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The Long Composting Period Effect of Leaf Shallots on the Compost Quality

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The Long Composting Period Effect of Leaf Shallots on the Compost Quality

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Abstract. Compost is a solid organic material that biologically changes into a final product that can be used as fertilizer. Utilizing shallot leaf waste as raw material for composting is the latest technology and has never been applied by shallot farmers. This study aimed to determine the best quality of shallot leaf compost with the long treatment of the composting process. This process was supported through *Trichoderma, sp* activator with 10^6 cfu/mL density. The treatment design was arranged as follows: K0 = no composting (leaves were simply dried in the sun), K1 = composting for 1 day, K2 = composting for 2 days, K3 = composting for 3 days, K4 = composting for 4 days, K5 = composting for 5 days, K6 = composting for 6 days, K7 = composting for 7 days, K8 = composting for 14 days, K9 = composting for 21 days, and K10 = composting for 28 days. The data were analyzed descriptively. The results showed that the shallot leaf waste with the composting process was dried by the sunlight (natural composting) and had a C/N ratio. Meanwhile, the C-organic and N-total of this composting process were better than that of composting using a solution containing *Trichoderma sp.* activator.

Keywords: *Shallots; Trichoderma; Compost; C-organic; N-total*

1. Introduction

Shallots (*Allium ascalonicum L.*) are horticultural commodities that have many benefits and high economic value and are used as food and traditional medicinal ingredients [15]. Farmers in post-harvest activities of shallots always separate the scallions from the tubers which will be distributed to traders who sell them to consumers. The abundant shallot leaf waste is not utilized properly by farmers because the waste is burned or left to rot in the trash. The potential for shallot leaf waste from shallot cultivation that can be used as raw material for compost is 1.15 t/ha [10].

Compost is solid organic material that biologically changes into a final applicable product, such as fertilizer [6]. N-total, C-organic, and C/N ratio are some of the variables compulsorily considered to determine the level of quality of the compost produced in the composting process [4]- [11]. Composting is a process of aerobic degradation of organic waste into a stable organic matter with the help of microbes to assist the degradation process. Moreover, composting is an important activity to apply organic waste [12]. The results of the composting process depend on various factors, including the length of time to process. The content of N-total, C-organic, and C/N ratio in rice straw compost depends on the length of the composting process [4]. The composting process has several stages so that the compost material can be decomposed by microorganisms and become mature compost [2].

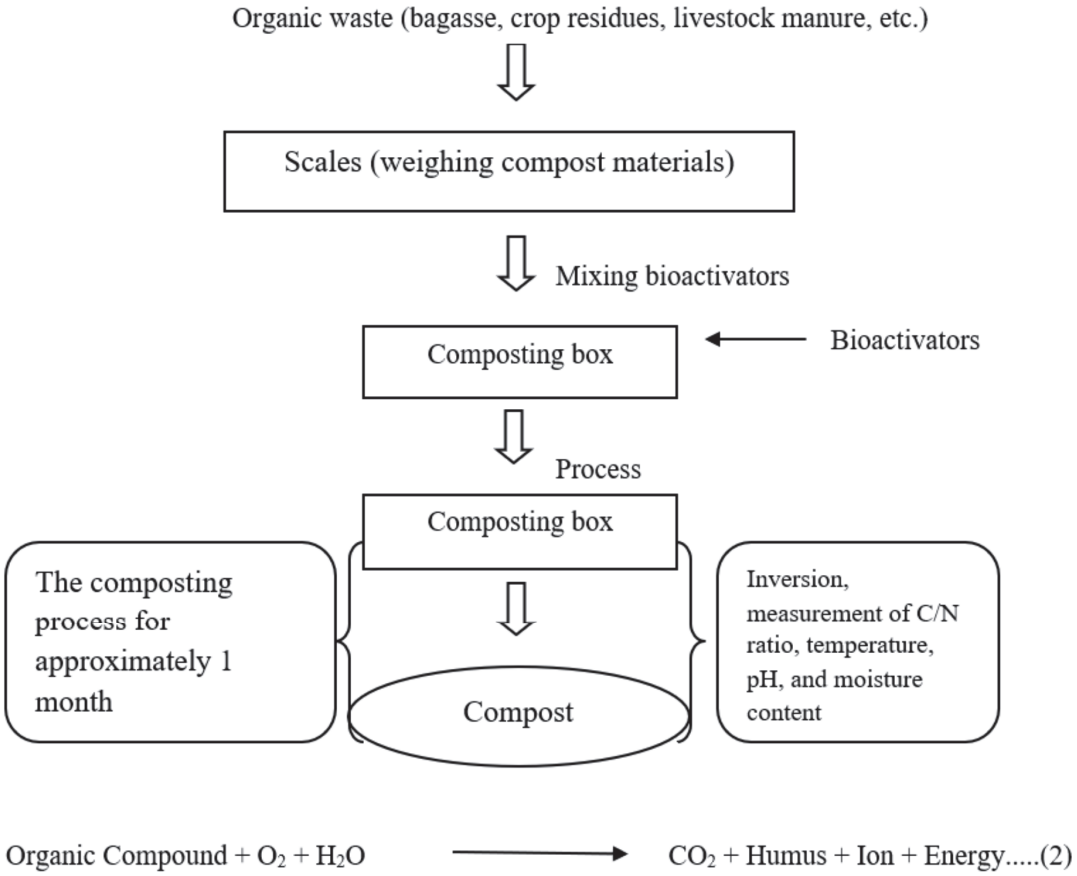

Figure 1. Composting stage [2]

Shallots not been maximally utilized by farmers as a source of organic matter are potentially developed into compost raw materials. The standard contents of compost are a minimum of 15% of organic C and a maximum C/N ratio of 25 [9]. The leaves of the shallot plant after being harvested and separated from the tubers cannot be used directly into the soil as compost because they contain a C/N ratio of 41.09; thus, a composting process is necessary. Organic matter of fresh leaves cannot be used directly into the soil because the C/N ratio in the material is still relatively high, approximately > 50. Organic matter can be utilized by plants if the value of the C/N ratio is almost the same as the soil [13]. The utilization of red onion waste as raw material for composting is the latest technology that has never been applied by shallot farmers in Brebes.

It is necessary to investigate the effects of the length of a period of composting shallot leaf waste on the quality of the compost produced. As a result, the shallot leaf waste can be further developed, and plant cultivation science, especially shallots, can be advanced. The purpose of this study was to determine the best quality of shallot leaf compost with the long treatment of the composting process.

2. Methodology

Research Materials and Tools

Composting materials and tools consisted of shallots, water, and *Trichoderma sp*. The tools used were a bucket, fermenter box totaling 10 boxes (1 m^3), thermometer, knife, pencil, and paper.

Experimental Designs

The treatment design was arranged as follows: K0 = no composting (leaves were simply dried in the sun), K1 = composting for 1 day, K2 = composting for 2 days, K3 = composting for 3 days, K4

= composting for 4 days, K5 = composting for 5 days, K6 = composting for 6 days, K7 = composting for 7 days, K8 = composting for 14 days, K9 = composting for 21 days, and K10 = composting for 28 days.

The observed variables included C-organic, N totals, C/N ratio, element P, element K, element S, and pH of the compost. These variables were analyzed using the method postulated in the Soil Research Institute book (2009). The results of the composting process were then compared with compost standards regulated by the Government of Indonesia [9].

Research Implementation

The experiment was carried out for three months from January to March 2018. The study was conducted in a shallot warehouse, Gandasuli Village, Brebes District, Brebes Regency. The composting process was done in a composting box. The composting box (fermenter) in the form of a cube measuring 1 m^3 was assembled by tying the top and bottom sides, and the box was made of assembled bamboo. Moisture control plastic was placed in a composting box on each side. Shallot waste was cut into pieces of approximately 5 cm (each composting box contained 90 kg of dry spring onions). The solution contained in the activator was prepared with a mixture of 54 L water + *Trichoderma sp.* and bioactivators with a concentration of 10^6 cfu/mL + molasses (the solution was left overnight to deactivate the bioactivators).

Shallot compost material was placed evenly in the fermenter box mixed with the solution containing the gradual activator and compacted by trampling to a thickness of 25 cm (called the first 25-cm layer) and so on in the layers until the layers were filled with 90 kg of shallots. The compost box (fermenter) was covered with a plastic or bamboo board, and the compost was left for a period of time according to the treatment of each box. The composting ran normally at temperatures between 50 - 70°C. Therefore, it was necessary to control temperature measurements for each day.

Data analysis

The obtained data were analyzed descriptively.

3. Result and Discussion

This study revealed that the shallot leaf waste was better without the composting process (dried in the sun) than with the composting process (Tables 1 and 2). The decomposition process of green shallots into compost was easier than the decomposition process of other organic materials, such as straw, bagasse, and livestock manure. Rice straw has a C/N ratio of 48.15; this value must be reduced through the composting process [7].

Table 1. The Quality Parameters of Shallot Compost in 6 days of the Composting Process

No	Parameters	Unit	Results	Time Period (Day)					
				1	2	3	4	5	6
1.	Component C-organic	%	35.22	30.40	26.29	29.47	30.65	27.36	29.85
2.	N-total	%	2.11	2.11	2.08	1.97	2.23	2.59	2.09
3.	C/N ratio value		16.70	14.44	12.62	14.98	13.76	13.43	11.62
4.	P_2O_5	mg/100 g	1,191	1,017	859	912	838	893	868
5.	K_2O	mg/100 g	7,361	10,994	6,999	5,992	6,430	6,578	5,543
6.	$(SO_4)^{2-}$	mg/100 g	1,479	798	1,107	852	165	207	831

Table 2. The Quality Variables of Shallot Compost in 28 Days of the Composting Process

No	Parameter	Unit	Results	Time Period (Day)			
				7	14	21	28
1.	Component C-organic	%	35.22	26.88	28.35	24.96	24.32
2.	N-total	%	2.11	2.51	2.96	2.85	3.07
3.	C/N ratio value		16.70	11.42	9.57	8.77	7.92
4.	pH		6.56	7.88	7.46	7.93	8.21

The results of the analysis showed that the composting time affected the quality of the produced compost. The compost was analyzed in several stages according to the predetermined incubation time. The not decomposed shallot leaves were analyzed one day before other treatments were decomposed.

The value of the C/N ratio refers to the ratios of carbon (C) and nitrogen (N) contained in organic material. The composting process aims to reduce the C/N ratio of organic matter in the compost. Compost with a C/N ratio value > 20 is not recommended being used for agricultural land because of the immobilization of N elements; moreover, if the C/N ratio reaches 12-20, the nutrients bound to the humus will be released through the mineralization process so that they can be used by plants [7]. The composting period affects the C-organic content and the C/N ratio of the compost. The long composting process of rice straw will increase the total N content and pH as well as decrease the C-organic content and C/N ratio [8].

The research analysis discovered that the value of the C/N ratio decreased (Table 2). This fact showed that the composting time reduced the C-organic content and increased the N-total compost. The decrease in the C-organic content of the soil was due to the composting process. Meanwhile, the fungus *Trichoderma sp*. will utilize the C-organic present in the scallion waste to produce energy as a source of life. Carbon is a source of energy for the life of microorganisms [8]–[5]. During the composting process, C-organic content will correlate with the time of the composting process, and the organic C will decrease during the composting process [3]. The N-total compost content in this research increased during the composting process (Table 2). The total N content increases because the microorganisms breaks down proteins into amino acids and then the ammonification process into ammonium that will produce nitrite and nitrate during the decomposition of the oxidation process [1].

The value of the C/N ratio is an important factor in the composting process because the process depends on the microorganism activities that require carbon as an energy source and nitrogen to form cells. If the C/N ratio is low, the nitrogen not used by microorganisms will be excessive and lost through volatilization as ammonia or denitrification. If the C/N ratio is too high, the microbes will have lack N for protein synthesis; thus, the decomposition process runs slowly [14].

The value of the C/N ratio of shallots without composting (treatment in the sun) was 16.70 with an organic C-content of 35.22% and a total N of 2.11%. Shallots without composting had a better C/N ratio than the other treatments. The assessment was conducted by considering the standard guidelines for solid organic fertilizers based on the 2019 Minister of Agriculture Regulation (Tables 1 and 2). Therefore, the organic material of shallot leaf waste used as compost was more effective when dried under the sunlight (natural composting) without any artificial composting processes.

Shallot compost with easy manufacture/process will facilitate shallot farmers to apply it in the shallot cultivation. The shallot leaf compost from shallot cultivation waste is a new technological innovation appropriately applied in shallot cultivation to maintain soil fertility and increase shallot crop yields.

4. Conclusion

The shallot leaf waste processed with the compost and dried by sunlight (natural composting) had a C/N ratio. The C-organic and N-total of this composting process were better than those of composting using a solution containing *Trichoderma sp.* activator. The long composting time of the shallot leaves could lower the quality of the produced compost.

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