Performance of Tomato Applied with Bokashi Using Various Substrates

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Abstract

This study was conducted to evaluate the effect of Bokashi using various substrates on the performance of tomato. Three treatments were tested, namely: rice bran (A), coco dust (B), and sawdust (C). The experimental treatments were replicated five times and were arranged in Randomized Complete Block Design (RCBD). Plots measuring 4 x 4 m were made and seedlings were transplanted at 50 x 50 cm distance. Recommended practices for tomato production were followed. Bokashi was applied at a rate of five tons per hectare. Growth data were collected and recorded every week and yield data at harvest. Samples of soil and the different treatments were prepared and submitted to the Regional Soils Laboratory for analysis of soil pH, % organic matter, available phosphorus and exchangeable potassium.

The initial fertility condition of the experimental area was generally described as basic or alkaline with low organic matter, available P and exchangeable K. Results showed that the growth components of tomato were not affected by the application of bokashi with different substrates. The length of fruit was significantly affected by the kind of substrates, while all other yield parameters have comparable results. Coco dust and sawdust are potential substitutes for rice bran as substrates for bokashi.

Keywords: bokashi, coco dust, organic agriculture, rice bran, saw dust, tomato

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Introduction

Tomato (Lycopersicum esculentum Miller) otherwise known as "Kamatis", is an important and popular fruit vegetable grown for both home and market in in the Philippines. Tomatoes are now the fourth most popular fresh-market vegetable behind potatoes, lettuce, and onions. Tomatoes are rich sources of vitamins A and C and folic acid and contain a wide array of beneficial nutrients and antioxidants including alpha-lipoic acid, lycopene, choline, folic acid, beta-carotene and lutein (PSA, 2018).

The use of beneficial and effective microorganisms (EM) as microbial inoculants in agriculture is a promising new technology. It has been shown to be effective in improving soil health and quality, inevitably raising the yield and quality of crops. EM Bokashi can increase soil organic matter content, improve soil porosity and permeability, and raise the soil's levels of available nutrients. EM Bokashi can reduce the necessary amount of chemical fertilizer application, thereby improving the agricultural environment (Xiaohou et. al., 2008).

At the heart of bokashi composting is the microbe laced bran that is used to naturally ferment agricultural residues. In the earlier times, rice bran was just used as either fertilizer or animal feed. But in these days, it is used for extraction of oil namely rice bran oil (RBO) (Sharma, et.al., 2015). With the increasing economic importance of rice bran, an alternative substitute using other agricultural residues should be established, hence this study.

The study was conducted to evaluate the performance of tomato applied with bokashi using various substrates. Specifically, it aimed to: 1. To determine the growth and yield performance of tomato applied with bokashi using various substrates; 2. To evaluate which substrate will promote the best growth and yield of tomato; and 3. To assess the profitability of tomato production applied with bokashi using various substrates.

Materials and Methods

Experimental Methods

The study was conducted with three treatments, namely: A – Rice Bran, B – Coco Dust, C- Saw Dust. The treatments were arranged in Randomized Complete Block Design and was replicated five times.

Cultural and Management Practices

The 529 m2 experimental area was prepared by removing the weeds and cultivating thereafter. Fifteen plots were prepared measuring 4 x 4 meters to accommodate all the experimental units. Each plot was spaced 0.5 meter apart. Ridges were constructed and sixty-four seedlings were transplanted at a distance

of 50 cm x 50 cm. Hilling-up was done to control the weeds and aerate the soil. Nine kilograms per plot of bokashi of each substrates was applied as basal fertilizer. Cleanliness and sanitation were strictly implemented and pest monitoring was done. The tomato plants were harvested when they reached the marketable stage had attained its full-grown stage. Harvesting was done by manually picking the fruits of the plants. Data on growth and yield were taken from 10 samples per treatment. Growth and yield data were recorded.

Soil Sampling and Analysis

Soil samples were collected before the start of the experiment to determine the soil chemical properties. Composite soil samples were air-dried, sieve to pass through a 2-mm mesh and brought to the Regional Soils Laboratory for the analysis of soil pH (potentiometric method), % organic matter (S. A. Wides method), available P (Olsen's P method) and exchangeable K (cold H2SO4 method).
Analysis of Bokashi

Samples of bokashi using different substrates were brought to the Regional Organic Laboratory in WESVIARC, Iloilo City for chemical analysis.

Data Analysis

All the data gathered from the study will be subjected to the Analysis of Variance using F-test and the results will be interpreted at 5% and 1% level of significance. Least Significant Difference (LSD) will be used to detect the differences among treatment means.

Economics of Production

The economics of production of the different rice varieties was based on cost and return analysis and in terms of return on investment (ROI). All expenses incurred which included labor, inputs, and other miscellaneous expenses were properly recorded and then later were converted into per hectare basis.

Results and Discussion

Growth Parameters

The growth characteristics of tomato was not influenced by the application of bokashi using various substrates. This imply the potential of using coco dust and sawdust as substitute to rice bran in the formulation of bokashi. Tomatoes applied with bokashi using rice bran produced the tallest plant (74.63 cm), biggest stem girth (1.24 cm), greatest number of leaves (22.24), longest leaves (22.29 cm) and takes the most number of days from transplanting to flowering (31.97).

Yield Parameters

The yield of tomato as affected by the application of bokashi using various substrates is presented in Table 2.0. Results showed that the length of fruit was significantly affected by the kind of substrate used. The longest fruit was obtained from rice bran (5.63 cm) followed by saw dust (5.31 cm) and coco dust (5.07 cm). Other yield parameters in terms of diameter, number of marketable fruit, weight of marketable fruit, number of non-marketable fruit and weight of non-marketable fruit were found to be statistically the same. The most number of marketable fruit was obtained from plants applied with rice bran (3.59), however, the heaviest weight of marketable fruit was recorded from saw dust (115.23 g).

Nutrient Analysis of Soil

Nutrient analysis of the soil in the experimental area showed no significant difference in the pH, organic matter, available P and exchangeable K before the application of bokashi. The soil was found to be moderately acidic (pH=5.94), with low organic matter (1.27%), low available Phosphorous (5.61 ppm) and low to medium exchangeable Potassium (149.93 ppm) (PCAARRD, 2013).

Nutrient Analysis of Bokashi

The formulated bokashi regardless of substrate used were generally basic or alkaline ranging from pH 8.91 to 9.06. Rice bran obtained the highest N percentage (1.45%), available phosphorous (4.12%), exchangeable potassium (1.57%) and organic carbon (13.4%). Sawdust gave the lowest total nitrogen (1.24%), exchangeable potassium (1.41%) and organic carbon (8.98%) while the lowest available phosphorous was obtained from coco dust (3.68%). Results showed that bokashi could be considered as an organic plant supplement as suggested by PCARRD (2006).

Table 1.0. Growth parameters of tomato applied with bokashi using various substrates.

Growth Parameters [ns]	Treatment		
	Rice Bran	Coco Dust	Saw Dust
Plant Height, cm	74.63	64.44	55.84
Stem girth, cm	1.24	0.96	1.10
Number of leaves	22.24	21.70	21.42
Length of leaves	22.29	21.60	20.73
Width of leaves, cm	15.43	16.52	15.91
Biomass, g	198.30	144.00	213.76
Number of days from transplanting to flowering	31.97	31.55	31.70

Table 2.0. Yield parameters of tomato applied with bokashi using various substrates.

Yield Parameters	Treatment		
	Rice Bran	Coco Dust	Saw Dust
Length of fruit, cm	5.63a	5.07b	5.31b
Diameter of fruit, cm	5.35	5.07	5.31
Weight of marketable fruit, g	105.41	108.62	115.23
Weight of non-marketable fruit, g	47.86	54.64	58.99
Number of marketable fruit	3.59	3.23	3.27
Number of non-marketable fruit	2.63	2.63	2.99

Means followed by a common letter are not significantly different at 5% level by LSD.

Table 3.0. Nutrient analysis of the soil before the application of bokashi.

Treatment	pH	Soil Test Data[ns] OM (%) SA Wildes	P (ppm) Olsen's Method	K (ppm) Cold H2SO4
Rice Bran	5.9	1.3	5.81	164.6a
Coco Dust	5.94	1.3	5.43	133.0b
Saw Dust	5.98	1.2	5.58	152.2c

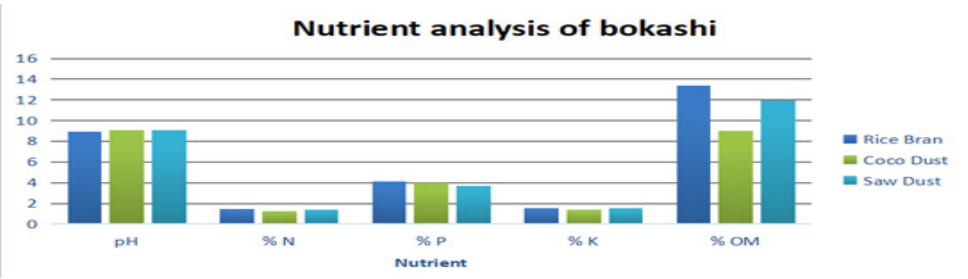

Figure 1. Nutrient analysis of bokashi.

Economic Analysis

The mean total expenses incurred in the production of tomato applied with bokashi using various substrates on a hectare basis was computed to be Php63,525.00/ha (Php2.51/kg). The cost of production incurred is lower than the average variable and fixed costs of tomato farmers from Iloilo for the period September 2016-May 2017 (Php 186,277.71 /ha) as reported by the Philippine Statistics Authority (PSA, 2018).

Plants applied with bokashi using sawdust earned the highest gross income amounting to Php691,380.00 /ha and a net income of Php627,855/ha (Php22.70/kg), followed by coco dust with a gross income of (Php651,720/ha) and net income of Php588,195/ha (Php22.56/kg) and the lowest gross income was recorded from rice bran amounting

to Php632,460/ha and a net income of Php568,935/ha (Php22.49/kg).

In consideration of the expenses, gross and net incomes presented above, the return on investment for the three treatments were 988%, 926% and 896% for sawdust, coco dust and rice bran, respectively. The result is higher than that of ROI (710%) obtained by the tomato farmers from Iloilo as reported by PSA (2018).

Table 4.0. Economics of production of tomato applied with bokashi using various substrates.

Economic Parameters	Treatment		
	Rice Bran	Coco Dust	Saw Dust
Cost of Production, Php/ha	63,525.00	63,525.00	63,525.00
Gross Income, Php/ha	632,460.00	651,720.00	691,380.00
Net Income, Php/ha	568,935.00	588,195.00	627,855.00
Return on Investment (ROI), %	896	926	988

Conclusions

Based on the results of the study, the following conclusions were obtained:

1. The growth of tomato applied with bokashi was comparable regardless of the substrate used.

2. Bokashi using rice bran as substrate has better performance in terms of length of tomato fruits as compared to cocodust and sawdust.

3. The efficacy of bokashi is not affected by the kind of substrate when applied to tomato in terms of diameter of fruit, number of marketable fruit, weight of marketable fruit, number of non-marketable fruit, and weight of non-marketable fruit.

4. Coco dust and sawdust are potential substitute for rice bran as subtrates for bokashi.

Recommendations

Based on the conclusions, the following recommendations are forwarded:

1.The use of bokashi to supplement the nutrient requirement of tomato.

2. The use of cocodust and saw dust as substitute to rice bran in the production of bokashi.

3. Increase the dosage or frequency of application of bokashi to supply more

N,P, K and OM to meet the crops' nutrient requirement and to enhance soil fertility.

4. The use of bokashi to other vegetables and crops to determine its efficacy.

5.Test the nutrient properties of the soil after harvest to determine nutrient balance.

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