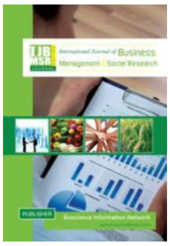
Journal BiNET
Scientific Publication

Published with Open Access at Journal BiNET
Vol. 04, Issue 02: 251-258
International
Journal of Business, Management and Social Research
Journal Home: www.journalbinet.com/ijbmsr-journal.html



Risk of production and income of rice farming based on landscape integrated pest management in Pliken village Kembaran district Banyumas regency

Dinda Dewi Aisyah, Sugiyarto and Irham

Dept. of Agricultural Sosio-economics, Universitas Gadjah Mada, Indonesia

✉For any information: ask.author@journalbinet.com

Received: 18 January 2018; Revised: 13 May 2018 and Published online: 25 June 2018.

ABSTRACT

Landscape IPM has been developed in several regions in Java to strengthen the ecosystem that has been impacted by the massive utilization of pesticide during long period. Therefore, this study about LIPM farm was started from September 2016 for collecting data until the finishing of the report which was fully completed in May 2017. This research aims to compare the level of risk of production and risk of income between LIPM adopters and non-adopters. Moreover, there will be analysis about the determinant factors of risk of production and risk of income in this study. The level of risk of production and income were measured by calculation the Coefficient of variation (CV). The determinant factors of risk of production and income analyzed by using multiple linear regression based on the method of multiplicative heterocedastic. The result shows that LIPM farm are proved to have a lower level of risk of production. Otherwise, it has higher level of risk of income compared to the non LIPM farm. Pest attack has significantly influenced the risk of production; meanwhile size of farm and the labour wage are the determinant factors of risk of income. Considering the results suggestions given to farmers are farmers are expected to apply LIPM altogether to optimize the benefits of implementing LIPM on the rice field.

Key Words: *Landscape IPM, Risk, Production, Income and Coefficient of variation*

Cite Article: Aisyah, D. D., Sugiyarto & Irham (2018). Risk of production and income of rice farming based on landscape integrated pest management in Pliken village Kembaran district Banyumas regency. *International Journal of Business, Management and Social Research,* 04(02), 251-258.
Crossref: https://doi.org/10.18801/ijbmsr.040218.28

I. Introduction

The ultimate massive application of fertilizers and chemical pesticides until now causing environmental pollution due to the residue of the chemical elements contained therein. Hence, many lands are degraded by soil fertility because of the environmental pollution, and this leads to a decrease in agricultural productivity. Therefore, it is necessary to develop more program that environmentally friendly and enable to give benefit for farmers as well. Production technology is able to gives benefits for farmers since the Production creativity can only appear when farmer use appropriate technology.

Published with open access at journalbinet.com
EISSN:2412-8279,

The idea of craftsmen to choose the less costly technology is profitable. This capability includes as an entrepreneurial spirit (Dumasari et al., 2017). One of the agricultural development programs that can be used as an attempt to solve the problem is Integrated Pest Management (IPM). In 1992 the government determined the policy of IPM to be able to resolve the pest problem. According to Edwards et al. (1990), Integrated Pest Management (IPM) is a pest control strategy that aims to maximise the effectiveness of controls that can be done biologically and culturally. The use of chemicals as pest control is only done when required with minimum doses that will not cause damage to the environment. In 2014, Pliken Village, located in Kembaran Sub-district, Banyumas District, Central Java became one of the villages to be guided by FAO in the form of Integrated Pest Control Field School (SLPHT). In other words, Pliken Village has implemented the concept of Landscape IPM (LIPM) in almost two years until 2016. In SLPHT, farmers are encouraged to plant refugia flower along the rice field fringe, apply jajarlegowo planting system and reduce the use of chemical fertilizers and pesticides. The planting of refugia flowers on farms has been shown to increase biodiversity and provide adequate shelter and alternative food sources for predators and parasitoids that are natural enemies of rice pests (Kumar et al., 2013). Furthermore, Wahyuni et al. (2014) conducted research on various types of predators associated with flowering plants in rice cultivation. his research found that the most frequent refugia flowers approached by predators are *Alternantheraphiloxeroides*, *Cosmos caudatus* and *Impatiens balsamine* which have been cultivated as well in the Pliken Village.To assist farmers in making decisions related to the application of LIPM to their land, it is necessary to analyse the risk of production and risks of income based on LIPM farming and farming that have not yet adopted the LIPM. After knowing the risk of farming, it will help the farmer in deciding whether it is better to implement the LIPM in their field or not.

According to Kumbhakar and Tsionas (2010) the risk of farming production can be explained using parametric function analysis with some variables that are assumed to be the cause of the risk of farming. While, Salvatore (2004) states that risk is a condition in which there is more than one possible outcome of making a decision. Any possible outcome that can occur has an estimated probability. To manage the farm properly, the farmers are expected to understand all possible results that can occur on the farm. In every production process, especially agricultural production, risk always plays an essential role in influencing the level of production input use. Just and Pope as risk researchers developed a production function model known as Just and Pope's Postulate. The J-P postulate focuses on the risks of production as measured by the output variance (Asche and Ragnar, 1999). Measurement of risk in such a way can also be referred as a production function specification. The primary focus in the specifications expressed by Just and Pope enables farmers to make decisions that will increase risk or lower risk. Also, to use the production function specification, risk measurement can be done by looking at the probability distribution. To obtain the probability distribution, what needs to be done is to look at the coefficient of variation obtained from the division between the standard deviation with the average of production and income.

Factors affecting the risk of production are described in a study by Suharyanto et al. (2015). This study aims to examine the risks of rice farming and factors affecting production risk in Tabanan, Buleleng and Gianyar districts located in Bali Province. The results of his research found that the area of land, organic fertilizers, and pesticides are the factors of production that affect the amount of production risk. All three have a significant effect in reducing the risk of rice production. The result of this research is not much different from Zakirin et al. (2013) which also researched the factors that influence the risk of production. The results of the study suggest that land and seeds are capable in reducing production risks.In addition, the research conducted by Tahir et al. (2011) which has the purpose of knowing the factors that affect the risk of soybean production in South Sulawesi also found that pesticides have ansignificant effect on production risk. Similar to production risk, income risk can also be measured using the coefficient of variation as a tool of analysis. The previous research using CV to estimate the magnitude of income and production risks one of them implemented by Lawalata (2013). The results of his study found that CV onion farm income is higher than the CV of farming production. It illustrates the risk of farm income more significant than the risk of production. Meanwhile, Kurniati et al. (2014) study was conducted to find out the factors influencing the risk of income in Siam Orange Farming in KecamatanTebas, Sambas District. The results of her research indicate that the factors that influence the risk of rice farming income are the land area, the price of urea fertilizer, and farmer managerial ability. In the other side, Mulyanti (2015) conducted a study that aims to compare the level of productivity risks between soybean which planted in rice field and soybean which planted in the dry land and found that soybean planted in the dry land has a greater production risk than soybean which planted in paddy fields. There have been multiple researches conducted concerning the risk of production and risk of income. But none of those researches examine the amount of risk within the LIPM farm and non-LIPM farm. Hence, this study held to propose: 1) Comparison of the level of risk of production and risk of income between LIPM adopters and non-adopters. 2) Analysis of the determinant factors of risk of production and risk of income. The level of risk of production and income were measured by calculating the Coefficient of variation (CV).

II. Materials and Methods

The data used in this study is the primary data and it was started from September 2016 for collecting data until the finishing of the report which was fully completed in May 2017. This data was obtained through interviews with 60 farmers consisting of 30 farmers adopting the IPM landscape and 30 farmers who have not adopt the IPM landscape. The determination of sample size is considered to be able to represent a population which is relatively homogeneous. Respondents selected purposively to be adjusted for the purpose of comparing the risk of LIPM farming with non LIPM farm in Pliken Village which is located in Banyumas District, Central Java Province, Indonesia. The variation coefficient analysis (CV) is used to examine the amount of production risk. CV is a tool to measure the relative risk obtained by dividing the standard deviation by the expected value. With the standard deviation values already obtained, the coefficient of variation that describes the magnitude of the risk of production and price can be searched mathematically through the following formula (Salvatore, 2004).

$$CVp = \frac{\sigma p}{\gamma p}$$

CVp = variant coeffient of production
σ_p = standard deviation of production
γ_p = average production

The influence of input use on production risk was analysed by using the stages of production risk analysis following the requirements in Just and Pope (1978) cit. Asche and Ragnar (1999), known as the J-P Postulate. Several steps must be done to determine the effect of input on production risks. The first stage is to regulate the production function to determine the impact of input (production) factors on output. The second step is regression by using the residual of production function as dependent variable and production input as the independent variable.

$$\ln Y_p = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \delta_1 D_{OPT} + \delta_2 D_{ref} + \mu p$$
$$\ln \mu_p^2 = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \delta_1 D_{OPT} + \delta_2 D_{ref} + \mu$$

Y_p = yield (kg)	β_i = regression coefficient (estimated parameter) (i = 1 s/d 4)
μ_p^2 = risk of production	δ_i = regression coefficient*dummy variable* (i =1 s/d 2)
	D_{OPT} = Pest (1 = often distructed OPT; 0 = seldom distructed)
μ = residual	D_{ref} =cultivation ofrefugia flower (1= LIPM farm; 0 = non LIPM farm)
β_0 = intersept	
X_1 = size of farm (m^2)	X_3 = fertilizer (kg)
X_2 = seed (kg)	X_4 = labour (HKO)

Revenue is the amount of money earned from total farming production multiplied by the selling price of the product. While income is the difference between revenues and costs incurred in the production process of farming (Mubyarto, 1997 cit. Muzdalifah and Ani, 2012).

$$\pi = TR - TC$$

π = farm income (IDR)
TR = farm revenue (IDR)
TC = farm total amount of cost (IDR)

Having known the value of farm income, then the risk of income can be calculated using the formula coefficient of variation as follows.

$$CV_i = \frac{\sigma i}{\gamma i}$$

CV_i= variant coefficient of income
σi = standard deviation of income
γi = average income

In analysing the factors that influence income risk, regression is done with the same stages with regression analysis on production risk. However, this time the study to determine the effect of the number of inputs used to farm income. The regression model of revenue function and income risk function used are:

$$\ln Y_i = \alpha_0 + \alpha_1 \ln X_{1'} + \alpha_2 \ln X_{2'} + \alpha_3 \ln X_{3'} + \alpha_4 \ln X_{4'} + \theta_1 D_{ref} + \mu_i$$
$$\ln \mu_i^2 = \alpha_0 + \alpha_1 \ln X_{1'} + \alpha_2 \ln X_{2'} + \alpha_3 \ln X_{3'} + \alpha_4 \ln X_{4'} + \theta_1 D_{ref} + \mu$$

Y_i = farmer income normalized by output price (IDR)
μi^2= risk of income
μ = residual
α_0= intersept
α_i = regression coefficient(estimated parameter) (i = 1 s/d 4)
θ_1= regression coefficient*dummy variable*
D_{ref}= cultivation of refugia (1= LIPM farm; 0 = non LIPM farm)
$X_{1'}$= size of farm (m^2)
$X_{2'}$= seed price normalised by output price (IDR/kg)
$X_{3'}$= fertilizer price normalised by output price (IDR/kg)
$X_{4'}$= labour wage normalised by output price (IDR/HOK)

III. Results and Discussion

There are 66.67% of farmers who adopted IPM landscape, and 63.33% of farmers who have not adopted IPM landscape are in the productive age. Age factor affects farmer's performance in processing their land. Most of the respondents in this study had good performance regarding age. Good performance can be shown in the ability and work ethic of farmers in developing their farming. Based on the level of education, most of the farmers in Pliken Village both of who adopt LIPM and non-LIPM are educated in elementary school. But there is a difference between the two. Some farmers who adopt IPM landscapes attending high school. While the highest education owned by farmers, who do not adopt IPM landscape only until the stage of junior high school. It shows that the level of education influences the way of thinking and adaptation of farmers to technology. Farmers adopt IPM landscapes have a more open-minded way of thinking than farmers who do not adopt the IPM landscape making it easier for adopting farmers to absorb the information conveyed by agricultural extension workers.

Meanwhile, based on farming experience, most farmers of IPM landscape have experience for less than 26 years in managing the rice field. Unlike the non-LIPM farmers whose most of the farmers have become a farmer for 26 to 50 years. These results indicate that farmers who did not adopt the LIPM had more extended experience in cultivation than farmers adopting LIPM. With longer farming experience, farmers who do not follow the landscape IPM already feel comfortable with their conventional tillage. They argue that the application of IPM landscape on agricultural land can increase the risk of farming because of the concept of IPM landscape that encourages farmers not to use chemical pesticides at all on the land.

The number of seeds used in non-LIPM farming is higher than that used by landscape IPM farms. The use of seeds by the LIPM farm is 40.71 kilograms per hectare while the non-LIPM farm requires 47.90 kilograms per hectare of seed for their field. It can be caused by the application of the jajarlegowo planting system by the LIPM farm that can reduce the number of seeds required by the field.

Meanwhile, the amount of inorganic fertilizer used by LIPM farm is more significant than non-LIPM farm and it is not following thefertilizer recommendation delivered by the local counsellor. It is suspected to occur due to weather factors. Data collection is conducted when weather conditions at the study sites were extreme with high rainfall and strong winds that threaten the production of farming. Therefore, farmers anticipate this problem by adding morefertilizerthan that of the recommended doses. Farmers were worried if they keep on using fertilizer with the recommended amount, the fertilizer will soon flow into the deeper soil and away from the top soil which functioned asa place of the root of rice plants looking for nutrients. However, most of the LIPM farm tend to not use chemical pesticides at all, in contrast to non-LIPM farming that use chemical pesticides in the form of fungicides and insecticides that serve to control pest and fungal populations on land. Farmers of IPM landscape replaced the use of insecticides with refugia flowers as natural pesticides to control pest populations of rice plants and replace the use of fungicides with vegetable pesticides made routinely in farmer group meetings. Production risk analysis at Pliken Village rice farming indicated by the measurement of coefficient of variation.The coefficient of variation is particularly used to compare the relative risk between two or more farms. Farms with the highest coefficient of variation are the farmers with the most significant risk (Salvatore, 2004).

Table 01. Productivity and production risk of the rice farm

Description	LIPM farm	Non LIPM farm
Average productivity (ton/ha)	6,44	5,54
CV production	0,57	0,72

Source: Primary Data Analysed, 2016

Based on Table 01, it can be seen that farmers adopting Landscape IPM have higher productivity averages and lower variation coefficients than farmers who do not adopt a landscape IPM. Factors that play an essential role in determining the amount of production risk are local environmental conditions. If the climate supports the growth of cultivated crops but the type of soil in moist land and the risk of inviting the emergence of pest, then the farm will have high productivity, and production risks are also high. However, it only occurs when there are differences in environmental conditions on farms that are compared to the risks of production. In this study, both farmers adopt IPM landscape and farmers who do not adopt IPM landscape land adjacent to each other and being in the similarly typical environment so that these factors can not be used to distinguish between the two production risk.

Table 02. Factors affecting production and risk of production

Variables	Production Function		Risk of Production Function	
	Coefficient	t-sig	coefficient	t-sig
Konstanta	2,409	0,000	-3,341	0,338
Ln size of farm (X_1)	0,299***	0,008	-0,356	0,583
Ln seed (X_2)	0,603***	0,000	0,025	0,972
Ln fertilizer (X_3)	0,072	0,368	0,389	0,406
Ln Labour (X_4)	0,112	0,283	0,137	0,823
Dummyrefugia (D_{ref})	0,030	0,782	-0,518	0,441
Adjusted R^2	0,813		0,173	
F-stat	43,842		3,062	
F-sig	0,000		0,012	

***significance level 99% **significance level 95% * significance level 90%
Source: Primary Data Analysed, 2016

In terms of productivity, although the productivity of PHT landscape farming is much higher than that of the non-LIPM farm, in fact, their productivity has shown good value when compared to the average of rice productivity in Indonesia in 2015 of 5.34 tons per hectare (BPS, 2016). Although farming in Pliken Village has not used inputs in accordance with recommendations, but rice productivity in Pliken Village can outperform the average rice productivity of Indonesia. It shows that there is still a potential for Pliken Village's rice farming to improve its productivity by making various efforts, one of which is using production inputs that are in accordance with site-specific recommendations and extension recommendations. Based on two stages of regression can be seen that there are two variables that have a significant effect on the production of farming, i.e. land and seed area. However, there is only one independent variable that has a real impact. Based on two stages of regression can be seen that two variables significantly affect the production of farming, i.e. land and seed. However, pestis the only independent variable that has a significantly affect the production risks. While other independent variables such as land area, seed, urea fertilizer, labour, and refugia interest do not significantly influence the amount of production risk.

Size of a farm has a significant and positive effect on rice production in Pliken Village. It shows that the broader land that is planted with rice, the more output will be produced, so it is with the seed. The increasing number of seeds used in the land has a significant effect on increasing rice production. From the result of risk function regression, it is known that pest has the positive effect on production risk. So it can be said that the production owned by farming which often experiencing pest disturbance is significantly different to the farming production that seldom gets trouble of pest. The risk of farming production that is often experiencing pest disturbance is higher than the opposites. The difference is related to the efforts of pest control by farmers in Pliken Village. Based on the data obtained, known as much as 26.67% farmers IPM landscape often experience interference pest while farming the non-LIPM farm that often experiences interference pest is equal to 30%. These differences indicate that the percentage of the non-LIPM farm are more often experiencing pest disturbance than that the LIPM farm. However, the relatively small percentage difference demonstrates that LIPM farming is not yet optimal and still needs to be improved again. Although it's not directly impacted, the lack of intensive planting of refugia flowers on agricultural land in Pliken Village still causes pest problems that affect the amount of production risk. Refugia flowers that should be useful for controlling pests are not currently widely planted in any Pliken Village paddy fields.

Farm income

Based on the table above it can be seen that the income of LIPM farm per hectare is higher than a non-LIPM farm. The significant difference is in the total revenue held by LIPM farm is more significant than a non LIPM farm. It is closely related to the productivity of LIPM farm which is much higher than the non-LIPM farm. Productivity is measured in the form of harvested grain. With high productivity, adopting farmers can have higher per hectare income than farmers who do not adopt the landscape IPM. Besides, the total fixed costs incurred by non-LIPM farm are higher than that of landscape IPM farms. A significant difference is a cost of renting the land. However, these differences have no relevance to the IPM principles of the landscape implemented by farmers in Pliken Village. It happens because of the inclination of the non-LIPM farmers that tend to rent vast amounts of land so that the costs required for the lease of land becomes larger than the LIPM farmer. Besides, land location factors also affect the value of land rent, because the area close to the highway or village road will be more expensive rent compared to the opposite.

Risk of income

The coefficient of variation analysis was conducted to compare the income risk of LIPM farm with the non LIPM farm. It is essential to be used by farmers to consider whether by adopting the IPM landscape, the risk of income owned by the farm will be smaller or even higher. Based on Table 03, it is known that farmers adopting IPM landscape have higher average incomes than farmers who do not adopt IPM landscape. Nevertheless, the income risks that farmers adopt IPM landscape are slightly higher than non-LIPM farmers. This shows that higher income farms do not necessarily have lower income risks than the small income farms. The higher income risk of LIPM farming compared to the non LIPM farm can be caused by the allocation of production cost which causes the variability in farm income. The cost structure of the farm includes variable costs and fixed costs.

Table 03. The average income and risk of farmer's income

`

Description	LIPM Farm	Non LIPM farm
Average income(IDR/Ha)	15.343.151	10.123.936
CV of income	1,39	1,34

Source: Primary Data Analysed, 2016

Factors affecting the risk of income

The higher the risk of income a farmer has, the more likely the farmer will have less income. Farmers can make various efforts to control the risk of income they have. One way is to understand the factors that affect the income risks. The first thing to do is to regenerate the normalised income with the output price as the dependent variable and the normalised input prices with the output price as the independent variable. After regression of revenue function is done, then earn regression of income risk function with residual squared logarithm as dependent variable and input prices have been normalised with output price as the independent variable. Based on Table 04, it can be seen that size of a farm is positive and significant to income risk. It has the meaning that the broader land that is planted, the higher the risk of income owned by farmers. It is related to the costs that may be incurred by farmers when the farmers broaden the land area. Rice is the primary commodity where the area of land owned is the same as the area of land planted with rice, hence the broader land of farmers, the more prominent cost required to manage the land. The expenses to be paid by farmers who have large land area are the cost of land rent or a tax as well as the cost of more extensive inputs such as the cost for fertilizer, seeds, and pesticides.

Based on the results of the regression analysis of income and income risk functions, the effect of the wage of labour on income is adverse and significant, while the impact on income risk is positive and significant. Wages of labour is one of the problems faced by rice farmers in Pliken Village. Wages of labour that initially only ranged from IDR 30,000 to IDR 35,000 has now risen to reach IDR 50,000 for approximately 7 hours of work. The problem is then felt troublesome for farmers, especially those who are not in productive age so that farmers need more labour outside the family to cultivate the land.

Table 04. Factors affecting income and risk of income

Variables	Income Function		Risk of Income Function	
	Coefficient	t-sig	coefficient	t-sig
Konstanta	15,051***	0,000	-21,835***	0,000
Ln size of farm ($X_{1'}$)	0,092	0,392	1,223***	0,001
Ln seed price per output price ($X_{2'}$)	0,020	0,939	0,485	0,562
Ln fertilizer price per output price ($X_{3'}$)	0,019	0,901	0,688	0,180
Ln wage labout per output price ($X_{4'}$)	-3,450***	0,000	3,301***	0,003
*Dummy*Refugia (D_{Ref})	0,402**	0,020	0,235	0,669
Adjusted R^2	0,78		0,144	
F-stat	44,236		2,989	
F-sig	0,000		0,019	

*** significance level 99%; ** significance level 95%; * significance level 90%
Source: Primary Data Analysed, 2016

In profit function theory, it is assumed that every farmer always aims to maximise his farm profits. If the independent variable of labour wage instinct to decrease income and increase the risk of income, it indicates that the use of labour by the farm in Pliken Village should be reduced because it has exceeded the optimum point so that farmer cannot get maximum profit. Independent variables of refugia are used as dummy variables to signify farmers who follow IPM landscape and those who are not. Based on the result of regression analysis, it can be seen that there is a significant difference between the income of IPM farm landscape with an IPM farm landscape. Also, a positive regression coefficient indicates that LIPM farm income is higher than that of a LIPM farm.

IV. Conclusion

The risk of producing farmers adopting the IPM landscape is smaller than that of farmers who do not adopt the IPM landscape. Farmers who have not adopted the LIPM are advised to begin adopting the LIPM to optimize the implementation of LIPM on Pliken Village rice field altogether. Although the LIPM production risk is proved to be smaller, but the application of LIPM has not been able to give a real difference to the production of rice farming in Pliken Village. Additionally, factors that affect

Published with open access at journalbinet.com
EISSN:2412-8279,

production risk significantly are pests due to the role of the refugia interest that is not yet optimal in controlling the pest population. Thus, farmers should be more careful in allocating costs for their use of inputs and still follow the recommendations of 3: 2: 5 fertilizer. When they have to face an extreme weather, instead of adding chemical fertilizers, it would be better if farmers increase the amount of organic fertilizers which cost much cheaper than chemical fertilizers. Factors that have a significant effect on income risks include size of farm and labour wage. Thus, due to the continuous increase in fees, it is preferable that the number of off-shore labourers employed reduced due to the increase in performance which should meet the needs of the labour force even with fewer people.

Acknowledgements

The author would like to express a loads of gratitude for the Dean of Faculty of Agriculture, Universitas Gadjah Mada who has been very supportive throughout the process of this researchfrom the preparation of permission files that must be taken care of, collecting data, until the submission of this research report. Besides, the biggest appreciation must be delivered to every single partiesinPliken Village who have been immensely cooperativefor this research.

V. References

[1]. Asche, F. & Ragnar, T. (1999). Modelling production risk with a two-step procedure. *Journal of Agricultural and Resources Economics*, 24(2), 426-429.

[2]. Central Bureau of Statistics (BPS), 2016. Productivity of Paddy Field in Indonesia by province. bps.go.id. Accessed in 1 March 2018.

[3]. Dumasari, Budiningsih, S., Darmawan, W. & Santosa, I. (2017). Various determinant factors of production technology adoption in creative souvenir micro enterprise. *Journal of Arts and Humanities*, (6)10, 2. https://doi.org/10.18533/journal.v6i10.1273

[4]. Edwards, C. A., Rattan, L., Patrick, M., Robert, H. M. and Gar H. (1990). Sustainable Agricultural Systems. Soil and Water Conservation Society, Iowa.

[5]. Kumar, L., Yogi, M. K. & Jaba, J. (2013). Habitat manipulation for biological control of insect pests: A review. *Journal of Agriculture and Forestry Sciences*, 1(10), 27-31.

[6]. Kumbhakar, S. C. & Tsionas, E. G. (2010). Estimation of production risk and risk preference function: a nonparametric approach. *Annals of Operations Research*, 176, 369- 378 https://doi.org/10.1007/s10479-008-0472-5

[7]. Kurniati, D., Slamet H., Sri, W. & Any, S. (2014). Risk of Income at Siam Orange Farm in Sambas District. *Journal Social Economic of Agriculture*, 3(2), 12-19.

[8]. Lawalata, M. (2013). Relative Efficiency Analysis and Farmer Behavior on Risk of Red Onion Farming in Bantul District. (Master Thesis). Available on Universitas Gadjah Mada Thesis & Dissertasion Database.

[9]. Mulyanti (2015). Production Risk of Soybean Farming in East Java. (Undergraduate Thesis). Available on Universitas Gadjah Mada Thesis & Dissertasion Database.

[10]. Muzdalifah, M. & Ani, S. (2012). Revenue and Risk of Rice Farm Production of Irrigation And Non-Irrigation Area in Banjar District of South Kalimantan. *Journal Social Economic of Agriculture*, 1(1), 65-74.

[11]. Salvatore, D. (2004). Managerial Economics in a Global Economy Fifth Edition. South Western Thomson Coorporation, USA.

[12]. Suharyanto, Jemmy, R. & Nyoman, N. A. (2015). Risk Analysis of Wetland Paddy Production Production in Bali Province. *Journal of Agriculture*, 1(2), 70-77.

[13]. Tahir, A. G., Dwidjono H. D., Jangkung H. M. & Jamhari (2011). Soybean Production Risk Analysis in various Type of Land in South Sulawesi. *Journal of Socio-Economic Agriculture*, 8(1).

[14]. Wahyuni, R., Retno W. & Supriyadi (2014). Enhancing insect predator by using flowering plants in rice field. *Journal of Agronomy Research*, 2(5), 40-46.

[15]. Zakirin, M., Erlinda Y. & Novira, K. (2013). Risk Analysis of Rice Farming in Tidal Lines In Pontianak District. *Journal Social Economic of Agriculture*, 2(1), 75-76.