

Social, economic and ecological benefits and farmers' perception of agricultural waste processing in Banyuasin Regency

by Muhammad Yazid

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Social, economic and ecological benefits and farmers' perception of agricultural waste processing in Banyuasin Regency

M Yazid, W Pufasari and E Wildayana

Department of Agribusiness, Faculty of Agriculture, Universitas Sriwijaya,
Jalan Palembang-Prabumulih KM.32 Indralaya, Ogan Ilir 30662, Indonesia

E-mail: yazid_ppmal@yahoo.com

Abstract. The objectives of this study were to investigate and estimate the economic, social and ecological benefits of agricultural waste processing and to assess farmers' perception on agricultural waste processing. This research was conducted in Kecamatan Tanjung Lago, Banyuasin, Sumatera Selatan. Survey data were collected from farmers selected using disproportionate stratified random sampling. The results showed that the economic benefits of agricultural waste processing were reducing production costs, increasing income of rice and maize farming, and improving the welfare of farmers. The social benefits were raising the nature of cooperation and triggering farmers to have broader knowledge by organizing associations to exchange the knowledge. Whereas, the ecological benefits were reducing air pollution caused by combustion of agricultural wastes, improving soil physical properties and restoring nutrients obtained from agricultural waste processing. The value of economic benefits estimated from agricultural waste processing to produce liquid bacterial fertilizer were 29.4% and 29.8% increase in income of rice farmers and maize farmers respectively. The overall score of perception of farmers applying agricultural waste processing was higher than those not applying.

2 1. Introduction

South Sumatra Province is one of the major food producing provinces in Indonesia, especially rice and corn. Rice production in 2015 reached 4,106,495 tons of the harvest area of 821,666 ha with a productivity of 49.98 quintal / ha. While corn production in the same year reached 289,007 tons of the harvest area of 46,315 ha with a productivity of 62.40 quintal /ha [1].

Large agricultural land and high agricultural production will also be followed by high agricultural waste. Agricultural waste is the remainder of the agricultural production process, but still has benefits as animal feed ingredients and organic fertilizer. Types of agricultural waste that are widely used as animal feed ingredients and organic fertilizer are rice straw and corn stalks [2].

Abundant rice straw and corn stalks have not been able to be optimally processed by farmers because of their lack of knowledge. This causes farmers to tend to burn more. Burning waste results in losses because the nutrients contained in the rest of the crop cannot be returned to the ground. Burning waste can damage the structure and texture of the soil, kill the life of soil microbes, and cause the soil to become arid and difficult for plants to grow. In the end this can have a negative impact on the productivity and income of farmers.



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Rice straw and corn stalks are used as organic fertilizer. The use of organic fertilizers can consistently improve soil quality. Organic fertilizers can increase the ability of soil to bind water, increase soil resistance to erosion, improve biodiversity and soil health, and reduce the use of inorganic fertilizers. In addition, organic fertilizer does not leave residues on crop yields so it is safe for the environment and human health [3].

The processing of agricultural waste into organic fertilizer has been carried out by farmers in Banyuasin District. The activity initiated by the Banyuasin District Governments and Sinarmas Forestry was carried out in Tanjung Lago Subdistrict which has a fairly extensive agricultural land (802.42 km²) which is part of the tidal land suitable for rice cultivation in the rainy season and corn in the dry season. Thus, agricultural production achieved is quite large. The target of this agricultural waste treatment activity is the achievement of zero waste in agricultural activities in the pilot project location. This pilot project activity lasted for one year with quite intensive guidance from the Regional Government and Sinarmas Forestry. Currently, agricultural waste processing activities (rice straw and corn stalks) have been carried out individually by farmers.

This research was conducted with two objectives. First, this research was conducted to study and calculate the benefits of processing agricultural waste from social, economic and ecological aspects. Second, this research was conducted to reveal the farmers' perceptions of agricultural waste treatment activities. The benefits obtained from the processing of agricultural waste which are followed by a positive perception of waste treatment efforts are expected to support the achievement of independent waste treatment activities.

2. Method

This research was conducted through a sample survey. Samples are selected using the disproportionate stratified random sampling method based on two layers. The first layer is farmers who apply agricultural waste processing (rice straw and corn stalks) into organic fertilizer. While the second layer is farmers who do not apply.

Data were collected through observation and interviews directly to farmers using a questionnaire. The data obtained from this interview were then processed descriptively. The economic benefit of processing agricultural waste was estimated through the calculation of costs and benefits. Whereas, farmers' perceptions of processing agricultural waste were analyzed using scores and labels (criteria).

3. Results and Discussion

3.1 Agricultural Waste Processing

The processing of agricultural waste at the study site was carried out by local farmers facilitated by the District Government of Banyuasin in collaboration with Sinarmas Forestry. This activity was carried out in 2016 as one of the "Integrated Farming Without Waste" programs as a form of Creating Shared Values (CSV) activities. This CSV is a development of the concept of CSR (Corporate Social Responsibility). This agricultural waste treatment activity was focused on processing waste (rice straw and corn stalks) to produce organic fertilizer to realize zero waste after harvest. Previously, rice straw and corn stalks only became waste and were burned after harvest. With this activity, agricultural waste was used as an ingredient in making organic fertilizer that can be used for local crops, while reducing the negative impact of burning agricultural waste.

In addition to rice straw and corn stalks, making organic fertilizer requires decomposing materials such as livestock urine, coconut water, rice water, and fruit waste. The produced organic fertilizer can be used as a substitute for urea fertilizer so as to reduce production costs.

3.2 Benefits of Agricultural Waste Processing

Processing agricultural waste provides many benefits. Not only economic benefits can be directly obtained by farmers by reducing the cost of purchasing fertilizer, but the activities carried out together also provide social benefits. A similar thing was found by [4] who stated that farmers carry out rice

straw processing because they understand the benefits that can be obtained are quite high. In addition, activities that can shift the habits of farmers to burn post-harvest waste also contribute to the improvement of the local environment. Socially the activities carried out within a group succeeded in encouraging farmer collaboration and improving group performance so that it became a strong social capital future activities. In addition, through this group activity farmers become more frequent exchanging knowledge, thoughts and opinions not only about processing agricultural waste, but also fertilization, seed use, application of pesticides that are responsible for sustainable agriculture.

The economic benefit of this agricultural waste treatment was the reduction of production costs of farming. Activities that produce natural fertilizer can partially replace the need for chemical fertilizers. The amount of chemical fertilizers that can be replaced by the results of the processing of agricultural waste reaches 50% to 100% Urea fertilizer needs. Reduced production costs can directly contribute to increasing farm income, or indirectly through increased productivity due to improvements in soil and crop quality and increased yield quality.

Ecologically, processing agricultural waste directly reduces the negative effects of burning harvest and post-harvest waste (rice straw and corn stalks). In addition, the use of agricultural waste can improve the physical properties of the soil so that the soil structure becomes loose and does not compact. Biologically, the addition of organic matter also improves the living space of earthworms and other microorganisms that can increase soil nutrient content.

3.3 Value of the Benefits of Agricultural Waste Processing

The value of the benefits of processing agricultural waste (rice straw and corn stalks) into organic fertilizer is estimated through the calculation of costs and benefits. The cost of processing waste into fertilizer requires fixed and variable costs. Agricultural waste as a raw material for making bacterial liquid fertilizer can all be obtained without cost.

Fixed costs incurred in the treatment of this waste in the form of costs of procurement of production equipment such as plastic barrels and sprayers whose cost value is calculated based on the value of depreciation. Variable costs incurred in the form of costs for procurement of supporting materials such as coconut water, pineapple and papaya waste, *kentos* (inner seed of coconut), and labor costs. Whereas animal urine, rice water and fresh water are obtained without charge. The total production cost to produce 100 liters of output (organic fertilizer) in 6 months is IDR 1,197,500.

Liquid organic fertilizer produced from the processing of agricultural waste is then used in rice and corn farming which is run by farmers themselves in a period of 1 year planting. To calculate the benefits of using organic liquid fertilizers produced from processing agricultural waste, a comparative analysis was carried out between farming before processing waste (2015) and after (2016). Data collection and analysis were carried out after the 2016 rice and corn farming has been completed, namely in 2017. Data collected were total production, total cost, price of output, revenue, and income, both before and after the implementation of agricultural waste processing (Tabel 1).

Tabel 1. The value of economic benefits of waste processing.

Description	Rice		Maize	
	Before	After	Before	After
Production (kg/ha/yr)	4.713	5.847	4.187	5.253
Price (Rp/kg)	3,680	3,900	3,320	3,500
Revenue (Rp/ha)	17,261,000	22,802,000	13,972,667	18,386,667
Production Cost (Rp/ha)	4,734,400	5,044,300	4,481,000	4,866,933
Income (Rp/ha)	12,526,600	17,757,700	9,491,667	13,519,733

Tabel 1 indicated that the production of both rice and maize increased in significant amount (24.1% for rice and 25.5% for maize). There were slight increases in product price from 2015 to 2016 due to the nominal price increase and the increase in product quality, but the effect of both could not be

separated. As a result, the increase in total production and the price caused a significant increase in revenue for both rice and maize. The increase in revenue for rice was 32.1%, whereas for maize was 31.6%. There was a slight increase in production cost for rice and maize, mainly due to the increase of nominal price of other inputs. However, the overall income of farmers for both rice and maize exhibited a significant increase of 41.8% for rice and 42.4% for maize. The increase in income showed the total benefit of agricultural waste processing practiced by farmers. These findings were similar but higher to those found by [5]. He found that the application of compost has increased the income by 18.4% for rice and 26.0% for maize.

3.4 Farmers' Perception Regarding Agricultural Waste Processing

Perception is a process undergone by individuals to organize and interpret messages in order to provide benefits for their environment [6]. Perception is one of few things that are considered by people in doing any kind of activities. Positive perception regarding an activity would ensure the achievement of objectives of the activity.

Farmers' perceptions regarding agricultural waste processing were measured in three aspects, namely economic, social and ecological aspects. Farmers' perceptions regarding agricultural waste processing were obtained from farmers practicing and farmers not practicing agricultural waste processing. The results of analysis regarding farmers perception were presented in Table 2.

Table 2. Comparison of farmers' perception regarding waste processing.

Perception	Farmers processing waste		Farmers not processing waste	
	Score	Criteria	Score	Criteria
Economic aspect				
Reduce cost	4.53	Very good	3.13	Average
Increase income	4.53	Very good	3.40	Good
Promote welfare	4.67	Very good	3.13	Average
Total	13.73	Very good	9.67	Average
Social aspect				
Facilitate collaboration among farmers	4.07	Good	3.20	Good
Improve knowledge and attitude	4.53	Very good	3.87	Good
Provide support	2.93	Average	2.47	Bad
Total	11.53	Good	9.53	Average
Ecology aspects				
Reduce burning of agricultural waste	4.93	Very good	3.93	Good
Increase soil nutrients	4.80	Very good	3.33	Good
Improve soil physical properties	5.00	Very good	3.73	Good
Total	14.73	Very good	11.00	Good
Overall	39.99	Very good	30.20	Good

Table 2 indicates that the scores regarding perception on agricultural waste processing are higher in farmers applying waste processing than in those not. This means that farmers applying waste

processing scores more than those not in all aspects. Score of farmers' perception in ecology is the highest among three aspects. Score difference between farmers applying and not applying is also the highest in ecology. Previous research conducted by [7] similarly indicated that positive perception of farmers using organic fertilizer was due to social and environmental aspects. As indicated in Table 2, perception of farmers applying waste processing is categorized Very Good in all three economic aspects. Whereas, perception of farmers not applying waste processing is categorized *Average to Good*. The score of each of economic aspect (reducing cost, increasing income, and promoting welfare) is close one another for farmers applying waste processing.

There are quite significant differences among three indicators of social aspects for farmers applying waste processing. The highest score is for the improvement of knowledge and attitude. Whereas, the lowest score is for providing support for member farmers. The perception of providing support for farmers not applying waste processing is categorized *Bad*. Perception of farmers applying waste processing is consistently Very Good in all three ecological aspects. Similarly, perception of farmers not applying is consistently Good in all three ecological aspects. However, among the three ecological indicators, improvement of soil physical properties has the highest score for farmers applying waste processing. But, reduction of waste burning has the highest score for farmers not applying waste processing.

4. Conclusion

Agricultural waste processing provides economic benefits for farmers such as the reduction of production cost, increase in income of farmers. Social benefits obtained by farmers include close collaboration among farmers, improvement of knowledge and attitude, and provision of support among farmers. Whereas, ecological benefits include reduction of agricultural waste burning. The value obtained by farmers practicing agricultural waste burning include the increase in production of both rice and maize in a significant amount (24.1% for rice and 25.5% for maize). In addition, the income of farmers practicing waste processing is 29.40% higher for rice and 29.80% for maize than those not practicing. The score of perception of farmers practicing waste processing is higher than those not in all aspects. The score of perception in ecology is the highest among the 3 aspects either for farmers practicing or not practicing waste processing.

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