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INCOME RISK AND RISK MANAGEMENT OF RICE FARMING UNDER LANDSCAPE INTEGRATED PEST MANAGEMENT PROGRAM IN KLATEN REGENCY

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ABSTRACT

Landscape IPM is an extended version of IPM that implemented by the design of a wider expanse of land fields and a greater number of farmers involved. This study was aimed to determine (1) the comparative of income risk of the IPM and non-landscape IPM rice farmers and (2) factors that affect the income and income risk of the IPM and non-landscape IPM rice farm. The research location and respondents are selected by purposive sampling for 30 landscape IPM farmers and by simple random sampling for 30 Non-landscape IPM farmers chosen from four farmers groups in Klaten Regency. To determine the income risk of the IPM and non-landscape IPM rice farm, the coefficient of variation (CV) is used. To determine the factors that affect the income and risk income of the IPM and non-landscape IPM, multiple regression analysis is employed. The results showed that landscape IPM rice farm has a higher risk of income than the on-landscape IPM rice farm. The factors that positively affect income of the landscape IPM rice farm are farm size and refugia flower while it is negatively affected by seed prices. The factors that positively affect the Non-landscape IPM rice farm income is farm size, and it is negatively affected by seed prices and liquid pesticide prices. The factors that positively affect income risk of the landscape IPM rice farm is farm size and negatively affected by refugia flower. The factors that positively affect non-landscape IPM rice farm income risk are liquid pesticide prices and solid pesticide prices.

Keywords: *coefficient of variation, income risk, landscape IPM, multiple regression analysis, risk*

INTRODUCTION

In 2009 there was an explosion of the brown planthopper pest (WBC) in Klaten Regency, leading farmers to face the risk of crop failure (Winarto, 2011). As a result, the high pest attack in Klaten Regency has caused a decrease in production which obviously affects the level of farm income in Klaten Regency. This has resulted in a decrease in farm income due to the increased input costs and the occurrence of land degradation due to excessive use of pesticides (Wongso, 2006).

In addressing these problems, the Indonesian government is working with FAO to develop an Integrated Pest Management program. As an effort to control pest populations that are environmentally friendly and to increase the effectiveness of IPM, it is necessary to handle them on a large scale, a landscape. Integrated Landscape Pest Management is one type of Integrated Pest Management which is carried out with the concept of designing agricultural land arrangements to plant plants in a landscape that functions as a host for predators such as refugia flowers (Trisyono, 2015).

In order to assist farmers in making decisions related to the application of landscape IPM on their land, it is necessary to conduct a risk analysis of farm income. The importance of the risk of rice farming income is that it can affect the welfare of farmers. Furthermore, in making decisions related to the application of landscape IPM on those lands, it is necessary to carry out an analysis of the risk of rice farming income in IPM and non-landscape IPM. After that, an analysis of the factors affecting the income and risk of income in rice farming in landscape IPM and non-landscape IPM is carried out. Therefore, the impact of landscape IPM on rice farming income can be seen. As a result of these risks, risk management is needed as a strategy to control risks that might occur in rice farming both in the landscape IPM and non-landscape IPM. This is becoming important information for farmers in Klaten Regency and at the same time, is the objective of research.

METHOD

This research was conducted in Juwiring District, Klaten Regency, Central Java. The location of this study was determined purposively because the area is a rice production center and one of the areas that has cultivated refugia flowers on its farming in

2014 so that the data will be homogeneous. In addition, the determination in Klaten Regency is due to the implementation of landscape IPM in collaboration with the Indonesian government and the Food Agriculture Organization (FAO).The sampling method of this research was purposive method for 30 landscape IPM rice farmers who did olant refugia flowers from 2 farmer groups in Juwiring District, which is a landscape IPM applied area, the result of collaboration between the Indonesian government and FAO and a simple random sampling method for 30 non-landscape IPM rice farmers who did not plant refugia flowers. Therefore, the characteristics of the sample are homogeneous, where the treatment in farming and the variables studied are the same according to the objectives of this study. The data analysis methods used in this research are:

Income risk analysis of landscape IPM and non-landscape IPM farmers

The income risk can be determined using the coefficient of variation (CV) analysis obtained from the quotient of the standard deviation of income and average income. To find out the coefficient of variation (CV), it is necessary to know the standard deviation value of income first. According to Pappas and Hurschey (1995), it can be formulated as follows:

$$CV = \frac{s}{\overline{Y}}$$

where:

s = standard deviation

$\overline{Y}$ = average of income

CV = coefficient of variation

Naftaliasari et al. (2015) stated that CV value is directly proportional to risk. The higher the CV value, the greater the risk accepted. This means that the higher the income received, the greater the level of risk received. The level of risk can be categorized as follows (Hermanto, 1993):

$CV \geq 0.5$ = High risk

$0.2 \leq CV < 0.5$ = Medium risk

$CV < 0.2$ = Low risk

After obtaining the income risk of landscape IPM and non-landscape IPM farming, hypothesis testing by independent samples t-test is carried out, namely:

H0: $\mu 1 \geq \mu 2$ = The average risk income of Landscape IPM farm is greater than or equal to the average income risk of the non-landscape IPM farm.

H1: $\mu 1 < \mu 2$ = The average risk income of Landscape IPM farm is less than the average income risk of the non-landscape IPM farm.

Analysis of Factors Affecting the Income and Risk Income of Rice Farming

The method used to analyze the factors affecting the income of Landscape IPM farms, the Multiple Linear Regression Method is used, where it is formulated using the following equation:

$$\ln Y_1 = \alpha_{1.0} + \alpha_{1.1}\ln X_{1.1} + \alpha_{1.2}\ln X_{1.2} + \alpha_{1.3}\ln X_{1.3} + \alpha_{1.4}\ln X_{1.4} + \alpha_{1.5}\ln X_{1.5} + \alpha_{1.6}\ln X_{1.6} + \alpha_{1.7}\ln X_{1.7} + \alpha_{1.8}\ln X_{1.8} + \alpha_{1.9}\ln X_{1.9} + \varepsilon_1$$

Where:

Y_1 = normalized Landscape IPM rice farming income at the output price (IDR)

ε_1 = income risk of Landscape IPM rice farming

$\alpha_{1.0}$ = intercept

$\alpha_{1.i}$ = regression coefficient (estimated parameter) (i = 1 to 9)

$X_{1.1}$ = farming experience (years)

$X_{1.2}$ = age (years)

$X_{1.3}$ = land area (m^2)

$X_{1.4}$ = seed price normalized to the output price (IDR / kg)

$X_{1.5}$ = normalized fertilizer price with output price (IDR / kg)

$X_{1.6}$ = liquid pesticide price normalized by the output price (Rp / ml)

$X_{1.7}$ = solid pesticide price normalized by the output price (Rp / g)

$X_{1.8}$ = labor wages normalized at the price of output (IDR / HOK)

$X_{1.9}$ = refugia flower (number of trees)

The analysis of the factors affecting the income risk of landscape IPM rice farming can be carried out by regressing the income risk function of landscape IPM rice farming using the residual square obtained from the previous model. The income risk function regression model is as follows:

$$\ln \varepsilon_1^2 = \alpha_{2.0} + \alpha_{2.1}\ln X_{2.1} + \alpha_{2.2}\ln X_{2.2} + \alpha_{2.3}\ln X_{2.3} + \alpha_{2.4}\ln X_{2.4} + \alpha_{2.5}\ln X_{2.5} + \alpha_{2.6}\ln X_{2.6} + \alpha_{2.7}\ln X_{2.7} + \alpha_{2.8}\ln X_{2.8} + \alpha_{2.9}\ln X_{2.9} + e_2$$

Where:

ε_1^2 = risk income of Landscape IPM rice farming

e2 = residual

α2.0 = intercept

α2.i = regression coefficient (estimated parameter) (i = 1 to 9)

X2.1 = farming experience (years)

X2.2 = age (years) X2.3 = land area (m^2)

X2.4 = seed price normalized to the output price (IDR / kg)

X2.5 = normalized fertilizer price with output price (IDR / kg)

X2.6 = liquid pesticide price normalized by the output price (Rp / ml)

X2.7 = solid pesticide price normalized by the output price (Rp / g)

X2.8 = labor wages normalized at the price of output (IDR / HOK)
X2.9 = refugia flower (number of trees)

The method used to analyze the factors affecting the income of Non-Landscape IPM farms, the Multiple Linear Regression Method is used, where it is formulated using the following equation:

$$\ln Y_2 = \alpha_{3.0} + \alpha_{3.1}\ln X_{3.1} + \alpha_{3.2}\ln X_{3.2} + \alpha_{3.3}\ln X_{3.3} + \alpha_{3.4}\ln X_{3.4} + \alpha_{3.5}\ln X_{3.5} + \alpha_{3.6}\ln X_{3.6} + \alpha_{3.7}\ln X_{3.7} + \alpha_{3.8}\ln X_{3.8} + \varepsilon_2$$

Where:
Y_2 = normalized Non -Landscape IPM rice farming income at the output price (IDR)
ε_2 = income risk of Non Landscape IPM rice farming
$\alpha_{3.0}$ = intercept
$\alpha_{3.i}$ = regression coefficient (estimated parameter) (i = 1 to8)
$X_{3.1}$ = farming experience (years)
$X_{3.2}$ = age (years)
$X_{3.3}$ = land area (m^2)
$X_{3.4}$ = seed price normalized to the output price (IDR / kg)
$X_{3.5}$ = normalized fertilizer price with output price (IDR / kg)
$X_{3.6}$ = liquid pesticide price normalized by the output price (Rp / ml)
$X_{3.7}$ = solid pesticide price normalized by the output price (Rp / g)
$X_{3.8}$ = labor wages normalized at the price of output (IDR / HOK)

The analysis of the factors affecting the income risk of non landscape IPM rice farming can be carried out by regressing the income risk function of non landscape IPM rice farming using the residual square obtained from the previous model. The income risk function regression model is as follows:

$$\ln \varepsilon_2^2 = \alpha_{4.0} + \alpha_{4.1}\ln X_{4.1} + \alpha_{4.2}\ln X_{4.2} + \alpha_{4.3}\ln X_{4.3} + \alpha_{4.4}\ln X_{4.4} + \alpha_{4.5}\ln X_{4.5} + \alpha_{4.6}\ln X_{4.6} + \alpha_{4.7}\ln X_{4.7} + \alpha_{4.8}\ln X_{4.8} + e_2$$

Where:
ε_2^2 = risk income of non Landscape IPM rice farming
e2 = residual
α2.0 = intercept
α2.i = regression coefficient (estimated parameter) (i = 1 to 8)
X4.1 = farming experience (years)
X4.2 = age (years) X2.3 = land area (m^2)
X4.4 = seed price normalized to the output price (IDR / kg)
X4.5 = normalized fertilizer price with output price (IDR / kg)
X4.6 = liquid pesticide price normalized by the output price (Rp / ml)
X4.7 = solid pesticide price normalized by the output price (Rp / g)
X4.8 = labor wages normalized at the price of output (IDR / HOK)

RESULTS AND DISCUSSION

Income risk analysis of rice farming

Income risk is a type of risk that will be experienced by farmers. This is because farmers always expects revenue to be received from the farming activities. Farmers will not utilize their products, instead they only utilize the income that has been received from the sale of the production that has been generated. Based on table 1.1. It is known that the average income of landscape IPM rice farming is higher than the landscape non-IPM rice farming, as well as the risk of landscape IPM rice farming income (30%) is greater than non-IPM rice farming (20%) which indicates that farm income in the landscape IPM and non-IPM are at moderate risk. The difference in productivity between the two of them is the main factor that causes the difference in income. Productivity is measured in the form of harvested dry unhulled rice. This is influenced by the higher costs of production facilities, labor costs, fixed costs, and other costs of landscape IPM rice farming, which are higher than thee landscape non-IPM landscape farming.

Factors Affecting the Income and Income Risk of Rice Farming

The factors that affect the income and income risk from landscape IPM and landscape non-IPM rice farming can be identified after several stages of regression testing are carried out. The first stage is to determine the regression model for the farm income function as the dependent variable in the income risk function regression model.

Table 1.1. Average Income and Income Risk of Rice Farming

Variables	IPM Farmers (Rp)	Percentage (%)	Non-IPM Farmers (Rp)	Percentage (%)
Income	35,315,940.00	100.00	26,004,088.00	100.00
Variable costs:				

Seeds	838,750.00	2.37	1,243,500.00	4.78
Fertilizers	2,697,773.93	7.64	3,791,646.80	14.58
Pesticides	824,954.14	2.34	1,671,485.02	6.42
Refugia Flowers	676,000.00	1.91	0.00	0.00
Labor	6,953,951.96	19.69	4,104,850.00	15.79
Fixed costs				
Rental costs	3,076,666.67	8.71	3,348,333.33	12.88
Tax costs	127,428.73	0.36	102,412.65	0.39
Other costs	2,514,891.35	7.12	1,608,393.93	6.19
Total Costs	17,710,416.78	50.14	15,870,621.73	61.03
Farming Income	17,605,523.22	49.86	10,133,466.27	38.97
CV of Farming Income	0.30		0.20	

Source: Primary Data Analysis in 2018

Based on table 1.2, it is known that the independent variables that have an individual significant effect on the dependent variable on landscape IPM rice farming include land area, seed price, refugia flower while the age of the farmer, farming experience, fertilizer price, solid pesticide price, liquid pesticide price, labor wages and refugia do not have a significant effect individually on the dependent variable on landscape IPM rice farming, including land area, seed price, refugia flower while age farmers, farming experience, fertilizer prices, solid pesticide prices, liquid pesticide prices, labor wages and refugia interest do not individually have a significant effect on the dependent variable (landscape IPM rice farming income). In addition, it can be seen that the independent variables that have an individual significant effect on the dependent variable on landscape non-IPM farming include land area and price of liquid pesticides while the age of the farmer, farming experience, seed prices, fertilizer prices, solid pesticide prices and labor wages. does not have a significant effect on the dependent variable (non-IPM landscape rice farm income).

Table 1.2. Regression Analysis Results of Factors Affecting Rice Farming Income

Variables	Expected sign	Landscape IPM Farmers		Non-landscape IPM Farmers	
		Coefficient	t- sig	Coefficient	t- sig
C	+/-	-5,419**	0,037	-5,138***	0,000
Ln Farmer's Age	+	0,000	1,000	-0,238	0,731
Ln Experience	+	-0,157	0,685	-0,036	0,830
Ln Land Areal	+	0,169***	0,003	0,970**	0,025
Ln Seed's Price	-	-0,608**	0,098	-0,116*	0,097
Ln Fertilizer's Price	-	-0,290	0,635	-0,208	0,475
Ln Liquid Pesticides Price	-	-0,018	0,384	-0,008*	0,058
Ln Solid Pesticides Price	-	0,005	0,843	0,012	0,502
Ln Labor Wage	-	0,256	0,438	-0,041	0,822
Ln Refugia	+	0,135**	0,006	-	-
F-value		1,944***	0,004	3,403***	0,002
Adjusted R^2			0,27		0,399

Source: Primary Data Analysis in 2018
Notes:
***) = Significant at the level of α = 1%
**) = Significant at the level of α = 5%
*) = Significant at the level of α = 10%

Based on the results of the classical assumption test of the risk function model for rice farming in landscape IPM and landscape non-IPM, it can be concluded that the income risk model is a good model to use.

Based on table 1.3, it can be seen that the independent variables that have an individual significant effect on the dependent variable (risk of landscape IPM rice farming income) include land area and refugia while the age of the farmer, farming experience, seed price, fertilizer price, solid pesticide price, liquid pesticide price and labor wages do not individually have a significant effect on the dependent variable (risk of landscape IPM rice farming income). In addition, it can be seen that the independent variables that have an individual significant effect on the dependent variable (risk of landscape non-IPM farm income) include liquid pesticide prices and solid pesticide prices while farmer age, farming experience, seed prices, fertilizer prices and labor wages work does not individually have a significant effect on the dependent variable (risk of non-IPM landscape rice farming income).

Table 1.3. Regression Analysis Results of Factors Affecting Income Risk of Rice Farming

Variables	Expected sign	Landscape IPM Farmers		Non-landscape IPM Farmers	
		Coefficient	t- sig	Coefficient	t- sig
C	+/-	-5.762	0.426	-6.972	0.384
Ln Farmer's Age	-	2.064	0.506	1.720	0.703
Ln Experience	-	-0.081	0.943	-6.280	0.571
Ln Land Areal	+	0.591**	0.037	1.117	0.673
Ln Seed's Price	+	3.267	0.126	-0.969	0.617
Ln Fertilizer's Price	+	3.433	0.129	-1.085	0.567
Ln Liquid Pesticides Price	+	0,053	0.389	0.139**	0.042
Ln Solid Pesticides Price	+	-0,027	0.718	0.0170*	0.079
Ln Labor Wage	+	0,154	0.173	-0.041	0.321
Ln Refugia	-	-1,003**	0.033		
F-value		1.116***	0.033	0,428***	0,001
Adjusted R^2			0.135		0.187

Source: Primary Data Analysis in 2018

Notes:
***) = Significant at the level of α = 1%
**) = Significant at the level of α = 5%
*) = Significant at the level of α = 10%

CONCLUSIONS

Based on the results of the analysis and discussion in the previous chapter, it can be concluded that:

1. The income risk of landscape IPM rice farming is greater than landscape IPM rice farming.
2. Income of landscape IPM rice farming is positively influenced by the area of land and refugia flowers and is negatively affected by the price of seeds, while the income of landscape IPM rice farming is positively influenced by land area and is negatively influenced by the price of seeds and the price of liquid pesticides. The income risk of landscape IPM rice farming is positively influenced by land area and negatively by refugia interest, while the risk of landscape non-IPM rice farming income is positively influenced by solid pesticides and liquid pesticides.

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