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Effect of Applying Compost Tea Through Leaves and Soil on Soil P availability and P Uptake of Maize (Zea mays L.) at Alfisol Jatikerto Kab. Malang

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ABSTRACT

This study aims to determine the effect of the compost application on P availability in Alfisols and to compare the compost application through leaves and soil to the P uptake of corn plants. The low availability of P in Alfisol is due to the bond with Ca to form tricalcium phosphate which is difficult to dissolve. One effort that can be done to overcome the lack of P in Alfisols is the addition of organic matter to the soil, both from plants and animals. The final process of decomposition of organic matter produces humic and fulvic acid compounds which can increase the availability of P. Compost tea is the result of a solution of washing nutrients and extracts of bacteria, fungi, protozoa and nematodes from compost. Compost tea can be given in two ways, namely by spraying it through the leaves and giving it to the soil through the leaves and the soil against the P uptake of corn plants. Compost tea is made using the Bubbler method. Before being applied, the compost must be diluted with distilled water (1:1 ratio) to reduce the concentration. The experimental design used in this study was a completely randomized design with 7 treatments and 3 replications with the following types of treatment: CT0 (control); CT1 (soil + compost tea 130 ml/plant equivalent to 50 l/100 m2); CT2 (soil + compost tea 250 ml/plant equivalent to 100 l/100m2); CT3 (soil + compost tea 400 ml/plant equivalent to 150 l/100 m2); CT4 (soil + compost tea 60 ml/plant equivalent to 25 l/100 m2); CT5 (soil + compost tea 130 ml/plant equivalent to 50 l/100 m2); CT6 (soil + compost tea 200 ml/plant equivalent to 75 l/100 m2); The results showed that the application of compost tea through the leaves and soil had a significant effect on the difference in available-P levels. Application of the compost through the leaves increased plant height, number of leaves, plant dry weight and P uptake. There was a positive correlation (r=0.386) which showed that increasing available P levels in the soil would increase plant P uptake.

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1. INTRODUCTION

Phosphorus is a functional nutrient for plants. One of the functions of P for plants according to Hardjowigeno (2003) is to support root development. Winarso (2005) suggests that the element phosphorus is very useful in the process of photosynthesis, respiration, transfer and storage of

energy, cell division and enlargement as well as other processes in plants. Deficiency of P element causes stunted growth and fruit maturity, thereby reducing production. One effort that can be done to overcome P deficiency in Alfisols is the addition of organic matter to the soil, both from plants and animals.

The final process of organic matter decomposition produces humic and fulfic acid compounds which can increase the availability of P. In addition, Sugito, Nuraini and Nihayati (1995) suggested that the results of weathering of organic matter can produce amino acids such as alanine and glycine which then undergo ammonification releasing NH4 + ions. Harjadi, 1979 (in Sugito et al., 2002) suggests that if plants experience limitations in the process of using fertilizers given through the soil, then giving them through the leaves can help overcome these limitations.

Kuepper (2003) reported that foliar fertilization can increase yields, resistance to pests and diseases, resistance to drought and increase crop quality. On the other hand, from the results of research and application by farmers, it was also reported that there was growth and an increase in crop production, especially food crops (rice, corn, soybeans) after applying cypramin liquid fertilizer to the soil.

Compost tea is the result of a solution of washing nutrients and extracts of bacteria, fungi, protozoa and nematodes from compost (Anonymous, 2005). Today compost tea has been widely used for large-scale agriculture, plantations, horticulture and landscaping. Giving organic matter that has been incubated for 30 days can reduce P uptake by plants because organic anions are effective compounds to replace phosphate ions which are adsorbed by soil minerals.

One form of compost is liquid compost or commonly called the compost. Compost tea is the result of a solution of washing nutrients and extracts of bacteria, fungi, protozoa and nematodes from compost (Anonymous, 2005). The compost can be given in two ways, namely sprayed through the leaves and given to the soil. In general, these two methods are better known as Foliar Application (giving through leaves) and Soil Application (giving through the soil).

Compost tea applied to the soil will move into the root zone and affect the plant rhizosphere. The nutrients in the compost will be used by plants as well as possible. Organisms in compost tea may compete with organisms in the soil, but are more likely to become part of the soil and plant ecology (Ingham, 2005b).

2. METHOD

2.1 Types of research

The research method used in this study is the experimental method. The experimental method is a form of observation under artificial conditions, where these conditions are created and regulated by the researcher. That is, basically conducting an experiment to see the results, and the results of the experiment will confirm how the causal position is between the variables being investigated.

2.2 Research Variables

The research variables are the independent and dependent variables with the independent variable being the soil and the dependent variable being the effect of the compost on the soil.

2.3 Research design

This study used a completely randomized design (CRD) with 7 treatments and 3 replications. According to Ingham (2005a) the optimum dose of compost tea that has been given is 100 l/100m2 (to soil) and 50 l/100m2 (to plants). The difference in the dosage of compost tea in each treatment aims to obtain a minimum and maximum yield of soil P availability and P uptake of corn plants while still being guided by the optimum dose (to soil: to plants = 2:1). The dose of compost tea that has been obtained is then converted into the number of applications per plant.

2.4 Sampling location

This study used a sample of tea compost by adding it to the soil and its effect on the availability of P in Alfisols and comparing the application of tea

compost through leaves and soil on P uptake of corn plants.

2.5 Time and Place of Research.

This research was conducted in a greenhouse, UPT Compost and Soil Chemistry Laboratory, Department of Soil, Faculty of Agriculture, University of Brawijaya. Implementation time started in February to March 2006.

2.6 Tools and Materials

The tools used in the study were scopes, buckets and scales for taking soil samples, 5 kg polybags as soil containers for plant media, aerators to create an aerobic atmosphere during compost tea making, a ruler and tape measure to measure plant height, splashing water to water the plants, and sprayer.

The materials used in the research include organic matter in the form of finished compost produced by UPT Compost, Faculty of Agriculture, University of Brawijaya; origin of campus organic waste from the Final Disposal Site (TPA) Universitas Brawijaya. The above compost is made into compost tea using the Bubbler method. Aquadest to dilute the compost tea so that the concentration decreases. While the soil medium used is Alfisol derived from the experimental garden of the Faculty of Agriculture, University of Brawijaya in Jatikerto, taken compositely at a depth of 0–20 cm (top layer). The corn seeds used were Bisi 10 hybrids and the sources of N and K were Urea (150 kg N ha-1) and KCl (100 kg K ha-1).

2.7 Research procedure

The study began with the soil taken compositely at a depth of 0–20 cm (processed layer), air-dried, then pulverized and sieved through a 2 mm sieve for the observation sample which was then weighed equivalent to 5 kg of oven dry soil (1 polybag = equivalent to 5 kg of dry soil oven) and put into polybags and continued with making compost tea then making media for making observations.

2.8 Data analysis.

The data obtained was tested statistically using the F test ANOVA (5%) to see the difference in effect between treatments. If there is an effect between treatments, continue with Duncan's test at the 5% level. Correlation test is used to determine the relationship between parameters.

3. RESULTS AND DISCUSSION

3.1 Research result

3.1.1 Effect of Giving Compost Tea Through Leaves and Soil on Soil Chemical Properties

The results of the analysis of variance showed that the application of compost tea through soil and leaves had a significant effect at 14 and 28 DAP and very significant at 42 DAP on soil pH. The effect of this soil pH changes the criteria for the pH value at the beginning of the basic soil analysis, namely, it becomes slightly acidic to neutral (5.5-6.5; 6.5-7.5 according to Syarief, 1989).

Table 1. Effect of Compost Tea Treatment on pH

Treatment	Application	Dose (ml/plant)	14 HST	28 HST	42 HST
CT0	Control	-	6023	6.027a	6.087a
CT1	to the ground	130	6.25ab	6.027a	5,78a
CT2	to the ground	250	6.37c	6.32ab	6.37ab
CT3	to the ground	400	6.38c	6.42c	6.6b
CT4	to plants	60	6.067a	6.43c	6.64b
CT5	to plants	130	6.07a	6.08a	6.12a
CT6	to plants	200	6.08a	6.19ab	6.24a

Note: Numbers accompanied by the same letter in the same column are not significantly different in the 5% Duncan test.

During the observation period (14, 28 and 42 DAP) soil pH increased in all treatments. In the control (without treatment) has the lowest pH value. But this pH value does not differ much from the treatment on the leaves. It is suspected that in the treatment of the leaves, the compost tea given did not interact directly with the soil so that the pH value did not change much. Whereas in the treatment of soil, soil pH values tended to be higher presumably due to organic acids dissolved in the compost tea. These organic acids are able to reduce the Ca-P Alfisol bonds, so that the pH increases due to the addition of alkaline cations in the soil (Hakim et al., 1986). Added by Stevenson (1977) an increase in pH is suspected of protonation and deprotonation of the results of the decomposition of organic matter which in turn affects the H+ concentration of the soil solution.

3.1.2 The Effect of Giving Compost Tea Through Leaves and Soil on Growth, Dry Weight and P Uptake of Plants.

The results showed that all treatments experienced an increase in plant height, number of leaves, plant dry weight and plant P uptake. as in plant height the application of compost tea through the leaves significantly increased plant height compared to the application through the soil. This is presumably because the application of compost tea through the leaves is more quickly absorbed by plants than that given through the soil then on the number of leaves giving compost tea to the leaves has a more significant effect on the growth of corn plants compared to the soil and

on the dry weight of plants giving compost tea through leaves and soil has a very real effect on the dry weight of corn plants. Similarly with plant height and number of leaves.

Allegedly because the compost tea that is applied to the leaves can be directly absorbed by the plants. Meanwhile, the application of compost tea to the soil has a lower P absorption value, presumably due to the activity of microorganisms in the soil which temporarily bind inorganic P in their body tissues, thereby affecting the absorption of P by corn plants (Buckman and Brady, 1982).

3.2 Discussion

In general, the application of compost tea through leaves and soil has a significant effect on soil pH, available-P, plant growth, dry weight and P absorption. The organic acids dissolved in the compost tea are able to release Ca-P bonds in the soil solution so that P becomes more available which in turn affects plant growth, dry weight and P uptake. The relationship between available P and plant P uptake in the correlation table is positive with r = 0.386. This positive correlation indicates that an increase in available P will be followed by an increase in plant P uptake.

The relatively small correlation value is thought to be due to differences in the absorption factor between the compost tea treatment through leaves and soil. The relationship between plant P uptake and plant height is shown in the correlation table (Appendix 6, r = 0.978) is positive. This positive correlation indicates that an increase in P uptake will be followed by an increase in plant height.

According to Rifai (2006) there is a relationship between plant P uptake and plant height which results in an increase in plant height with an increase in P absorbed by plants during the vegetative period. Added by Syarief (1986) P is from the cell nucleus, very important in cell division and also for the development of meristem tissue.

Thus P can stimulate the growth of roots and young plants, accelerate flowering and ripening of fruit, seeds or grain, besides that it is also a constituent of fat and protein. According to Sugito et al. (2002) the important function of N during the vegetative phase is to assist in the formation of photosynthate which is then used to form new cells, cell elongation and tissue thickening. The rate of cell division, elongation and tissue formation goes fast according to the increase in carbohydrates, so that stem growth both in height and in diameter increases which in turn affects plant dry weight. Winarso (2005) added that increasing the dose of N fertilization in the soil can directly increase the protein content and production of corn plants.

4. CONCLUSION

Application of compost tea through leaves and soil had a significant effect on differences in available-P levels. The highest available P level occurred at 42 DAP. The percentage increase in available P levels in the application of compost tea to the soil (CT3) was 85.78% and to the leaves (CT6) of 29% compared to the control and the application of compost tea through the leaves increased plant height, number of leaves, plant dry weight and absorption. P

From the high yield of plants, applying compost tea to leaves (CT6) increased by 48.63% and to soil (CT3) 24.66%. While the P uptake value of plants in the application of compost tea to the leaves (CT6) increased by 63.81% and the application to the soil (CT3) increased by 19.62% compared to the control and there was a positive correlation (r=0.386) which showed an increasing level of P-available in soil will increase plant P uptake.

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Further research is needed for the combination of giving the compost through leaves and soil.

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