Decision analysis of pepper (*Piper nisrum L.*) farmers in choosing organic farming system

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Abstract. All Organic farming considered as one of the solutions to the green revolution. Organic farming business is relatively profitable because the selling price of organic commodities is more expensive than non-organic. On contrary farmers’ interest were still lacking in organic farming. This study aims to analyze the influences factors of pepper farmers in decision making on choosing organic farming systems, so as to analyze the ratio of income levels of organic pepper farmers compared to non-organic pepper growers. Descriptive analysis, logistic regression analysis and income comparison analysis was applied. The results showed that age, level of education and price were some factors that influence the decision of pepper farmers on choose an organic farming system. Furthermore, organic pepper farmer incomes is higher than the income of non-organic pepper farmers by a difference at IDR 11,884,591.3.

1. Introduction

Organic farming is an agricultural cultivation technique which oriented towards the utilization of natural materials (local) without using synthesis chemicals such as fertilizers and pesticides (except materials allowed) [1]. According to the United States Department of Agriculture, the use of chemicals such as chemical fertilizers, chemical pesticides or other chemicals, were replaced by the use of natural fertilizers and pesticides in organic agricultural production systems [2]. The characteristic of organic farming is using local varieties, fertilizers, and organic pesticides to preserve the environment [3]. Therefore, organic farming become one of the solutions for the green revolution that is considered to cause environmental damage, especially land whose productivity is decreasing [4].

Based on empirical research, a broad range of factors have been identified as relevant in influencing farmers’ decisions to adopt organic production. These factors include the socio-economic characteristics of the farmers, farm characteristics, farmers’ attitudes and perceptions of risk, sources of information, national agricultural policies, governmental and non-governmental organisation (NGOs) initiatives, and membership in a farmer association. [5] The trend of organic farming in Indonesia was introduced to some established farmers whom acknowledge the advantages in organic farming system, through a government policy called *Go Organik 2010*. It is intended to be grow, be facilitated, directing and regulating the development of organic farming [2]. The seriousness of the government in order to develop organic agriculture is shown by the issuance of the Decree of the

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Minister of Agriculture Number 64/Permentan/OT.140/ 5/2013 on concerning the Organic Agriculture System. The ministerial regulation of agriculture states that the organic farming system is a holistic production management system to improve and develop the health of the agroecosystem, including biodiversity, biological cycles and soil biological activities. There are no official statistical data on organic agricultural production in Indonesia, but it was mentions rice, vegetables, fruits, coffee, chocolate, cashew nuts, herbs, coconut oil, spices and honey are the main organic agricultural products which produced in Indonesia, and pepper (Piper nisrum L.) as one of the organic spices developed [4].

Pepper has been used both domestic and foreign, especially as ingredients in the food industry, pharmaceutical industry so as fragrance ingredients [6]. The main producing centers of pepper in Indonesia are Bangka Belitung, Lampung, South Sumatra, East Kalimantan, Central Kalimantan and South Sulawesi. Bulukumba regency took place as the five largest pepper production in South Sulawesi [6]. Rilau Ale sub-district, especially in Swatani Village is an area that develops many pepper plants in district. Some of pepper farmers in this region had adopted organic farming systems and applied to their land, but there are still many farmers who still work on pepper crops non-organically. Some studies that compared organic and non-organic farming systems showed that organic farming is more profitable than non-organic. This contradicts on the fact that only few farmers are interested in adopting the agricultural system organically.

Based on empirical research, a broad range of factors have been identified as relevant in influencing farmers’ decisions to adopt organic production. These factors include the socio-economic characteristics of the farmers, farm characteristics, farmers’ attitudes and perceptions of risk, sources of information, national agricultural policies, governmental and non-governmental organisations (NGOs) initiatives, and membership in a farmer association. From the description of the important and knowing still lack of farmers who apply the organic pepper farming system, it is considering important to analyze the influence factors in decision making of pepper farmers in choosing organic farming systems and analyze the comparison of income levels of organic pepper farmers and non-organic pepper farmers in Swatani Village, Rilau Ale District, Bulukumba Regency.

2. Research methods
This research was conducted in Swatani Village, Rilau Ale District, Bulukumba Regency, South Sulawesi Province. The determination of the research location was done purposively (intentionally), with the consideration of Rilau Ale District has the largest amount of pepper production in Bulukumba Regency. Survey method and questionnaire were used to collect data. Cluster sampling were determined to get the selection of sample farmers respondents by dividing the organic farmers and non-organic farmers which attempt as many as 23 organic pepper farmers and 22 non-organic pepper farmers.

The farmer’s decision on choosing the agricultural system was analyzed by logistic regression with exogenous modifiers namely educational level, farm costs, length of farming, farmer ages, and intensity stricken with pests also prices. Farmers’ income for both agricultural systems (organic and non-organic) was calculated through the difference of its total revenue and total expenditure. Total Revenue gained from the value of pepper sales, while the total expenditure is counted from the overall cost that been used in pepper farming in the form of fixed costs and variable costs.

3. Result and discussions

3.1. Identity of respondent farmer
The identity of the respondent farmer describes their status in his/her farming activity. The identity of the respondent farmers in Swatani Village were derived from their ages, level of education, experience of farming, number of family dependents, and land area. Respondent farmers in Swatani Village almost entirely (98%) classified in the productive age range of 27 - 64 years, both organic and non-organic farmers. The level of education of organic pepper farmers is relatively higher than non-organic farmers, where about 61% of organic farmers graduated from high school to college, the rest are
elementary and junior high school educated. While non-organic pepper farmers dominated (77%) by elementary and junior high school educated, even some of them were never went to school and the remaining about 23% were high school educated. Organic pepper farmers who have experience in pepper cultivation on range over than 25 years is 43%, slightly higher than non-organic pepper farmers which only 41%. The number of dependents both in organic and non-organic pepper farming families showed the same figure of 91% had family dependents less than 5 people. Regarding of arable land, as many as 26% of organic farmers have more than 1 Ha of arable land, meanwhile non-organic farmers only had 14%.

3.2. Stages of activities applied in organic pepper and non organic pepper farming system
Swatani village which is located in Bulukumba Regency, considerably very suitable for pepper cultivation. Most farmers grow pepper in an effort to make ends meet. They usually grow pepper once a year, either by uses organic or non-organic farming systems.

There are several stages of activities in pepper farming, both for organic and non-organic pepper, include:

3.2.1. Land processing. This was an opening activity that started by clearing land from civity grass or the remains of previous plants by using hoe, sickle or machete. After that, burn the land and make a planting hole with a size of 40cm x 40cm and provide fertilizer around the hole and in the hole to neutralize the soil PH. For organic pepper farming using organic fertilizer (KAPTAN), while non-organic farming using urea fertilizer, NPK, Phonska, and KCL.

3.2.2. Nursery. Activities on using cuttings seeds obtained from previous crops or seeds purchased from agricultural shops in Bulukumba Regency. Making cuttings seeds by taking plants to be cut and soaked for 30 minutes to 1 hour in water given a little sugar to stimulate plant growth. After that, cuttings are planted in polybags and given a plastic round. After 21 days to 1 month, seedlings are ready to be moved to land by farmers.

3.2.3. Planting. A monoculture treatments by applied planting distance of 2 m x 2 m. For organic pepper farming, Cultivation holes are given trichoderma (organic fertilizer) first before the pepper seedlings are planted.

3.2.4. Fertilization. This activity attempt when the plant is already 3 months old. For organic pepper farming, tripochompas and agrodyke were used as liquid fertilizer. This liquid was made by the farmers, which are the ingredients collected from kitchen waste. Tripochompas fertilizer is given 3 times a year and agrodyke is given 2 times a year. As for non-organic farming using urea, KCL, Phonska and NPK as fertilizer and applied 2 times a year.

3.2.5. Pest and disease control. This activity done by squirt out pesticides on plants that affected by pests and diseases. Organic farming used vegetable pesticides which made by farmers, while non-organic farming using chemical pesticides.

3.2.6. Harvesting. Harvesting activity happened when the plant is reach 8-10 months old and doing by picking. Pepper labelled ready to harvest when there are found several colors, namely red, yellow and green in one stalk, where the green pepper fruit reaches 75%.

3.2.7. Post-harvest. Generally, farmers are tend to cultivate the pepper fruit till it become white pepper because the price level of white pepper is better than black pepper. The processing of pepper seeds into white pepper begins with soaking. The peppercorns that have been picked are put in a sack and soaked in water for 10 to 12 days. After the rind is fermented, the peel is produced from the seed by
rubbing or trampling until the seeds are clean from the skin of the fruit. Then the pepper seeds are washed and dried. Pepper seeds that have been dried and have met the water content standard for storage are marked with seeds that are difficult to break when bitten. Furthermore, sorting and cleaning were carried out, then packaging is done by using sacks to be stored or marketed.

3.2.8. Marketing. Numerous of organic pepper farmers sell their product to village-level collectors, but some of them also sell to collector force even the purchase price of village-level collectors is higher than the collectors force, it happened caused by the farmers are no longer bothered to bring their produce to the market and no need to spend transport costs to markets their pepper.

3.3. The decision determinant of pepper farmers on choosing organic farming system

The decision making by the respondent farmers in determining the farming system using organic or an-organic systems is also influenced by their backgrounds, namely: Age, Education Level, Length of Farming, Intensity of Pests, Cost of Farming and Price. These factors then analyzed by logistic regression in which the response modifiers were categorized as Y = 0 (respondents chose non-organic) and Y = 1 (respondents chose organic). The results of logistic regression analysis employed the SPSS application can be seen in table 1.

Table 1. Result of logistic regression analysis of pepper farmers’ decision to choose organic farming system in Swatani Village, Rilau Ale District, Bulukumba Regency, 2017.

| Variable          | Coef (B) | Sig (P) |
|-------------------|----------|----------|
| Constant          | -41.545  | 0.003    |
| Age (X1)          | 0.250    | 0.042    |
| Education Level (X2) | 0.455 | 0.032    |
| Length of Farming (X4) | -0.230 | 0.129    |
| Intensity of Pest (X6) | -3.480 | 0.100    |
| Cost of Farming(X7) | 0.000   | 0.879    |
| Price (X8)        | 0.001    | 0.005    |

Omnibus test of Model sig=0.00

R square= 0.753

Table 1 shows that the value of the sig omnibus test of the model is below alpha (0.05), meaning that there is at least one variable described in the logistics regression model affecting Y. Simultaneously, variable-variables measured in this logistic regression model exert an influence of 75%, while the other 25% are influenced or explained by variables not described in this study. It is drawn from R Square value at 0.753. Based on the results of a partial logistic regression analysis, it was found that variable age, level of education and price, significantly influenced the decision of the selection of organic farming systems. While variabe lenght of farming, the intensity of pests and the cost of farming does not significantly affect the selection of organic farming systems.

3.4. Age factor

The results of logistic regression analysis show that age has a positive and significant effect on farmers’ decision on choosing organic farming system. The older the farmers, they tend to choose organic farming systems, and vice versa. The results of this study are different from Soekartawi’s that stated the age of farmers will affect physical ability and response to new things in running their business. [7] Younger farmers usually have a passion to find out what they do not know, so they try to adopt innovation faster even though they are still inexperienced in terms of adoption of such innovations. The older ages (over 50 years old), usually slow to adopt innovations and tend to only
carry out activities that are commonly applied by local residents [8]. Organic pepper farmers in Swatani Village are about 56% over the age of 50. Maturity of age and experience of pepper farming makes farmers have more understanding and wiser in determining agricultural systems that will provide higher profits.

3.5. Price factor
Variable prices have a positive effect and significant to the decision on choosing an organic farming system. The higher selling price of organic pepper, the farmer will likely choose the organic farming system. This is in accordance with the conditions in the field that shows that the selling price of organic pepper can reach the highest of IDR 85,000/kg, while for non-organic pepper the highest selling price is only IDR 75,000/kg. Organic commodity prices are relatively expensive compared to non-organic, since organic production costs are expensive and its production volumes are low. Today, organic farming still managed on a small scale. The demand for organic products is limited, so farmers who work on organic farming are also limited. Consumers do not buy organic food because it costs more. Lack of consumer awareness in consuming healthy products that produced from organic farming is one of the factors that resulting low demand for organic products, limited availability in organic products and high prices. In case of demand increases, farmers will be encouraged to raise their production volume so that the cost of production per unit of products will decrease and the selling price of organic products will be able to compete with non-organic products.

3.6. Education level factor
The impact of education level towards decision making in selecting organic farming system is positive. This means that the higher level of education of pepper farmers, it will influence the judgement to choose an organic farming system to be applied in their farming, and vice versa. The level of education nor length of education of a person will affect the values he embraces, the way of thought, perspective, even his perception of a problem [9]. In addition, highly educated people relatively were faster in implementing the adoption of innovation, than lowly educated people [7]. The results of this study further emphasize the second statement, where the dominant organic pepper farmers have a high education, namely high school and college graduation, on the contrary non-organic pepper farmers are dominantly consist of less educated. Higher education encourages organic pepper farmers to more actively seek and implement new technologies that can increase the acceptance of farming.

3.7. Cost structure of organic pepper farmers and non organic pepper farmers
Cost of farming is the value of all necessary economic inputs, which can be estimated and can be measured in the form of objects and services during the production process. The costs incurred in pepper farming for one year are affected by the topography, soil structure, type and varieties of cultivated commodities, cultivation techniques and the level of technology used. Costs incurred by farmers to produce pepper include labor usage costs, fertilizer purchases, seeds, pesticides and tax payments. Details of these costs were described in table 2.

Table 2. Analysis of rice farming costs of respondent farmers in Swatani Village, Rilau Ale District, Bulukumba Regency, 2017.

| No | Type of Cost          | Organic Pepper Farming | Non Organic Pepper Farming |
|----|-----------------------|-------------------------|-----------------------------|
| 1. | **Variable cost**     |                         |                             |
|    | a. Seeds              | 2,800,869,56            | 2,710,454,54                |
|    | b. Fertilizers :      |                         |                             |
|    | o Trichokompos Fertilizer | 192,272,72             |                             |
|    | o Liquid Fertilizer   | 529,347,82              |                             |
|    | o Agrodyke Fertilizer | 225,000                 |                             |
o Urea 429.772.72
o KCL 197.159.09
o Phonska 133.909.09
o NPK 132.477.27
c. Pesticides :
  o Botanical 95.434.78
  o Chemical 205.454.54
d. Labor wages 1.809.347.82 2.688.636.36
  **Total Variable cost (1)** $5.624.347.81 $6.497.863.62

2. Fixed Cost
   a. Land Tax 60.130.43 56.545.45
   b. NPA 48.358.69 35.359.09
   **Total Fixed cost (2)** $108.489.12 $91.904.54

3. **Total Cost (1) + (2)** $5.732.836.93 $6.589.768.16

Table 2 showed that the total cost for non-organic pepper farming is greater than organic pepper farming. The total cost for non-organic farming was IDR 6,589,768.16, while the total cost for organic farming was IDR 5,732,836.93. The cost savings on organic pepper farming can be seen in the pesticides and labor wages cost heading. The difference between organic farming and un-organic agriculture were based on the input-output aspect of production. Economically, organic farming is more profitable than an-organic farming, because the costs incurred in organic farming are less than inorganic farming. Pepper farmers in Swatini Village experienced the same thing, which shown by a difference in cost for IDR 856,931.23 between organic and non-organic pepper farmers, where organic pepper farmers spend more than organic pepper farmers.

3.8. **Revenue farmers organic pepper and non organic pepper**
The acceptance of farming derived from a multiplication between the number of products obtained and the price of products received by farmers respondents. While income is the difference between the reception and the cost of farming farmers respondents. Details of the admission, production cost, prices and income of respondent farmers were described in table 3.

**Table 3.** The value of receipts, costs, selling price and income of pepper farmers respondents in Swatani Village, Rilau AleCamtan, Bulukumba Regency, 2017.

| No. | Description                  | Organic Pepper | Non organic Pepper |
|-----|------------------------------|----------------|--------------------|
| 1.  | Production (kg)              | 478.5          | 352.7              |
| 2.  | Price (Rp)                   | 71.739         | 65.136             |
| 3.  | Admission (Rp)               | 34.518.478.26  | 23.490.818.18      |
| 4.  | Total production cost (RP)   | 5.732.836.93   | 6.589.768.16       |
| 5.  | Net Income (Rp)              | 28.785.641.3   | 16.901.050         |

Information which shown in Table 3 indicated the net income of organic pepper farmers is greater than the net income of non-organic pepper farmers. The net income of organic pepper farmers is IDR 28,785,641.3, while the net income of non-organic pepper farmers is IDR 16,901,050, which clearly had a difference of IDR 11,884,591.3. The net income of organic pepper farmers is higher than non-organic pepper since its production is higher, namely 478.5 kg for organic pepper and 352.7 kg for non-organic pepper. The quality of organic pepper seeds that is heavier and solid than an-organic pepper results in a greater difference in the volume of production. Moreover, the selling price of pepper is also one of the factors that impacted the income of organic pepper farmers to be higher, namely the selling price of organic pepper on average of IDR 71,739 while the average selling price of
non-organic pepper is IDR 65.136. Since revenue is the multiplication of price and number of products, where the price and number of organic pepper farmers are higher than non-organic, it is certain that the income received by organic pepper farmers is higher than the income from non-organic pepper farmers. Organic farming provides greater benefits and has a real effect on farmers’ income [10].

4. Conclusion
Factors that influenced pepper farmer in decided on choosing organics farming systems are age, education level and price. More over from this research it was found that the income of organic pepper farmers is higher than the income of non-organic pepper farmers with an income difference of Rp. 11,884,591.3. This result confirmed that economically by choosing organic farming system pepper farmers will get a higher income. For the future, organics farming system is potentially improved farmers welfare nor sustainability in agriculture.

References
[1] Tandisau, Peter and Herniwati 2011 Prinsip dasar pengembangan pertanian organik Bul. Litbang Pertan. Sulawesi Selatan
[2] Departemen Pertanian 2009 4 Tahun Go Organik 2010
[3] Firmanto 2011 Sukses Bertanam Padi Secara Organik Bandung: Angkasa
[4] Mayrowani 2012 Pengembangan pertanian organik di Indonesia Forum Penelit. Agro Ekon. 30 91–108
[5] Issa I and Hamm U 2017 Adoption of organic farming as an opportunity for Syrian farmers of fresh fruit and vegetables: An application of the theory of planned behaviour and structural equation modelling Sustainability 9 2024
[6] Direktorat Jenderal Perkebunan 2017 Statistik Perkebunan Indonesia Indonesia: Sekretariat Direktorat Jenderal Perkebunan
[7] Soekartawi 2005 Prinsip Dasar Komunikasi Pertanian Jakarta, Indonesia: UI – Press
[8] Mardikanto 2009 Sistem Penyuluhan Pertanian Surakarta: Sebelas Maret University Press
[9] Sumarwan 2011 Tingkat Pendidikan Berhubungan dengan Tingkat Intelegensia.
[10] Rahmawati 2012 Upaya Peningkatan Pendapatan Petani melalui Penggunaan Pupuk Organik. Studi Kasus pada Petani Jagung di Desa Surabayan, Kecamatan Sukodadi, Kabupaten Lamongan Malang: Universitas Brawijaya