Implementation of conservation farming and its effect on farmers' income: A study on citrus farmers in Petung Sewu Village, Dau District, Malang Regency

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SINTA 2

Implementation of Conservation Farming and Its Effect on Farmers' Income: A Study on Citrus Farmers in Petung Sewu Village, Dau District, Malang Regency

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Abstract

This study aims to analyze the effect of applying vegetation and mechanical conservation on the income of citrus farmers. The method of determining the sample was simple random with a sample of 86 people. Data analysis used the income function model with multiple linear regression method. The results showed that the application of conservation that had a significant effect on income was the application of vegetation conservation, while other variables that had a significant effect were land area, plant maintenance costs, chemical fertilizer costs, pesticide costs and labor costs. The vegetation conservation is the best conservation, and profitable that is widely applied by farmers. This model has a significant effect on farmers' income with a significance level of 90 percent. Thus, the application of conservation adapts to land conditions, and increases the income of linear farmers with the ability of farmers to finance

Keywords: *Income, Citrus Farming, Conservation, Mechanics, Vegetation.*

INTRODUCTION

The increasing economic needs of the community along with the increase in population, demands more creative and productive land management. Community needs must be met, but the long-term need for sustainable agriculture, which is the main support for community food, is also very important to do. This is because agriculture has a vital role for the welfare of society. Apart from being a producer of food, agriculture also absorbs a large amount of labor (Ratag et al., 2016), both from the main sub-system and its derivative sub-systems. Various tropical food commodities can be cultivated in Indonesia as food commodities, as well as industrial raw material commodities. Indonesia's agro ecology and agro-climate, which are supportive for the development of various tropical commodities, are advantages that are not owned by many countries in the world. With the support of abundant natural resources plus human resources who is ready to work, the agricultural sector is a mainstay sector in poverty alleviation programs and improving community welfare. Gunawan & Reiza (2017), found that the availability of ready-made human resources in development could reduce poverty and improve people's welfare. Therefore, human resource management is very important, especially in land management to increase productivity and support the achievement of agricultural development goals.

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The potential of land that can be increased in productivity is widely spread throughout Indonesia. In East Java, Malang Regency is one area that still has potential land availability that can be managed more productively, both for the cultivation of seasonal crops and annual crops. Management of land with a certain slope, using certain conservation adapted to the level of the slope, because land conservation (Kiage, 2013) is an effective treatment adapted to the conditions needed to increase and or maintain farm productivity. In addition, the commodities cultivated are also adjusted and in general are annual plants. Widyawati & Nurbai (2017) in their research stated citrus is one of the annual horticultural crops that are widely cultivated throughout Indonesia, including in Malang Regency. Even in the cultivation area of Malang Raya, superior citrus of Batu 55 have been found. Various varieties of citrus are cultivated by farmers on dry land and have a certain slope. This is also one of the strategies to increase dryland productivity by implementing conservation farming, in order to support the achievement of agricultural development goals (Muyan & Mariay, 2017). Conservation farming is expected to protect land resources to support sustainable agriculture and increase benefit, therefore its success is largely determined by all farming actors and stakeholders (Pranadji, 2006).

The success of conservation farming has a positive impact on the welfare of farmers by increasing household income. Alitawan & Sutrisna (2017) concludes that a significant factor in increasing farmers' income from citrus conservation farming is the number of productive plants and land area. In addition to increasing farmers' income, in the long-term conservation farming also has a positive impact on increasing soil and plant productivity. Thus, the increase in farmers' income because of conservation farming cannot absolutely be achieved in the short term. The research of (Sulistyono et al., 2013), states that conservation farming by making terraces, planting reinforcement plants with annual plants, making water absorption channels, making drainage channels, using manure, and using plant litter, in the short term does not show any effect on farmers' income. Another study conducted by (Darmadi et al., 2014), states that the application of conservation farming with low, medium and high categories has an influence on farmers' income, where farmers' incomes are getting higher along with the high level of implementation of conservation farming. Akoit et al. (2019), strengthen the results of comparative analysis of citrus farming with conservation and conventional applications, where conservation farming provides farmers with higher incomes.

Conservation farming is not only limited to agricultural land, but also includes reforestation activities in forest and land rehabilitation programs (Agustinus et al., 2013), which plays a role in supporting the sustainability of soil productivity, minimizing the rate of critical land with community involvement, which has an impact on increasing income. Basri et al. (2018) examined the development of conservation-based agro-ecosystem areas and the result is that conservation-based agro-ecosystems have an influence on farm income. In addition, the use of biochar soil amendments and organic manure fertilizers can also improve farming performance on dry land and degraded land (Asnah et al., 2018). This is reinforced by Sumarni et al. (2010) that the use of organic matter from livestock manure can increase the nutrients in the soil and improve the physical and biological properties of the soil so that it can increase productivity and affect the increase in farm income.

Petung Sewu Village is one of the villages in Dau District, Malang Regency, where the community cultivates citrus on dry land with varying slopes, so that farmers implement conservation farming. However, the conservation applied by farmers is still limited to the ability of farmers to finance which on average is still low. Thus, farmers apply conservation

farming with several methods, including the use of cover crops, the use of organic matter, the individual terrace method and bench terraces, and the construction of drainage channels. Farmers realize that the condition of the land they cultivate requires special treatment in order to increase its productivity, thus having an impact on family income. Therefore, this study was conducted with the aim of analyzing the effect of applying vegetative and mechanical conservation technology on the income of citrus farmers

METHODOLOGY

This research was conducted in PetungSewu Village, Dau District, Malang Regency. Determination of the location using the purposive method, according to Sugiyono (2016) with the consideration that the location has dry land with varying slopes and farmers apply citrus plant conservation farming, so that it can answer the research objectives.

Farmers in the research location apply 2 types of conservation, namely vegetative conservation, and mechanical conservation. However, in data analysis, three kinds analysis were carried out, namely the analysis of factors that affect the income of citrus farmers with vegetative conservation (Y1), analysis of factors that affect the income of citrus farmers with mechanical conservation (Y2), and analysis of factors that affect the income of citrus farmers with vegetative and mechanical conservation (Y3). The population of this study were all citrus farmers as many as 201 people who implemented conservation farming, and were divided into 2 groups where as many as 100 people were farmers with mechanical conservation farming and 101 people with vegetative conservation farming. The research sample is 100 people which is formulated as,

$$n = \frac{N}{1+N.e^2}$$

Where n is sample size; N is population; and e^2 = Data retrieval error rate 0.10%.

The total sample of 86 people was divided into 2 groups, of which 43 farmers applied vegetative conservation farming, and 43 other farmers applied mechanical conservation farming. Sampling using simple random sampling method (Sugiyono, 2016). Vegetative conservation carried out by farmers at the research site includes planting cover crops, using organic matter, planting land strengthening plants or hedges, and a combination of them, while mechanical conservation carried out by farmers includes making bagku terraces, individual terraces and a combination of them. To measure vegetative conservation and mechanical conservation (X1) carried out by farmers, the Sturges formula is used according to Sugiyono (2016), as follows:

$$\mathbf{K = 1+ 3, 3 \log n}$$

Where K is amount of class; n is amount data; Log is Logarithm.

The method of data analysis in this study used multiple linear regression analysis as follows:

$$Y_1 = a + b_1X_1 + b_2 X_2 + b_3X_3 + b_4X_4 + b_5X_5. + b_6X_6 + e$$

Where Y_1 is Citrus farming income with vegetative conservation (Rp/Ha/year); X_1 is Application of Vegetative Conservation (Surges Model); X_2 is Seed cost (Rp/Ha/year); X_3 is Chemical fertilizer cost (Rp/Ha/year); X_4 is Manure cost (Rp/Ha/year); X_5 is Pesticide cost (Rp/Ha/year); X_6 is labor cost (Rp/Ha/year); b_1–b_6 = Regression coefficient; and e = *error term.*

$$Y_2 = a + b_1X_1 + b_2 X_2 + b_3X_3 + b_4X_4 + b_5X_5. + b_6X_6 + e$$

Where Y_2 is Citrus farming income with mechanical conservation (Rp/Ha/year); X_1 is Application of Mechanical Conservation (Sturges Model); X_2 is Seed cost (Rp/Ha/year); X_3 is Chemical fertilizer cost (Rp/Ha/year); X_4 is Manure cost (/Rp/Ha/year); X_5 is Pesticide cost (Rp/Ha/year); X_6 is Labor cost (Rp/Ha/year); b_1–b_6 is Regression coefficient and e is *error term.*

$$Y_3 = a + b_1X_1 + b_2 X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_6X_{6+} e$$

Where Y_3 is Citrus farming income with vegetative and mechanical conservation (Rp/Ha/year); X_1 is Application of Mechanical and Vegetative Conservation

(Sturges Model); X_2 is Farming experience (Year); X_3 is Land area (Ha); X_4 is Chemical fertilizer cost (Rp/Ha/year); X_5 is Manure cost (/Rp/Ha/year); X_6 is Pesticide cost (Rp/Ha/year).
$X_7$is Labor cost (Rp/Ha/year); b_1–b_7 is Regression coefficient; and e is *error term*.

The data in this study were tested with the classical assumption test, which includes normality, and multicollinearity tests.

RESULT AND DISCUSSION

The results of the classical assumption deviation test from the data in this study include normality test and multicollinearity test, considering that the data in this study is cross section data. Based on the normality test, it was found that the data in this study were normally distributed from the results of the Kolmogorov-Smirnov Test, a value of 0.181 (>0.05) was obtained at the 95% confidence level in the vegetation conservation farming data, and 0.095 (>0.05) in the conservation farming mechanical data, and 0.072 (>0.05) in the combination of vegetation conservation and mechanical farming. While the results of the multicollinearity test showed that, there was no multicollinearity or the independent variables did not affect each other. In other words, the independent variable only affects the dependent variable. This can be seen from the value of VIF (variance inflation factor), all independent variables have a value <10, which means that there is no multicollinearity, in vegetation conservation farming, mechanical conservation and in the combination of vegetative and mechanical conservation farming.

The results of the analysis of the factors that influence the income of conservation farming show a coefficient of determination (R^2) of 0.72, for farms that apply vegetation conservation, and 0.68, for farms that apply mechanical conservation. These results mean that 0,72 of the selected independent variable combinations, which include the application of conservation, plant maintenance costs, chemical fertilizer costs, manure costs, pesticide costs and labor costs, affect the dependent variable on vegetation conservation farming income, while for mechanical conservation farming only 0,68. The value of the coefficient of determination is good if it is close to 1. And the two models show the value in question. The selected independent variable can explain the dependent variable of citrus farming income; the rest is influenced by variables outside the model. The magnitude of the coefficient of determination indicates that the selected model is quite good, because the variation of the selected independent variable can explain the dependent variable with a precision close to 1. This result is strengthened by the f statistic test, where simultaneously all independent variables have a significant effect on the dependent variable with a confidence level of 0,99. The coefficient of determination is higher when the sample is combined, where between farmers who apply vegetation conservation and mechanics are analyzed simultaneously, so that the coefficient of determination becomes 0.84, which means that 0,84 of the selected independent variables are able to explain the dependent variable.

Table 1
Factors Affecting Vegetative Conservation Farming Income

Model	Coefficients	T	Sig.
(Constant)	-3958,50	-2,25	0,03
Application of vegetation conservation (X1)	129,62	1,76	0,09
Plant maintenance cost (Rp/Ha/year) (X2)	1,28	4,22	0,00
Chemical fertilizer cost (Rp/Ha/year) (X3)	2,07	2,58	0,01
Manure cost (Rp/Ha/year) (X4)	0,64	1,62	0,12
Pesticide cost (Rp/Ha/year) (X5)	1,83	2,23	0,03

Labor cost (Rp/Ha/year) (X6)	1,23	1,75	0,09
R Square	0,72		
F-Stat	14.879		0,00

Source: Managed of primary data, 2021.

Individually, the independent variables that significantly affect the dependent variable on farmers' income are, among others: the variable application of vegetative conservation, with a confidence level of 0.90. The regression coefficient of 129.62 means that the increase in the application of vegetative conservation by 1 has a significant effect on the increase in farmers' income by Rp 129.62. Farmers carry out vegetative conservation by applying several models, including planting cover crops, using organic matter, planting land strengthening plants or hedges, and a combination of them. This technique is carried out by farmers consistently from year to year, because farmers feel that the technique is suitable for the conditions of the land they manage, which has a slope of less than 25 percent, and does not require a lot of money. Farmers have the perception and experience with vegetation conservation techniques that can increase land productivity and cultivated citrus.

Variable plant maintenance costs have a significant effect on farmers' income, with a confidence level of 0,99. The regression coefficient is 1.28 for vegetation conservation farming and 3.45 for mechanical conservation farming, and 1.87 for a combination of vegetation conservation and mechanical farming. This means that every Rp 1 increase in maintenance costs will increase income by Rp 1.28 in vegetation conservation farming and Rp 3.45 in mechanical conservation farming, and Rp 1.87 in combined conservation farming. The increase in maintenance costs is linear with the increase in farmer's income. This is because citrus plants as a commodity cultivated by farmers are productive plants, so to maintain their productivity they need plant care. The treatments carried out by farmers include pruning unproductive branches, giving plant hormones, removing parasites, strengthening branches and trees and preventing diseases on the trunk. The cost of plant maintenance in this study is separated from the cost of fertilizers, pesticides and labor costs.

The cost of chemical fertilizers has a significant effect on farmers' income with a confidence level of 0,99. The regression coefficient is 2.07 on vegetative conservation farming and 0.38 on a combination of vegetation conservation and mechanical farming. This shows that an increase of Rp 1 in the cost of chemical fertilizers will increase farmers' income by Rp 2.07 in vegetative conservation farming and Rp 0.38 in a combination of vegetation conservation and mechanical farming. Types of chemical fertilizers used by farmers include nitrogen, phosphorus and potassium fertilizers, as well as NPK compound fertilizers. However, because the average farmer has limited capital, the use of chemical fertilizers is still below the recommended dose. The results of the study by Thamrin, et al (2015), recommended that fertilization on citrus pamelo plants for land with moderate nutrient status was 0.99 kg Urea, 1.16 kg SP-36, and 0.76 kg KCl per plant per year. Meanwhile, the average farmer dose is only 0.78 kg per plant per year for N fertilizer, 0.95 kg P fertilizer and 0.5 kg K fertilizer per plant per year. Thus, it is still possible to increase the cost of using fertilizers, so that the increase in the cost of chemical fertilizers can actually increase farmers' income.

The cost of pesticides has a significant effect on farmers' income with a confidence level of 0,99. The regression coefficient is 1.83 in vegetative conservation farming and 2.83 in mechanical conservation farming, indicating that every Rp 1 increase in

pesticide costs will increase income by Rp 1.83 and Rp 2.83 in each farm. Citrus farming in the study area requires a lot of pesticide use to avoid the risk of pest and disease attacks that result in crop failure. So far, farmers use pesticides, which are still below the recommended dose of 250 ml for 8 sprays with a dose of 2 ml per 1 liter of water. Meanwhile, farmers spray only 1 ml per 1 liter of water, so 250 ml of pesticide is used for 16 sprays. Farmers spray from flowering citrus plants to citrus fruits before ripening. Meanwhile, the recommended spraying is to start the plants that have not flowered until before harvest to avoid a decrease in plant productivity because of the of flowers and young fruit. Therefore, the results of this study are different from the theory that should be, an increase in the cost of pesticides should reduce income, but in this case, and it actually increases farmers' income. Lhachola et al. (2018) research results confirmed the results of this study that pest and disease attacks, the lack of use of chemical fertilizers and pesticides and the lack of knowledge of farmers in garden management, have caused a decline in citrus production in Chihukha.

Table 2
Factors Affecting Farming Income Mechanical Conservation

Variable	Coefficients	T-value	Sig
Constant	-3432,72	-0,50	0,14
Application of mechanical conservation (X1)	107,79	0,51	0,52
Plant Maintenance Cost (Rp/Ha/year) (X2)	3,45	3,02	0,00
Chemical fertilizer cost (Rp/Ha/year) (X3)	-1,08	0,59	0,16
Manure cost (Rp/Ha/year) (X4)	1,20	0,56	0,58
Pesticide cost (Rp/Ha/year) (X5)	2,83	1,43	0,00
Labor cost (Rp/Ha/year) (X6)	4,20	2,22	0,00
R Square	0,68		
F-stat	13,180		0,00

Source: Managed of primary data, 2021

Labor costs have a significant effect on the income of citrus farmers with a confidence level of 0,99. The regression coefficient of 1.23 indicates that an increase in the use of labor cost by Rp 1 will increase income by Rp 1.23. This is different from the theory because an increase in labor costs should have a significant effect on reducing income, but what happens is it increases income. The workers who work in citrus farming are, on average, family members of the respective garden owners. Workers outside the family are only used when doing fertilizing and cleaning weeds around citrus plants, and during harvesting. Some of the farmers at harvest time do not use paid labor, but they sell in bulk. In this study, workers in plant care were separated from fertilizing workers. Therefore, it is still possible to increase the use of labor, so that the addition of labor costs does not reduce income, but instead increases income. The variable cost of fertilizing labor is also related to the cost of fertilization. In this study, the cost of chemical fertilizers and manure both have positive regression coefficients, which means an increase in their use does not decrease income but on the contrary increases income, due to the physical use of these inputs, which can still be increased.

Table 3
Factors Affecting Farming Income Vegetative and Mechanical Conservation

Model	Coefficients	T-value	Sig
(Constant)	919,33	0,68	0,50
Application of conservation (X1)	0,45	0,52	0,61
Land area (Ha) (X2)	15,70	4,35	0,00
Plant maintenance cost (Rp/Ha/year) (X3)	1,87	3,43	0,00
Chemical fertilizer cost (Rp/Ha/year) (X4)	0,38	5,92	0,00
Manure cost (Rp/Ha/year) (X5)	0,64	0,90	0,37
Pesticide cost (Rp/Ha/year) (X6)	-0,41	0,50	0,62
Labor cost (Rp/Ha/year) (X7)	1,00	1,49	0,14
R Square	0,84		
F-stat	59,580		0,00

Source: Managed of primary data, 2021

Variable area of land has a significant effect on the income of citrus farming with vegetation conservation and mechanics. The regression coefficient is 15.70, meaning that every 1 square meter increase in land area will increase the income of citrus farmers by Rp 15.70. Citrus is an annual plant. It has a strong, tall, strong rooted, branched and leafy stem. Therefore, it requires a large area of land, and this will be linear with production, where the wider the area, the more plant population and the more production the higher the income of farmers. The results of this study are the same as the results of Asnah (2017), where land area has a significant effect on corn production and peanut production. Citrus production is largely determined by the use of inputs and will also affect the amount of production costs, as well as farmers' income. The results of research by Abbas et al. (2017) and Siagian et al. (2021), differ from the overall results of this study, that several factors that also affect citrus production are socio-economic factors (age, education, experience, skills and income of citrus farmers). On the other hand, natural factors (rainfall) and pest and disease attacks as well as low land fertility are also limiting factors for citrus farming productivity.

CONCLUSION

The application of conservation technology that is widely applied by farmers and has a significant effect on income is vegetation conservation. Other independent variables that have a significant effect on farmers' income are plant maintenance costs, chemical fertilizer costs, pesticide costs, labor costs and farm area. The application of conservation technology adapts to land conditions. The average land slope of farmers is less than 25 percent, with limited financial capacity, farmers apply more vegetation conservation. Increasing farmers' income is linear with the ability of farmers to finance citrus farming.

The use of chemical fertilizers needs to be increased to the recommended limit to increase farmers' production and income, but it can also use input substitution with the use of more manure or organic fertilizers than before. The application of vegetation technology needs to be maintained and improved by using plants that do not compete with citrus plants as the main crop. Further research needs to be done in terms of dose of input use and crop productivity.

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