536
Woman	1,052	1,501	2,640
Total	1,928	1,404	4,176

Source: Pangulu Nagori officeGajing Embankment 2025

Based on the age structure of the population in Nagori Pematang Gajing, the ages are diverse, as can be seen in Table 3.

Table 3. Population Data Based on RangeAgePematang Gajing Barat Village in 2025

Age	Amount	Presentation
0 – 24	955	22.87%
25 – 34	836	20.02%
35 – 44	933	22.34%
45 – 55	715	17.12%
55 >	737	17.65%
Amount	4,176	**100.00%**

Source: Pangulu Nagori officeGajing Embankment 2025

Description of Research Respondents

The respondent descriptions in this study concern the impact of rice field cultivation on rice crop rotation with carp farming and calculating farmer income in Nagori Pematang Gajing. Therefore, to obtain data, the researcher distributed 30 questionnaires, consisting of rice farmers and carp farmers. After obtaining the completed questionnaires, the first step was to group the respondents based on their personal identity, which included gender, age, education, and number of dependents.

a) Gender

Table 4. Respondent Gender Characteristics

Gender	Number (of Souls)
Man	19
Woman	11
Total	30

Source: Processed Primary Data2025

Based on table 3, it can be seen that the respondents used in this study were male and female, where the largest number of respondents were male.

b) Farmer Age

Age is a crucial factor influencing farmer productivity in farming activities, including rice cultivation. This age factor is closely related to the farmer's physical and psychological condition, as well as their ability to respond to various changes in the agricultural sector.

Table 5. Respondents' Age Characteristics

Age	Number (of Souls)
31-40	6
41-50	16
61>	8
Total	30

Source: Processed Primary Data2025

c) Level of education

Education is a crucial factor in agricultural development, particularly in improving the quality of human resources among farmers. Education plays a crucial role in shaping farmers' mindsets, attitudes, and skills in managing farms effectively and efficiently.

Table 6. Characteristics of Respondents' Education Level

Education (Year)	Number (of Souls)
6	10
9	15
12	5
Total	30

Source: Processed Primary Data2025

d) Number of Respondents' Dependents

Table 7. Respondents' Dependents' Characteristics

Liability (Soul)	Number (of Souls)
2	10
3	11
4	5
5	2
6	2
Total	30

Source: Processed Primary Data2025

AnalysisCrop IndexRice and Goldfish Farming (IP)

Cropping patterns are the most important aspect of cropping planning. The purpose of providing a cropping pattern is to regulate the timing, location, type, and area of crops in an irrigated area. The goal of a cropping pattern is to utilize irrigation water supplies as efficiently and effectively as possible, ensuring optimal crop growth. Therefore, cropping patterns are developed based on water availability and farmer demand.

Rice Farming and Goldfish Farming System

The procedures for implementing the goldfish cultivation system in rice fields in agriculture are as follows:

a. Preparing Rice Fields
   This preparation begins with establishing the rice field, then constructing a drainage system, and constructing irrigation channels into the rice fields. Land management can be done either by tractor or by hand.
b. Fertilization System
   The fertilizer applied must be organic, preferably chicken manure, as it does not contain high levels of nutrients. Organic fertilizer is applied at a rate of 1-2 tons per hectare. In addition to chicken manure, farmers can also use synthetic NPK fertilizers, with the required dosages as directed on the packaging label.
c. Types of Fish and Rice
   Rice varieties suitable for the mina padi system are adapted to the climate and environmental conditions, using a 2:1 to 4:1 planting ratio. The fish selected are fast-growing, disease-resistant, highly sought-after, and have high selling prices. Fish that don't thrive in mud include tilapia, mujair, carp, koi, and others.
d. Rice Harvesting
   Rice harvesting is carried out after 90% of the rice plants have turned yellow. The harvesting technique employed by farmers at the research site begins with harvesting the rice without reducing the water level in the fields. This means that when harvesting the rice, the fields are not dry, allowing the carp to be released after the harvest is complete.
e. Fish Seed Distribution
   Farmers distribute fish seeds when the rice plants have turned yellow or are harvested, reaching 30 days after planting (DAP), or after fertilization. The number of fish varies from 100 to 1,000 per hectare and is distributed in the afternoon or morning. Regulating irrigation water flow is crucial. If the water level is too high, it will impact rice growth, while if the water level is too low, it will also impact fish growth.
f. Goldfish Harvesting
   Carp are harvested after two months. Harvesting the fish involves draining the rice fields and placing nets along the irrigation outlets. The harvesting technique employed by farmers at the research site begins with harvesting the rice without reducing the water level in the fields.

Fish farming techniques in rice fields are an integrated farming system (IFS) that combines agriculture and fisheries. An IFS is a management (business) system that combines agricultural components, such as plants, animals, and fish, into a unified whole. To clarify the process of cultivating rice and carp, consider the description in the table below:

Table 8. Average Land Area and Annual Rice and Carp Production

Description	Land area (Ha)	Productivity (Kg/Ha)
Paddy	1.41	8181.86
Goldfish	0.70	225.70

Source: Processed from primary data (2025)

Table 9. Average Use of Production Facilities Per Hectare by Rice Farmers and Goldfish FarmersPer year

Production Facilities	Amount	Unit
Rice 1		
Seed	21.16	Kg/Ha
Urea	101,568	Kg/Ha
SP-36	70.53333	Kg/Ha
KCL	35,26667	Kg/Ha

NPK	70.53333	Kg/Ha
Lannate	0.493733	L/Ha
Brownup	1,410667	L/Ha
Rice 2		
Seed	21.16	Kg/Ha
Urea	101,568	Kg/Ha
SP-36	70.53333	Kg/Ha
KCL	35,26667	Kg/Ha
NPK	70.53333	Kg/Ha
Lannate	0.493733	L/Ha
Brownup	1,410667	L/Ha
Goldfish Farming		
Seeds	56.42667	Kg/Ha
Feed	92,624	Kg/Ha

Source: Processed from primary data (2025)

In table 9Average Use of Production Facilities by Rice Farmers and Carp Farmers.

Table 10. Average Labor Use of Rice Farmers and Goldfish Farmers Per Year

Rice Farmers Labor	
Rice Processing M.1	**Amount (Rp)**
Repairing the Fort	10.6
Plowing the Land	35.2
Land Equity	4.2
Seed Sowing	4
Planting	30.5
Maintenance (fertilizers)	2.26
Treatment(fertilizer1)	4.2
Treatment(fertilizer3)	4.2
Weeding	4.2
Pest Control 1	4.2
Pest Control 2	4.2
Harvesting	4.2

Source: Processed from primary data (2025)

Rice Farmers Labor	
Rice Processing M.2	**Amount (Rp)**
Repairing the Fort	10.6
Plowing the Land	35.2
Land Equity	4.2
Seed Sowing	4
Planting	30.5
Maintenance (fertilizers)	2.26
Treatment(fertilizer1)	4.2
Treatment(fertilizer3)	4.2
Weeding	4.2
Pest Control 1	4.2
Pest Control 2	4.2
Harvesting	4.2

Source: Processed from primary data (2025)

Table 11. Average Economic Time of Equipment Usage per Ha by Rice Processing and Carp Farming Status

Economic Life of Rice Processing Equipment	
Economic Life of Equipment	**Rice Processing**
Hoe	4
Sapal	5
Sickle	2
Bag	6

Source: Processed from primary data (2025)

Fish Farming	Amount (HOK)
Repairing the Fort	7.67
Repairing the Channel	1
Sowing the Seeds	1
Feeding	10.58
Fish Harvesting	7.73

Economic Life of Fish Farming Equipment	
Economic Life of Equipment	**Rice Processing**
Net	10.58
Bucket	4.1

Source: Processed from primary data (2025)

Table 12. Average Cost of Production Facility Usage Per Hectare for Rice Farmers and Goldfish Farmers Per Year

Production Facility Costs	
Padi M.1	**Amount (Rp)**
Seed	714,150
Urea	205,675
SP-36	143,888
KCL	145,475
NPK	312,110
Lannate	48,139
Brownup	61,364
Total	**1,630,801**
Padi M.2	**Amount (Rp)**
Seed	714,150
Urea	205,675
SP-36	143,888
KCL	145,475
NPK	312,110
Lannate	48,139
Brownup	61,364
Total	**1,630,801**
Goldfish Farming	**Amount (Rp)**
Seeds	1,692,800
Feed	740,992
Total	**2,433,792**

Source: Processed from primary data (2025)

Table 13. Average Labor Costs for Rice Farmers and Goldfish Farmers Per Year

Rice Farmers Labor	
Rice Processing M.1	**Amount (Rp)**
Repairing the Fort	371,000
Plowing the Land	1,234,333
Land Equity	149,333
Seed Sowing	140,000
Planting	1,068,667
Treatment(fertilizer1)	79,333
Maintenance (fertilizers)	147,000

Treatment(fertilizer3)	147,000
Weeding	147,000
Pest Control 1	147,000
Pest Control 2	147,000
Harvesting	1,304,333
Total	**5,081,999**

Source: Processed from primary data (2025)

Rice Farmers Labor	
Rice Processing M.2	**Amount (Rp)**
Repairing the Fort	245,000
Plowing the Land	989,333
Land Equity	149,333
Seed Sowing	140,000
Planting	1,068,667
Maintenance (fertilizers)	147,000
Treatment(fertilizer1)	147,000
Treatment(fertilizer3)	147,000
Weeding	147,000
Pest Control 1	147,000
Pest Control 2	1,304,333
Harvesting	147,000
Total	**4,778,666**

Source: Processed from primary data (2025)

Fish Farming	**Amount (Rp)**
Repairing the Fort	613,667
Repairing the Channel	70,000
Sowing the Seeds	70,000
Feeding	740,600
Fish Harvesting	399,000
TOTAL	**1,893,267**

Source: Processed from primary data (2025)

Table 14. Average Cost of Economic Period Use of Equipment per Hectare According to Rice Processing and Goldfish Farming Status

Economic Life of Rice Processing Equipment	
Economic Life of Equipment	**Rice Processing (Rp)**
Hoe	186,000
Sapal	400,000
Sickle	50,000
Bag	72,798
Total	**708,798**

Source: Processed from primary data (2025)

Economic Life of Fish Farming Equipment	
Economic Life of Equipment	**Rice Processing (Rp)**
Net	24,000
Bucket	96,000
Total	**120.00**

Source: Processed from primary data (2025)

Revenue Analysis

Income is the income received by rice and carp farmers for their work performance over a specific period, whether daily, weekly, monthly, or annually. For more details on rice paddy farmer income, see Table 15 below:

Table 15. Average Value of Rice Farming and Goldfish FarmingPer Year

No.	Description	Unit	Paddy	Goldfish
1	Production	Kg	8,181.86	225.70
2	Reception	Rp	44,182,044	6,319,600
3	Total Cost	Rp	13,122,976	4,447,059
4	Income	Rp	31,059,068	1,872,541
5	R/C		3	1

Source: Processed Primary Data (2025)

To Identify Factors Affecting Farmers' Income

The data analysis method used in this study is a multiple regression model. Multiple linear regression analysis is used to determine the influence between variables X and Y. The multiple linear regression model calculations were performed using the SPSS program. The results of the analysis are as follows:

Table 16. Multiple Linear Regression Results

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9,207	5,627		1,636	.114
	Cropping Pattern Index	.718	.219	.628	3,275	.000
	Rice Production Costs	.531	.207	.408	2,563	.001
	Fish Production Costs	.091	.163	.082	.556	.583
	Petan's Experience	.911	.329	.558	2,769	.001

a. Dependent Variable: Income

From table 16, the results of the multiple linear regression analysis obtained the following equation:

Y = 9.207 + 0.718 X1+ 0.531X2 + 0.091X3 + 0.911X4 + e

Based on the regression equation, it can be explained as follows:

1. The constant value (a) = 9.207 means that if there is no change in the value of the cropping pattern index variable (X1), rice production costs (X2), fish production costs (X3), farmer experience (X4) is zero (0), then the farmer's income or (Y) is 9.027.
2. The regression coefficient value of the cropping pattern index variable is 0.718, meaning that if the cropping pattern index variable (X1) increases, the income level will increase by 0.718.
3. The regression coefficient value of the rice production cost variable is 0.531, meaning that if the rice production cost variable (X2) increases, the income level or (Y) will increase by 0.531.
4. The regression coefficient value of the carp production cost variable is 0.091, meaning that if the carp production cost variable (X3) increases, the income level (Y) will increase by 0.091.
5. The regression coefficient value of the farmer experience variable is 0.911, meaning that if the farmer experience variable in managing land (X4) increases, the income level (Y) will increase by 0.258.

1) Coefficient of Determination Test (R2)

Table 17. Results of the Determination Coefficient Test

Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	.777a	.604	.541	1.54846

a. Predictors: (Constant), Farmer Experience, Fish Production Cost, Rice Production Cost, Cropping Pattern Index

Based on table 17. From the results of the R2 square test, the R2 Square value was obtained at 0.604 or 60.4%. This result indicates that the level of farmer income influenced by the Cropping Pattern Index, Rice Production Costs, Carp Production Costs, and farmer experience can explain 60.4% while the difference of 39.6% is influenced by variables not included in this study.

1) Simultaneous Significance Test (F Test)

To influence the farmer experience variable, rice production costs, fish production costs, and cropping pattern index together can be seen in the following table:

Table 18. Simultaneous Significance Test Results (F Test)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	91,523	4	22,881	9,543	.000b
	Residual	59,944	25	2,398		
	Total	151,467	29			

a. Dependent Variable: Income

b. Predictors: (Constant), Farmer Experience, Fish Production Cost, Rice Production Cost, Cropping Pattern Index

Based on Table 18, it can be concluded that the Cropping Pattern Index, Rice Production Costs, Carp Production Costs, and farmer experience have a simultaneous and significant effect on farmer income. This can be seen from the significance value of 0.00 < 0.05. Based on the hypothesis criteria, Ha is accepted and Ho is rejected. It can be concluded based on the results of the F test that the variables Cropping Pattern Index, Rice Production Costs, Carp Production Costs, and farmer experience have a significant effect on increasing farmer income.

2) Partial Significance Test (t-Test)

Table 19. Partial Significance Test Results (t-Test)

Coefficientsa

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	9,207	5,627		1,636	.114
	Cropping Pattern Index	.718	.219	.628	3,275	.000
	Rice Production Costs	.531	.207	.408	2,563	.001
	Fish Production Costs	.091	.163	.082	.556	.583
	Farmer Experience	.911	.329	.558	2,769	.001

a. Dependent Variable: Income

a. Dependent Variable: Productivity

To test the significance of the factors that influence the level of farmer income, the test used is the t test (Student's test) to determine the level of significance between variable X and variable Y. The respondents used in this study amounted to 30 people, so the use of the t test is as follows: df = nk = 30-4 = 26 and the level of significance α = 0.05, then the T table value is obtained = 2.015. From the table above, it can be explained as follows:

a) Cropping Pattern Index Variable

The sig. value of the variable: cropping pattern index is 0.00 < 0.05, while the t-test probability value of the variable: cropping pattern index is 3.275 < 2.015 ttable, so ho is accepted and ha is rejected. The negative sign (+) on the land area variable indicates a unidirectional relationship, meaning that the increasing cropping pattern index will increase the productivity level by 3.275. Where it can be concluded that the variable: cropping pattern index is significant to the level of farmer income.

b) Rice Production Costs

The sig. value of the rice production cost variable is 0.01 < 0.05, while the Prob tcount value of the rice production cost variable is 2.563 < 2.015 ttable, so Ha is accepted and Ho is rejected. The positive sign (+) on the certification variable indicates a unidirectional relationship, meaning that the increasing cost of rice production will increase the level of farmer income by 2.653. Where it can be concluded that the cost of rice production has a significant effect on increasing farmer income.

c) Goldfish Production Costs

The sig. value of the carp production cost variable is 0.583 > 0.05, while the Prob thitung value of the carp production cost variable is 0.556 > 2.015 ttable, so Ha is rejected and Ho is accepted. The positive sign (+) on the carp production cost variable indicates a unidirectional relationship, meaning that the increasing

cost of carp production will increase the level of farmer income by 0.556. Where it can be concluded that the cost of carp production does not have a significant effect on the level of farmer income.

d) Farmer Experience

The sig. value of the farmer experience variable is 0.01 < 0.05, while the t-test Prob value of the farmer experience variable is 2.769 < 2.015 t-table, so Ha is accepted and H0 is rejected. The positive sign (+) on the farmer experience variable indicates a unidirectional relationship, meaning that as farmer experience increases, the farmer's income level will increase by 2.769. This means that the farmer experience variable has a significant effect. on the level of farmer income.

IV. CONCLUSION AND SUGGESTIONS

Conclusion

Based on the research results and discussions obtained in this study, it can be said that the conclusions from the answers to the problem formulation in this study are as follows:

1. Based on the results analysiscropping intensity indexrice and carp farming (IIP) withThe calculation of the rice-rice-carp farming concept shows that the results are (100% - 41.63%), which is 58.37%. It can be concluded that the utilization of the rice-rice-carp farming system is less than optimal. That is, rice = 33.33% and carp farming only 8.33%.
2. The average value of rice production and carp farming is the largest from rice production where the amount of production per year is 8,181.86 Kg/Ha, where the average income is Rp. 44,182,044, and the total cost of expenditure is Rp. 13,122,976. So the income is Rp. 31,059,068 per year, with an average value of R/C = 3. While from carp farming farmers only get 225.70 Kg/Ha where the average income is Rp. 6,319,600, and the total cost of expenditure is Rp. 4,447,059. So the income is Rp. 1,872,541. with an average value of R/C = 1.
3. From the results of the determination test analysis (R2) it can be seen that the cropping pattern index variable, rice production costs, carp livestock production costs, and farmer experience can explain 60.4% therefore it can be concluded that the results of the determination test (R2) can explain farmers' income while the difference of 39.6 is influenced by factors not included in the study. From the results of the slimutan test analysis (F test) it can be seen that together the cropping pattern index, rice production costs, carp livestock production costs, and farmer experience have a significant effect on farmer income (Y). with a significant value of 0.00 <0.05. From the results of the partial test analysis (t test) the cropping pattern index, rice production costs, and farmer experience have a significant effect on farmer income (Y). While the cost of carp livestock production is not significant to increasing farmer income (Y).

Suggestion

Based on the conclusions above, the author can present several suggestions as follows:

1. Based on the results of this study, farmers should pay more attention to the cropping pattern index, rice production costs, and farmer experience in order to increase farmer income.
2. For further researchers, it is recommended to add more comprehensive variables and expand the research both in terms of objects and research time.

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