Composting Pig Manure: Economic and Environmental Study in the Framework of Integrated Farming of Pig and Stone Banana (*Musa balbisiana*)

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Abstract. The high increase of pig population has brought an increase in volume of pig manure were also high. On the one hand, pig manure contributes to environmental pollution. On the other hand, this waste contains organic material which is very important for plants. This paper aims to analyze (1) the economic benefits of composting pig manure, and (2) the environmental conservation benefits of composting pig manure. The composting of pig manure has been carried out, and the resulting compost products have been analyzed. The economic value of composting pig manure was analyzed descriptively quantitatively. Likewise, the benefits of environmental conservation on composting pig manure were analyzed descriptively. The results showed that (1) composting pig manure was able to significantly substitute the use of mineral fertilizers so that it could save tradable inputs, and (2) composting pig manure was able to improve the environmental quality of integrated farming of pigs and stone bananas. It is recommended that farmers continuously compost pig manure for fertilizing stone banana plants so that environmental sustainability is maintained.

Keywords: composting, pig manure, benefit, environment, economic

1 Introduction

The high increase of pig population has brought an increase in volume of pigs manure were also high. The regular build-up and inefficient treatment of large amounts of pig manure create a significant burden on the environment [1]. Pig manure has become an important factor hindering the development of a healthy livestock industry. On the one hand, this solid waste contributes to a certain level of pollution to the environment. On the other hand, this waste contains large amounts of organic matter and essential nutrients such as nitrogen, phosphorus, potassium and biomass which are very important for plants [2].

The factual condition shows that there are still large disparities in the management of pig manure. Some breeders just throw their pig manure into the surrounding environment, some use it to become biogas, and some have composted regularly. Pig manure is known to be rich in nutrients, but fresh pig manure greatly limiting their use in agriculture because it contains pathogens and nutrients are unstable. Pig manure that is thrown away without treatment, certainly causes environmental problems, and on the other hand, pig manure that is managed according to environmental principles is guaranteed to bring economic and environmental benefits.

Its great potential as a raw material for compost has positioned composting pig manure to be an activity that has economic and environmental value. From an economic standpoint, pig manure compost has a great potential substitution of the urea which popular used by farmers. Likewise from an environmental perspective, composting pig manure has great potential as an axis of environmental preservation. Therefore, it is very appropriate to say that composting pig manure has multiple dimensions in the form of saving domestic resources and also preserving the environment. However, a specific study of the dual benefits of composting pig manure on integrated farming of pigs and banana stones has not been published. Therefore, this paper aims to analyze (1) the economic benefits of composting pig manure, and (2) the environmental conservation benefits of composting pig manure.

2 Methods

The research of composting pig manure was conducted in Payangan District, Gianyar Regency. The composting of pig manure has been carried out, and the resulting compost products have been analyzed at the Laboratory of Soil Science, Faculty of Agriculture, Udayana University. The economic benefits of composting pig manure and environmental conservation benefits from composting activity of pig manure were analyzed descriptively.

3 Results and Discussion

3.1 The economic benefits of composting pig manure within the framework of integrated farming of pig and stone banana

Stone banana plants are now faring well. Why not, in the past his life was always on the edge, edge of cliff, and marginal land, but now it has turned into a commercial crop. The factual condition shows that many paddy fields have been converted into land for stone banana plants. This phenomenon occurs due to the increase in the economic value of the stone banana plant, whose main product is leaves, in addition to other multi-use plant parts, such as young fruit, young stems, ripe fruit, and post-productive stems.

The powerful economic value of stone banana has been able to conquer other commercial crops, including rice, sweet potato, cassava, and secondary crops. It is not surprising then that there has been a significant change in land use from the other plant to stone banana. The transformation of land into stone banana plants , in addition to as factors economy, also boosted by various advantages possessed by stone banana plants, namely (a) easily cultivated, (b) is drought resistant, (c) resistant to pests and diseases, (d) capable of producing throughout the year, (e) multi-use products, and (f) harvesting can be postponed.

In general, farmers use Urea to fertilize stone banana plants. This happens because urea is easy to apply, and the nutrients are quickly available to plants. However, there is the fact that the stone banana plant requires an increasing dose of Urea fertilization, increased

fertilizer prices, plus there is a case of scarcity of fertilizers in the field, so some farmers, especially farmers who also raise pigs, have made efforts to substitute Urea fertilizer with pig manure compost which he produced himself. The high use of Urea fertilizer, can not only cause a decrease in the quality and yield of crops, but also have an impact on the quality of soil and groundwater. Attempts to increase yields by adding excessive fertilizers are becoming an increasingly uneconomical problem, waste of resources and pollution. Previously, farmers fertilized stone banana plants using Urea with an average dose of 200 kg per hectare per semester. The price of non-subsidized Urea fertilizer is IDR 10,000 / kg. The rational use of pig manure compost is a necessary condition to achieve zero growth of chemical fertilizers and encourage the development of circular agriculture. By composting pig manure, farmers can save the tradable cost of input for the stone banana plant of IDR 4,000,000 per year. The results of laboratory tests on pig manure compost samples are presented in Table 1.

Table 1. Results of Laboratory Analysis of Pig Manure Compost

No	Description	Unit	Level	Information
1	C Organic	%	30.59	Very high
2	N Total	%	0.75	High
3	P Available	Ppm	368.35	Very high
4	K Available	Ppm	758.29	Very high
5	Moisture content	%	12.18	
6	The Conductivity	Mmhos / cm	0.91	Very low

Based on the results of the analysis (Table 1), it can be explained that the following matters:

1) The organic C content is 30.59% which is categorized as very high, it can be interpreted that fertilizer The compost is very well used for fertilizing stone bananas.
2) Total N obtained is 0.75% which is categorized as high, it can be interpreted that compost is able to provide sufficient nitrogen elements for the needs of stone banana plant.
3) The available P was obtained at 368.35 ppm, categorized as very high, it can be interpreted that the compost of pig manure is able to provide phosphate elements which are very adequate for the needs of stone banana plants.
4) The available K was obtained at 758.29 ppm, categorized as very high, it can be interpreted that the compost of pig manure is able to provide potassium elements which are very adequate for the needs of stone banana plants.

Based on the composition of nutrients contained in the compost of pig manure, the need for compost of pig manure to fertilize stone banana plants is 5-6 tons per hectare. The advantage of pig manure compost compared to urea fertilizer is the presence of macro elements other than nitrogen, such as P and K which are very much needed by stone banana plants. In short, fertilizing with pig manure compost provides stone banana plants with more complete nutrients. The potential for compost produced from raising 100 pigs has reached 5- 6 tons per semester, so that it can meet the need for compost.

Overall, compost of pig manure is able to provide adequate macro elements for the needs of stone banana plants. The use of compost (the result of composting pig manure) for fertilizing stone bananas can actually create added value and multiple benefits, including:

1) Stone banana plants become healthier and fresher with a better growth rate. This happens because the compost can improve soil physical properties (soil structure is

more loose), aeration and drainage soil, soil biology, so that the roots of stone banana plants can absorb the nutrients better that then lead to the achievement of better growth. Compost-fertilized stone bananas are more resistant to drought because the compost is able to hold water for a longer time.

2) Leaf production becomes faster, which in turn leads to an increase in the amount of leaf production per unit time. Stone bananas fertilized with compost have faster leaf growth in addition to wider leaf size, which leads to an increase in the amount of production.

Composting pig manure is an integrated farming knot for pigs and stone bananas which is able to create a more conducive farming climate due to a mutualistic synergy that has a broad impact on cumulative performance. The productivity of pig farming increases, the productivity of stone banana farming increases, and the productivity of farmers increases which in turn contributes to the cumulative productivity. The achievement of cumulative productivity is measurable performance indicator of integrated farming of pigs and stones bananas. Stone banana fertilized with pig manure compost on an ongoing basis will be able to grow and develop properly, thus resulting into stable production which then leads to the reception which also relative stable (another factor cateris varibus). Guarantee of acceptance relative sustainably stable positioning appropriately integrated farming of pigs and stone banana into farmers' rational choice.

The use of pig manure compost as organic fertilizer has a number of drawbacks. First, it is not known exactly how much N is available for plants [3], so there are two possibilities, namely N applications that exceed the recommended dose or N applications that are less than the recommended dose. In many cases, compost applications based on total N, the possibility of lower fertilizer efficiency than mineral fertilizers. Second, the rate of organic-N mineralization must be such that the available N must be generated when it is needed by plants [4], otherwise, it is likely that N will be lost to the environment or accumulate in the soil [5]. Third, the pig manure compost concentrations of Cu and Zn were high [6], where the two elements is supplied to the piglets in a number of relative large which is intended to promote the growth of pigs, and also prevent any disease. However, almost 90% is excreted in feces [7] and then concentrated in SPS and in derived compost [6].

3.2 Environmental studies of the composting activity of pig manure

Pig manure should be managed properly, because if it is not managed properly, it can cause various problems, especially environmental problems, such as the growth of fungi and pests, and the spread of disease [8], odor pollution [9], methane emissions [10], and water eutrophication [11]. Composting is one of the most promising bioconversion conversion methods for recycling livestock manure, and converting organic waste into valuable soil conditioner or fertilizer. Composting is an environmentally friendly and effective method for treating agricultural waste (especially for livestock manure) and has been applied with increasing popularity by farmers around the world. Composting also converts organic waste into a stable final product that is not phytotoxic and free from pathogens, to be used as organic fertilizer for plant growth or soil improvement [12]. Through the activity of pig manure composting, then the environment of pig farming will be better, which is characterized by indicator as follows.

1) Air pollution is reduced, and the environment becomes more comfortable which then has a broad impact on public health and also pigs. Pig manure that is processed into compost is able to reduce air pollution, because pig waste does not pollute the environment so that the community's environment becomes more comfortable without the presence of odors that interfere with breathing. In fact,

this can be compared to the condition where the pig manure is not managed to be processed into compost which causes an offensive odor.

2) Farmers' productivity increases, as a result of improved health and environmental comfort. Farmers are relative rarer diseases due to exposure to air pollution caused by pig manure. Healthy farmers will be able to carry out activities for productive economic activities and be able to save on family expenses.
3) The health and growth of pigs are getting better, which then leads to an increase in economic value which increases proportionally.

4 Conclusion

Broadly speaking, two benefit categories can be made from composting activities. Pig manure, namely economic benefits and environmental conservation benefits. Economic benefits, namely in the form of cumulative benefits from integrated farming of pigs and stone bananas. Farmers are able to save tradable inputs for the banana stone plant. Meanwhile, the benefit of environmental conservation is the creation of environmental quality improvements that have a broad impact on cumulative performance improvements. In the context of implementing integrated farming of pigs and stone bananas, environmental benefits can be spur and strengthen economic benefits. The advantages of integrated farming of pigs and stone bananas have strengthened the enthusiasm and readiness of farmers in operating the wheel of integrated farming of pigs and stone bananas.

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