Application of Compost APT01 to Increase the Apple Crop Production

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ABSTRACT -The use of chemical fertilizers impacts on degraded agricultural lands. The greater the land is degraded, the greater the chemical fertilizer is added to the soil to obtain a maximum result. This study aims to analyze the effect of the type and amount of compost APT01 as the soil organic matter to the apple crop production (*Malus sylvestris*) at 3 and 4 months of a day after defoliationand at harvest time (SR3, SR4 and SPN). The experiment was carried out according to completely randomized factorial design with the amount of compost and the season time of production. The experiment was conducted in a treeation area of 400 square meters. Organic materials was fermented for 1, 2, and 3 weeks (F1, F2, and F3). The amount of compost APT01 as much as 20, 30, and 40 kg per treewas applieda day after defoliation. A total of 27 apple trees aged about 7.0 to 7.5 years with a distance between trees 2-3 meters randomly selected. Observations made during fruit growth 3 and 4 months after giving compost (SR3 and SR4) and at harvest (SPN).The parameters measured werethe number and weight of fruit per tree. Results were analyzed variance, two-way ANOVA with interaction (α = 0.05),using Microsoft Excel. The results of ANOVA variance analysis concluded that: (1) Addition of compost APT01with fermentation time F1, F2 or F3 did not differ significantly (α = 0.05)to total fruit production on SR3, SR4, and SPN. This shows that the time required to ferment the blobs into compost with APT01 Biocatalyst was 1 week, (2) The addition of 20, 30, and 40 kg of compost per tree, respectively for F1, F2, and F3 show significant differences (α = 0.05) on the amount of fruit production on SR3, SR4, and SPN, (3) The addition of 30 and 40 kg of compostAPT01 has an impact on increasing the number of fruit ranged from 19-29, fruit weight increase of 3.3-3.9 kg per tree, and the quality of fruit from grade C (12-13fruits per kg) to grade AB (10-11 fruits per kg).

Keywords : mud cake; apple; APT01; compost; defoliation.

INTRODUCTION

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 degradated and decline in production (Milosevic, T. and N. Milosevic, 2009). 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 3%(Suhariyono *et al*, 2008). Based on the test results, the number of organic fertilizer needed by the apple tree which have 0.79% organic content in soil is 30 – 50 kg per tree(Pramono dan E. Siswanto, 2007).

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.

The interest of public to improve soil fertility is by applying compost as an organic filler. Farming communities are encouraged to convert agricultural waste such as corn stalks and grasses used as raw material to make compost. Quality of compost produced depends on the raw materials and the treatment of the composting process (Njira*et al*, 2012).

The process of composting organic materials can be accelerated by the addition of *T. viride* APT01 as biocatalyst that could decrease the C:N and total organic carbon which was originally 26.8 and 37.6% to 14.6 and 22.7% (Budiono *et al*, 2015a). This is supported by the addition of organic matter such as manure into the soil to improve the quality of physical and chemical impact on improving soil porosity, pH, soil organic carbon and nitrogen as well as capable of maintaining soil fertility (Eche *et al*, 2013).

Isolate*T. viride* APT01 as bio-activator of organic material, capable of accelerating the decomposition of mud cake in no more than six days of the incubation period. It can be concluded that fungus *Trichoderma* sp. is a high potential as a producer of cellulaseenzymes (Budiono*et al*, 2015a).

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 (2012) that after 140 days the addition of compost and bioactivator to an increase in the fertility of agricultural land trees, and diversity microorganism enzyme activity in the soil.

The carbon organic deficiency is an indicator in the excess of chemical fertilizer.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 (Budiono*et al*, 2013).

In period-1, production of fruit weight per tree by the addition of compost APT01 ranging from 3.24-4.22 kg, while on period-2 of 3.97-4.91 kg/tree. The addition of compost APT01 at period-1 is able to increase production 74.51-135.91% significantly (α = 0.05) compared with no addition of compost (Budiono *et al*, 2013). The addition of compost to the same treatment as period-1 for the next season (period-2) increasing production 16.35-22,53% compared to the period-1. The magnitude of the increase in the percentage of period-1 nutrient expected to remain high in the soil mainly nitrogen, potassium and phosphorus in the form of unavailable become available by adding compost APT01 (Budiono *et al*, 2015b).

Previous research on the use of compost in apple treeations was also carried out in Himachal Pradesh, India. The addition of compost as much as 5-15 kg per tree once a year. The study concluded that the quantity and quality of apples has increased in terms of fruit size, storage time of apple fruits, and soil quality (Vineet, 2012). Improvement on fruit size will have an impact on increasing the value of rupiah. It is known in the market in Batu, Indonesia that the apple grades currently are A, AA, AB and C. Grade A contains 6-7, AA 8-9, AB 10-11 and C 12-15 fruits per kg. The price of grade A > AA > AB > C (Budiono *et al*, 2015b).

METHODS

The experiment was carried out according to completely randomized factorial design with the amount of mud cake composting and the season time of production. The amount of compost APT01 as much as 20, 30, and 40 kg per treewas applieda day after defoliation. Fermentation time for 1, 2, and 3 weeks (F1, F2, and F3). The study was conducted in an apple crop of 400 square meters in the area of Batu, Indonesia.The age of the tree approximately 7.0-7.5 years, with a distance between trees 2-3 meters. Implementation of field research began in February-August 2017. Observations made during fruit growth 3 and 4 months after giving compost (SR3 and SR4) and at harvest (SPN). The parameters measured werethe number and weight of fruit per tree. Results were analyzed variance, two-way ANOVA with interaction (α = 0.05),using Microsoft Excel.

RESULTSANDDISCUSSION

Observation of fruit growth per period (SR3, SR4 and SPN) was conducted for 6 months from composting to harvest. Tree observations were undertaken at the completion of leaf assemblage in February of 2017 until fruit production was harvested in August 2017. The parameters observed were generative growth (total number and weight of fruit per tree) as shown in Tables 1, 2 and 3.

Table 1. The result of apple production by a compost APT01 at time of F1

Compost (kg) per tree	Number of Fruit			Weight ofFruit (kg)		
	SR3	SR4	SPN	SR3	SR4	SPN
20	75	67	62	2.0	3.1	5.3
30	96	93	89	2.8	4.9	9.0
40	98	95	91	2.8	5.0	9.1

Table 2. The result of apple production by a compost APT01 at time of F2

Compost (kg) per tree	Number of Fruit			Weight ofFruit (kg)		
	SR3	SR4	SPN	SR3	SR4	SPN
20	83	76	71	2.2	3.3	5.8
30	98	93	90	2.9	5.1	9.3
40	99	95	91	2.9	5.1	9.3

Table 3. The result of apple production by a compost APT01 at time of F3

Compost (kg) per tree	Number of Fruit			Weight ofFruit (kg)		
	SR3	SR4	SPN	SR3	SR4	SPN
20	82	75	70	2.2	3.4	5.9
30	96	93	90	2.8	5.0	9.2
40	98	95	92	2.9	5.1	9.2

At the time F1 of SR3, the amount of fruit produced by the addition of compost 30 and 40 kg increases ranged between 28.00 and 30.67% compared to 20 kg per tree. The percentage increase in the amount of fruit as a result of the addition of organic matter such as compost APT01. The addition of organic matter can improve soil fertility either physically, biologically and chemically. At this time the apple treeation 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 (Asio, 2012). The impact of land degradation resulting in yield reduction amount of fruit produced by trees.

The amount of fruit during four months after defoliation (F1 of SR4) increased by 38.80 to 41.79% by the addition of compost APT01 as much as 30 and 40 kg per tree. While the percentage of the number of fruit increases at harvest (F1 of SPN) ranging between 43.55% and 46.77%.

Addition of compost APT01 reducing the value of the original fruit to fall 32.78% to 16.48-16.49%. Application compost APT01 directly into the soil cannot be well absorbed by tree roots. This is shown by the growing strength of the fruit stalk during 4 months of composting than during 3 months. Strengthening the fruit stalk as a result of absorption of potassium and calcium those can be absorbed by trees. Potassium and calcium in the form of positive ions tend to be bound by negatively charged organic compounds to form compounds available to trees. These elements play a role in strengthening elements of trees such as flower and fruit so it does not easily fall out (Budiono *et al*, 2013).

Previous research in period-1, production of fruit weight per tree by the addition of compost APT01 ranging from 3.24-4.22 kg, while on period-2 of 3.97-4.91 kg/tree. The addition of compost APT01 at period-1 is able to increase production 74.51-135.91% significantly (α = 0.05) compared with no addition of compost (Budiono *et al*, 2013). The addition of compostAPT01 to the same treatment as period-1 for the next season (period-2) increasing production 16.35-22,53% compared to the period-1. The magnitude of the increase in the percentage of period-1 nutrient expected to remain high in the soil mainly nitrogen, potassium and phosphorus in the form of unavailable become available by adding compost APT01 (Budiono *et al*, 2015b).

Data of Table 1.could show that the percentage of

fruit loss on apple tree by the addition of compost APT01 of 20, 30, and 40 kg in F1 was(17.33, 7.29, and 7.14%). At the same addition of compost in Table 2 and Table 3 were (14.46, 8.16, and 8.08%) and (14.63, 6.25, and 6.12%). The value of the fruit loss tends to decrease by increasing the compost APT01 to the soil. This is evidenced by the addition of compost as much as 20, 30, and 40 kg for each apple tree aged 7.0 to 7.5 years have an impact on the reduction of fruit loss value.

Observations weight of fruit per tree from various compost treatments above mentioned that the addition of compost APT01 can enlarge apple production. The largest increase in yield 55.93-71.70 and 55.93-73.58% on the addition of compost APT01 as much as 30 and 40 kg per tree.

Previous research by Adebayo *et al* (2013), found that the addition of compost on Okra trees were able to increase significantly the number and weight of fruit production. Similar studies had been reported by Khan and Ishaq (2011), that the addition of compost made from the remains of trees and livestock manure into the soil can improve nutrient of potassium, nitrate, and phosphorus in the form available to trees. The availability of tree nutrients accelerated growth and increased sustainablility in production. The addition of composted organic material has been done previous research on apple crop varieties "Galaxy" were able to increase production more than 10% (Fediala *et al*, 2015).

The number of apple trees per hectare is 1,500-1,700 trees. Composting per season of production per hectare is 30-50 tons per hectare. For apple trees that are productive (10-20 years), the amount of compost added can reach 50-60 tons per hectare per season. The addition of the compost is expected to affect the increase of flower and fruit production. The results of the research of the productivity of apple trees by the addition of compost APT01showed an increase in the number of fruits as a result of the addition of compost.

The addition of compost APT01 as much as 20 and 30 kg per tree impact to increase in a weight and a number of fruit was originally 5.3-5.9 kg (62-71 fruits) to 9.0-9.3 kg (89-90 fruits). When it made the quality grade, the average fruit produced from 12-13 to 10-11 fruits/kg, and can be categorized into Grade C to AB. The research Previously by Caione *et al* (2015), which states that the use of compost of mud cake of 7.5 tonnes / ha can increase the content of phosphorus in the soil, leaves and stalks and crop productivity. The research data of Budiono *et a.* (2016),showed that 20 kg compost APT01addition gave the best result to improve quality and quantity productivity of apple trees than Bokashi compost in SPN. The 20 kg APT01 compost addition supressed the fruit loss until 13.85% and improve fruit weight until 49.11% .

CONCLUSION

The results of ANOVA variance analysis concluded that: (1) Addition of compost APT01with fermentation time F1, F2 or F3 did not differ significantly ($\alpha = 0.05$)to total fruit production on SR3, SR4, and SPN. This shows that the time required to ferment the blobs into compost with APT01 Biocatalyst was 1 week, (2) The addition of 20, 30, and 40 kg of compost per tree, respectively for F1, F2, and F3 show significant differences ($\alpha = 0.05$) on the amount of fruit production on SR3, SR4, and SPN, (3) The addition of 30 and 40 kg of compostAPT01 has an impact on increasing the number of fruit ranged from 19-29, fruit weight increase of 3.3-3.9 kg per tree, and the quality of fruit from grade C (12-13fruits per kg) to grade AB (10-11 fruits per kg).

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