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# Application Compost of Mud Cake by Trichoderma Viride Apt01 to Apples to Increase Production in Bumiaji Batu

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***ABSTRACT:*** *Production of apple field at Bumiaji Batu tends to decrease because of soil degradation. Objectives of this study are to determine whether the addition of compost by Trichoderma viride mud cake APT01 (compost APT) increase fruit production in apple crop "Anna" in Batu Bumiaji and to determine the effectiveness of adding compost APT also included treatment with (BKS) and without (TK) Bokashi compost addition as positive and negative controls. APT and BKS addition of compost as much as 10 and 20 kg per tree is given by the time the day after defoliation. A total of 15 old apple plants 4,0 - 4,5 years with the distance between plants 2-3 meters selected at random at the study site. Each treatment is applied to the 3 plants. After 3 and 4 months defoliation and harvest time (SR3, SR4 and SPN) receive such treatment, the production of fruit produced to be calculated its amount and weight. Furthermore, the data is processed by analysis of variance ANOVA. The results showed that the addition of compost APT by 10 and 20 kg per tree to increase the amount of fruit by 58.57 and 67.14% and the weight of fruit per tree 74.51 and 135.91% compared to controls.*

**Keywords:** *trichoderma, mud cake, apples, compost*

## I. INTRODUCTION

Region Bumiaji Batu city located in the watersheds of Brantas river. According to Soemarno [1] that the watersheds of Brantas river is a rainwater catchment area and very important for the areas underneath. This region has a mean annual rainfall of 1,700-2,700 mm, about 75% occurs in the rainy season and 25% on the dry season. Watersheds of Brantas river is one of the central production of horticultural crops, especially potatoes, cabbage, carrots, and apples. Apple plants can grow well in the area that the average rainfall is between 1,000 to 3,000 mm per year [2].

Apple plantation centers currently located in Tulungrejo. The village is very fertile with society's diverse style and mostly subsistence farmers apples, which are still productive agroecologicaly (soil and climate). However, the land used to produce crops usually have a much greater erosion of land with natural vegetation. Increasing of erosion causes by the replacement of the structure of forest plant roots which bind the soil strongly with a weaker root structure of agricultural crops [3]. This is reinforced by the application of farming system that uses high fertilizers and chemical pesticides and likely increases from year to year, both in quality and quantity, which in turn exceeds the carrying capacity of the land. As a result, the land being damaged and decline in production [4]. Such these conditions force us to constantly seek new breakthroughs for land use that can meet the needs of the community while helping to conserve resources and minimize the impact of external land. One form of such breakthrough was the addition of organic fertilizer such as compost given twice a year. Some of the literature mentioned that the content of organic matter in Java agricultural land is less than 1% which is ideally should be more than 2% [2]. The carbon organic deficiency is an indicator in the excess of chemical fertilizer.

Based on the test results, the number of organic fertilizer needed by the apple plant which have 0.79% organic content in soil is 30 – 50 kg per tree [5]. The organic fertilizer can be derived from agriculture waste and manure, household waste or even from the sugar cane industry known as mud cake. Mud cake waste generated by the sugar mills are dirty, brownish watery and smelled which disturb the surrounding community, therefore need to be composted to become organic fertilizer.

Basic principles of composting procedures has been widely discussed in the literature [6]. Aerobic composting of organic material is a humification process of unstable organic matter (C/N ratio >25) to become stable, characterized by the release of heat and gas from composted substrates. Composting duration varies from 2 to 7 weeks, depending on the type of decomposers and composting techniques used [7]. Level of maturity and stability in compost determine compost quality shown by the various changes in the physical, chemical and biological compost substrate. Good quality compost according to ISO quality standards: 19-7030-2004 is the

same as the temperature of the compost soil water temperature, pH ranged from 6.80 to 7.49, and the C/N ratio between 10-20 [8].

Composting strategy that has been developed at this time is to combine composting conditions by adding decomposers. The example to set conditions of organic material C/N ratio to be composted is when the C/N ratio of organic matter is more than 40, it is necessary to add organic material having C/N ratio around 20.

Energy is required for the growth of microorganisms derived from the element of carbon and nitrogen present in organic matter. For a good composting process, the C/N ratio is approximately 30. The carbon element is needed as the energy for microorganism and the nitrogen element as protein synthesis as well as for the energy supply. If the C/N ratio is too low or too high, it will inhibit the decomposition process. Something similar was stated by Isroi [9] that the C / N ratio effective for the composting process ranged from 30 to 40.

In addition to regulating the C/N ratio, the composting process can be accelerated by adding a mixture of various cultures microorganisms as a decomposers. Decomposers of organic materials on the market and containing various types of microorganisms are EM4, stardec, Biocompos, Orgadec, Starbio, Messbio. Mixture of microorganisms can be bacteria, actinomycetes, yeasts, and molds. One type of mold that is often used to decompose the organic matter is of a kind of fungus Trichoderma sp. This belongs to a class of microorganisms that can live askomisetes optimum temperature in the range of 25-30 0C [11]. Ability to respond to environmental acidity and carbon dioxide is quite varied. Increased carbon dioxide will lead to changes in the level of acidity. The optimum pH for growth of Trichoderma sp. ranged between 3-7. While other factors that influence the growth is moisture [12]. Growth of Trichoderma sp. can take place in a maximum at 79% relative humidity conditions [13].

## II. METHODS

Implementation of field research began in February to October 2012 in an apple orchard crop "Anna" of 400 square meters located in the area of Tulungrejo, Bumiaji, Batu. The age of the plant approximately 4 - 4.5 years, with a distance between plants 2-3 feet. The research was carried out experimentally by treatment type and volume of compost made by three replications. The amount of compost as much as 10 and 20 kg per tree, good compost decomposition Trichoderma viride APT01 (compost APT) and Bokashi decomposition with EM4 (compost BKS) as a positive control. Whereas without given compost plant (TK) is treated as a negative control. Each type and amount of compost were randomly assigned to each plant apple a day after defoliation. Observations made during fruit growth 3 and 4 months after giving compost (SR3 and SR4) and at harvest (SPN). The parameters measured were the number and weight of fruit per tree. Furthermore, the data is processed using variance ANOVA statistical analysis.

## III. RESULTS AND DISCUSSION

The data research of compost APT decomposed by Trichoderma viride APT01 is shown in Table.1

Table 1. The outcome of the compost on the number and weight of fruit

| Type compost | Compost weight (kg) | Parameter | | | | | |
|---|---|---|---|---|---|---|---|
| | | Number of fruit | | | Weight of fruit (kg) | | |
| | | SR3 | SR4 | SPN | SR3 | SR4 | SPN |
| Without compost (TK) | 0 | 35 | 29 | 24 | 0,75 | 1,16 | 1,95 |
| | 0 | 32 | 27 | 21 | 0,55 | 0,98 | 1,73 |
| | 0 | 37 | 32 | 25 | 0,69 | 1,12 | 1,89 |
| Compost APT | 10 | 44 | 40 | 37 | 1,01 | 1,92 | 3,24 |
| | 10 | 41 | 37 | 34 | 0,98 | 1,70 | 3,07 |
| | 10 | 48 | 44 | 40 | 1,20 | 2,07 | 3,40 |
| Compost APT | 20 | 52 | 48 | 45 | 1,40 | 2,64 | 4,40 |
| | 20 | 42 | 38 | 34 | 1,09 | 2,20 | 3,89 |
| | 20 | 46 | 43 | 38 | 1,28 | 2,41 | 4,37 |
| Compost BKS | 10 | 45 | 41 | 38 | 0,98 | 1,68 | 3,07 |
| | 10 | 42 | 37 | 34 | 1,04 | 1,57 | 2,95 |
| | 10 | 46 | 43 | 38 | 1,08 | 1,72 | 3,03 |
| Compost BKS | 20 | 42 | 38 | 34 | 1,18 | 2,48 | 4,19 |
| | 20 | 56 | 52 | 48 | 1,30 | 2,67 | 4,58 |
| | 20 | 40 | 37 | 34 | 1,26 | 2,53 | 4,36 |

Description:
SR3 = after 3 months defoliation, SR4 = after 4 months defoliation, SPN = the time of harvest.

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The above observations data further processed by variance ANOVA statistical analysis and expressed in Table 2 and Figures 1 and 2.

Table 2. Average yield and the percentage of the number and weight of fruit

| Name | Number of Fruit | | | | | | Weight of Fruit | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SR3 | | SR4 | | SPN | | SR3 | | SR4 | | SPN | |
| | JB | % | JB | % | JB | % | BB | % | BB | % | BB | % |
| TK | 34.67 | | 29.00 | | 23.33 | | 0.87 | | 1.09 | | 1.86 | |
| APT 10 | 44.33 | 27.88 | 40.33 | 27.88 | 37.00 | 58.57 | 1.06 | 22.69 | 1.90 | 74.54 | 3.24 | 74.51 |
| BKS 10 | 44.33 | 27.88 | 40.33 | 27.88 | 36.67 | 57.14 | 1.03 | 19.23 | 1.66 | 52.45 | 3.02 | 62.48 |
| APT 20 | 46.67 | 34.62 | 43.00 | 34.62 | 39.00 | 67.14 | 1.26 | 45.00 | 2.42 | 122.39 | 4.38 | 135.91 |
| BKS 20 | 46.00 | 32.69 | 42.33 | 32.69 | 38.67 | 65.71 | 1.25 | 43.85 | 2.56 | 135.58 | 4.38 | 135.73 |

Description:
JB = Number of fruit BB = Weight of fruit TK = Without compost
APT 10 = 10 kg Compost APT01 APT 20 = 20 kg Compost APT01
BKS 10 = 10 kg Bokashi Compost BKS 20 = 20 kg Bokashi Compost

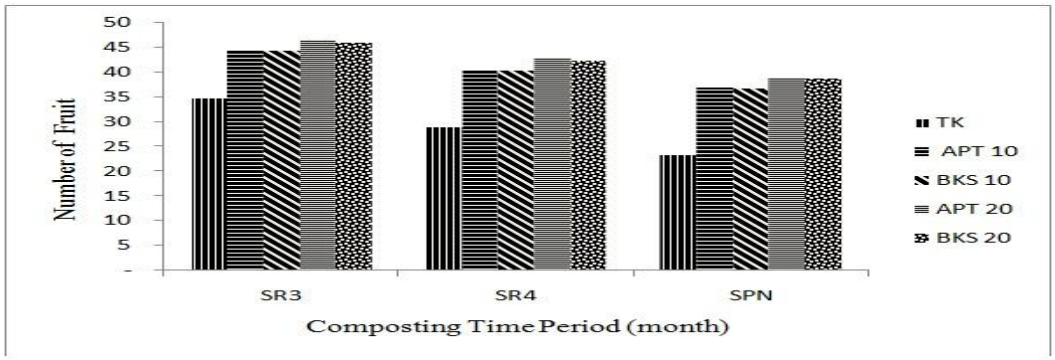


Figure 1. The amount of fruit on SR3, SR4, and SPN with various treatments

At the time of SR3, the amount of fruit produced by the addition of compost both APT and APT 10 APT 20 on apple plants increases ranged between 27.88 and 34.62% compared to the control without compost (TK). The addition of compost BKS as a positive control in an increase of the percentage of fruit between 27.88 and 32.69%. The percentage increase in the amount of fruit as a result of the addition of organic matter such as compost BKS or APT. The addition of organic matter can improve soil fertility either physically, biologically and chemically. At this time the apple plantation land in Batu likely already degraded.

Land degradation in the uplands mainly because of erosion, lack of organic matter and nutrient loss due to conversion of forest to agricultural land [14]. The impact of land degradation resulting in yield reduction amount of fruit produced by plants.

The amount of fruit during four months after defoliation (SR4) increased by 39.08% to 48.28% by the addition of compost APT as much as 10 and 20 kg per tree. While the percentage of the number of fruit increases at harvest (SPN) ranging between 58.57% and 67.14%.

Age tends to reinforce the fruit on the stem of the plant resulting in reduced fruit loss is concerned. The plants network systems become stronger as a result of nutrients such as potassium and calcium can be absorbed by plants. Both of these elements present in the compost organic matter both APT and BKS. Potassium and calcium is in the form of positive ions that tend to be bound by the negatively charged organic matter to form compounds available to plants. These elements play a role in strengthening and toughen plant tissues such as flowers and fruit so it does not easily fall out.

Some minerals such as potassium and calcium present in the soil organic matter tend to join and gives rise to the production [15]. Encourage increased soil organic matter and cation exchange capacity to respond to 90% adsorption strength of the soil. Cations such as potassium and calcium will be generated during the decomposition [16].

Nutrient potassium and calcium play a role in the absorption of further nutrients available to plants which can further strengthen such networks fruit, a decline in the number of pieces that fall off.

The addition of compost can reduce fruit loss as a result of the increasing value of soil fertility and biological diversity. This is according to research conducted by Adriano [17] that after 140 days the addition of compost and bio-activator to an increase in the fertility of agricultural land plants, and diversity microorganism enzyme activity in the soil.

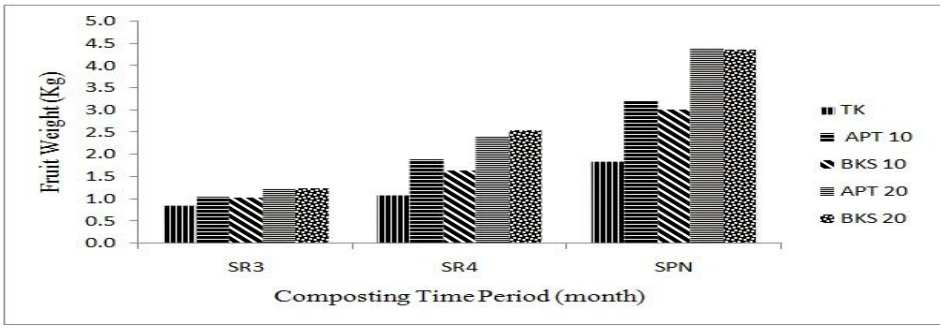


Figure 2. Fruit weight at SR3, SR4, and SPN with various treatments

Observations weight of fruit per tree from various compost treatments above mentioned that the addition of compost BKS and APT can enlarge apple production. The largest increase in yield 135.91% and 135.73% on the addition of compost obtained APT and BKS as much as 20 kg per tree. While the addition of 10 kg per tree, BKS and APT compost each able to increase fruit yield by 74.51 and 62.48% compared to controls.

The addition of composted organic material has been done previous research on apple crop varieties "Galaxy" were able to increase production more than 10% [18].

## IV. CONCLUSION

For apple crop ages between 4 to 4.5 years by the addition of APT compost as much as 10 and 20 kg per tree to increase the amount of fruit by 58.57 and 67.14%, and increase the weight of fruit per tree 74.51 and 135.91% compared to control.

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