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The Effect of Biostarter Addition on Kudzu (Pueraria Javanica) Compost to Nutrient Content and N Absoprtion of Mustard (*Brassica Juncea L.*)

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ABSTRACT

Compost fertilizer is very influential on the nutrient status of the soil and plants. Giving compost fertilizer will also have a good effect on the growth and development of mustard plants. This study aims to determine the effect of the addition of biostarter on compost fertilizer to N-total and N nutrient absorption on mustard plants. The experiment was structured using factorial randomized group (RAK) design. The method in this study using compost analysis,soil analysis, and plant analysis. The results showed that the nine samples have different nutrient content and nutrient nutrient absorption resulting in different effects on soil and mustard plants. Nitrogen in the soil greatly affects the N nutrient absorption on plants, the two parameters have a positive correlation which means directly proportional. Nitrogen absorbed by plants affects N-total levels in plants. N levels in plants and soil is very influential on the color of the leaves of mustard plants. Through the nutrient levels can be known proper fertilization recommendations for mustard plants. Based on the analysis of nutrient levels in soil and plants known fertilizer recommendations in nine samples with the addition of biostarter in kudzu compost and fertilizer doses.

INTRODUCTION

Mustard greens (*Brassica Juncea L.*) is a vegetable plant that is used by most people as food. Mustard greens (*Brassica Juncea L.*) can also be used as a medicine for various diseases so that mustard greens are a group of vegetables that have an important role in meeting the food, nutritional and medicinal needs of the community (Istarofah and Salamah, 2017). The quality of mustard greens is based on freshness and crispness, which is strongly influenced by moisture content, texture, nutritional content and physical appearance. Quality vegetables can also be based on freshness, cleanliness and leaf color (Yustina et al, 2017).

Provision of organic fertilizers will have a good effect on the growth and development of mustard plants. Compost is one of the organic fertilizers used in agriculture to reduce the use of inorganic fertilizers (Elpawati et al, 2015).

Kudzu plants have recently been used as compost by farmers. The kudzu plant (Pueraria javanica) grows quite well in absorbing nutrients indicating a high nutrient content in the kudzu plant tissue. According to Tropical Forages (2017), Kudzu is a type of cover crop which is classified as a legume plant, so it can carry out N fixation, suppress sugar growth, and contains high levels of nutrients.

Based on previous research, the results of the analysis of kudzu plant compost combined with decomposer types, namely EM4 and Trichoderma sp.

Table 1 Analysis of Kudzu Plant Compost

	Total N (%)	Total P (%)	C-organic (%)	C/N ratio
Kudzu (Kontrol)	3.79	0.90	17.6	19.56
Kudzu (EM4)	3.53	0.81	17.7	21.85
Kudzu (*Trichoderma*)	2.93	0.80	14.8	18.5

Source: Cahyanti (2018)

The N content in kudzu plant compost is high (Table 1.). So that kudzu fertilizer has more potential in its use as compost compared to other compost fertilizers such as straw and leaves which only contain N elements of 1.96 and 1.34 (Sitepu et al, 2017). Kudzu plants are more effectively used as compost than cover crops. According to Cahyanti (2018), said that the use of cover crops had a low effect on increasing soil pH due to NH_4 assimilation and no exchange of Ca^{2+} ions from the area of land around rye soil as the main crop in this study. The results of soil analysis on land that did not spread kudzu had higher soil C-Organic content compared to land without kudzu distribution. This is because there is a relationship between soil pH and Soil Organic C (Cahyanti, 2018).

This research was conducted in order to determine the composition of the media that is good for the growth and development of mustard plants with the addition of kudzu plant compost and types of decomposers. It is hoped that this research will obtain an appropriate combination of media for the growth and development of mustard plants. The results of this study are also expected to provide clearer information about the effect of kudzu plant compost on mustard greens. This research was conducted with the aim to determine the effect of adding biostarter to compost on total N and N absorption in mustard greens. The results of this study can also be used as fertilizer recommendations for further planting.

METHODS

Materials and Research Tools

The materials used in this study included EM4, liquid Trichoderma, mustard seeds of the Tosakan variety, gravel and low-nitrogen soil. The tools used in this study include pots, buckets, grass clippers, shovels, gembor, kjeldahl flasks, destruction tools, distillation tools, shakers, ovens, pH meters, spectrophotometers, volumetric flasks, analytical balances, volume pipettes, burettes and Erlenmeyer .

Experimental design

This experiment was arranged using a Factorial Randomized Block Design (RBD). The first factor was compost consisting of kudzu plants, kudzu plants and EM4, as well as kudzu plants and Trichoderma sp. dose of N urea (7.65 grams), 1½ x dose of N urea (11.47 grams).

Factor 1 : Compost

K1 = Kudzu Compost

K2 = Kudzu Compost + EM4

K3 = Kudzu Compost + *Trichoderma sp.*

Factor 2: Dosage of Kudzu Plant Compost

D1 = Equivalent to ½ x Dosage N in Urea (3.82 grams)

D2 = Equivalent to 1 x Dosage of N in Urea (7.65 grams)

D3 = Equivalent to 1½ x Dosage N in Urea (11.47 grams)

Calculation of the amount (grams) of kudzu to be applied:

Urea = 0.6 grams (Bangun et al, 2014)

N in Urea = x 0.6 = 0.27

Kudzu = 3.53 N (Cahyanti, 2018)

Kudzu = 100/3.53 x 0.135 = 3.82 grams (D1)

Kudzu = 100/3.53 x 0.27 = 7.65 grams (D2)

Kudzu = 100/3.53 x 0.405 = 11.47 grams (D3)

Research procedure

Soil sample analysis

Soil sample analysis was carried out twice, namely the soil before planting the plants and the soil after harvesting and after being treated. Soil analysis consists of six observation variables consisting of soil pH, N-Total, C-Organic, and texture.

Compost Analysis

Compost analysis consisted of two observational variables, namely pH-Compost, total N, and C-Organic. Compost N-Total analysis was carried out using the kjedhahl analysis method. C-Organic

in fertilizers is an organic form of Carbon content. C-Organic is done using the Kurmis method (Balittanah, 2009).

Plant Tissue Analysis

Plant tissue analysis consists of N-Total, and N-Absorption. Analysis of N-Total Plants was carried out using the wet washing method using H2SO4 (Balittanah, 2009).

N Absorption Formula:
N uptake (mg) = Soil DM (kg) x N-Plants (%) x 10000

Processing Data

The data obtained was analyzed for variance (ANOVA) then followed by the DMRT (Duncan Multiple Range Test) with a 95% confidence level to determine the effect of each treatment on the various variables observed.

RESULTS AND DISCUSSIONS

Soil Characteristics, and Kudzu Compost

Soil was taken at a depth of 30 cm (top soil) in Dungkek Sumenep District at coordinates 7o00'17.4"S, 114o03'12.7"E. The soil used in this study is soil that has low levels of nutrients. The soil used is soil belonging to the regosol soil type.

Table 2. Preliminary analysis of physical and chemical properties of soil

Parameter	Unit	Value	Criteria*
pH	-	6.47	Moderately Acid
N-Total	%	0.46	Moderate
C-Organic	%	1.27	Low
Sand	%	83	Sand
Dust	%	2	Sand
Clay	%	16	Sand

*) Based on Soil Analysis Results Assessment Criteria, Soil Research Institute (2009)

The kudzu compost used is mature condition. The three compost treatments have values that meet SNI 19-7030-2004 standards, thus kudzu compost meets the requirements to be used as fertilizer that can be applied to plants (Table 3.).

The soil used has a moderate Nitrogen nutrient content (Table 2.). Low nitrogen content in the soil can inhibit the growth and development of a plant. Sandy soil has a low nutrient content because of the weak texture of sandy soil. Sandy soil has a coarse texture with large pore spaces between the grains so that this soil has a loose structure. Improvement for sandy soil is usually

done by adding organic matter such as compost. The application of compost can improve soil properties such as the physical, chemical and biological properties of the soil.

Table 3. Results of kudzu's compost content

Sample	pH	N total (%)	C-Organic (%)	C/N ratio
Kudzu's compost (control)	6.13	3.13	31.76	10.14
Kudzu's compost (EM4)	6.62	2.51	29.59	11.78
Kudzu's compost (*Trichoderma*)	6.41	2.76	30.13	10.91

*) Standar SNI 19-7030-2004 : pH 6-7.49, N-Total min 0.04%, C-Organic 9.8-32, C/N ratio 10-20

The use of kudzu compost aims to increase soil nutrient levels which are classified as low. Kudzu compost has a high nitrogen content of 3.13%. Kudzu is a bean or legume plant that has a symbiosis with Rhizobium Leguminose Bacteria. Rhizobium bacteria have roots because the roots of leguminous plants provide carbohydrates and other compounds for bacteria to bind nitrogen. Organic nitrogen will be released into the soil by root nodules thereby increasing fertility in the soil. Kudzu compost in the manufacturing process is carried out by adding decomposing organisms such as EM4 and Trichoderma sp. EM4 is widely used among farmers in composting because EM4 contains many organisms such as Lactobacillus sp, lactic acid bacteria, photosynthetic bacteria, decomposers, and others. Apart from EM4, currently some farmers are starting to use Trichoderma sp. as a decomposer for weathering processes. Trichoderma contained in compost functions as a decomposer and can also suppress soil borne diseases.

Table 4. Results of the analysis of the various observations of chemical properties

	Kudzu Compost	Dosage	Kudzu compost dosage x
Soil pH	$0,81^{ns}$	$2,65^{ns}$	$4,65^{**}$
C-Organic	$0,87^{ns}$	$3,01^{ns}$	$1,56^{ns}$
N-Total	$1,65^{ns}$	$2,62^{ns}$	$4,05^{*}$

*) Information : ^{ns} non significnt, *significantly different, ** very significantly different

The Effect of Kudzu Compost Application on Some Soil Chemical Properties

The application of kudzu compost fertilizer can increase soil pH and soil organic C, while the total soil N experiences a decrease. The results of the interaction between compost and different doses are significant for the soil pH parameter, significant for the total soil N, but not significant for soil organic C. Meanwhile, in the single factor analysis, there is no significant difference observed between the pH, total N, and organic C of the soil (Table 4).

Soil pH

The application of kudzu compost fertilizer at a dose of 3.82 grams (K_1D_1) shows a significant difference compared to the treatments of K_1D_2, K_1D_3, K_2D_1, K_2D_2, dan K_3 at all levels of dosage (Figure 1). This may be due to the fact that K_1D_1 is a treatment without the use of a biostarter, which causes a slower decomposition process, allowing fewer organic acids to be produced, resulting in a higher soil pH. The addition of organic matter can increase or decrease soil pH, depending on the level of maturity of the organic matter. The addition of immature organic matter will undergo a decomposition process that causes a decrease in pH. This may have occurred in the K1 treatment, where an increase in dosage resulted in a decrease in pH due to the incomplete decomposition of the organic matter, as there was no addition of biostarter to accelerate the decomposition process. However, if the organic matter is too mature, it will increase the pH, as observed in the K_2 and K_3 treatments.

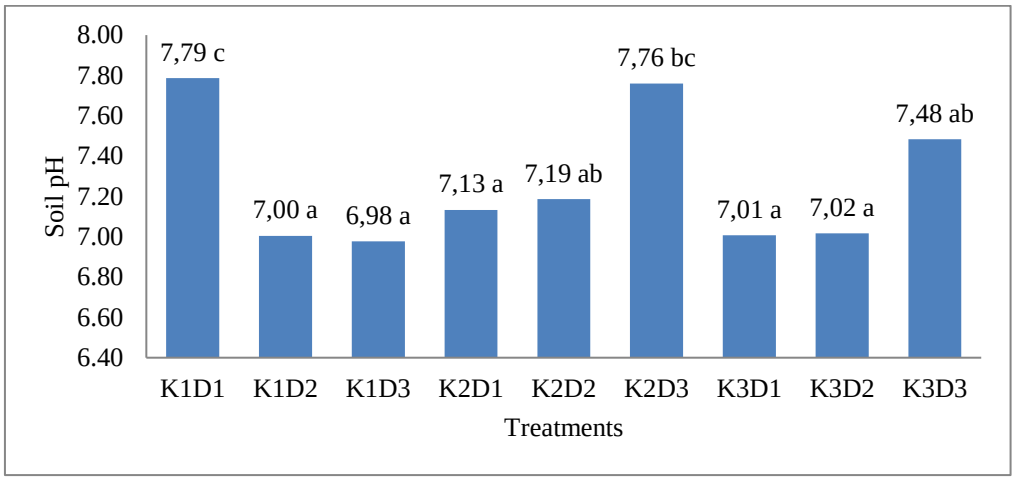

Figure 1. Application of kudzu compost and dosage to soil pH

The highest pH value was found in the K_1D_1 treatment, which was 7.79, while the lowest was found in the K_1D_3 treatment, which was 6.98 (Figure 1). This may be because during the decomposition process, organic acids are released into inorganic compounds that are available to plants, causing a decrease in pH. The more organic matter in the soil, the higher the content of organic acid compounds, which makes the soil more acidic. This is consistent with Astuti's (2016) statement that the process of humification of organic matter will produce organic acids and carbon dioxide, which helps to provide minerals such as potassium.

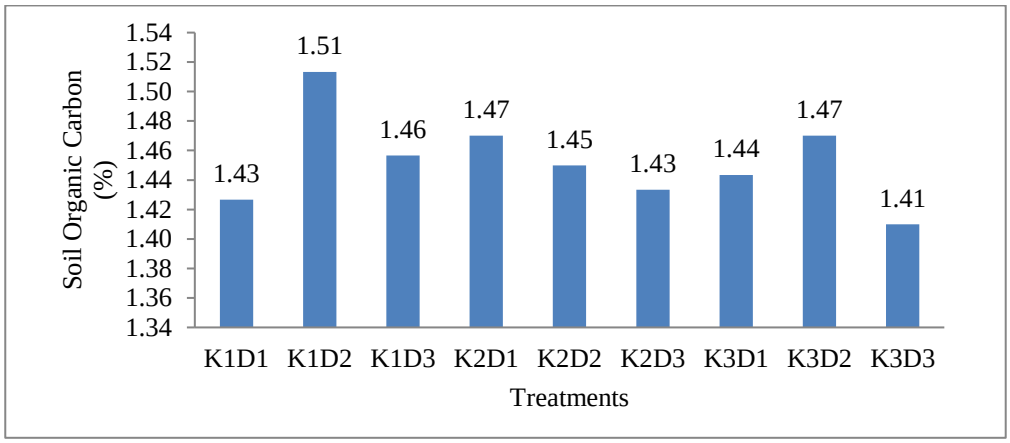

Figure 2. Application of kudzu compost and dosage of c-organic

C-Organic

The K_1D_2 treatment had the highest C-Organic concentration of 1.51%, while the lowest value was found in the K_3D_3 treatment, which was 1.41% (Figure 2.). Differences in the value of organic matter in the soil can be influenced by the compost application process and the decomposition process by soil microbes. The increase in C-Organic concentration after adding kudzu compost was due to the release of C-Organic from the compost (Widodo and Kusuma, 2018).

Soil Nitrogen

Nitrogen is a macronutrient that is widely used by plants in their growth phase. Nitrogen is the most responsive nutrient for the growth and development of mustard plants (Raghuvanshi et al, 2018). The highest average nitrogen concentration was found in the K_1D_2 treatment with a value of 0.44% N and the lowest average was in the K_3D_3 treatment, which was 0.22% N (Figure 3.). K3 treatment was lower than K_1, it is possible that N in the soil is used by bacteria as a food ingredient during the decomposition process. This is in line with Arafah's statement (2017), that the compounds produced will be used by bacteria which play a role in the decomposition process. In addition, there is a possibility of low total N-concentration in the soil in compost using fermetic bacteria because the compost is too ripe and continuously decomposes, causing an increase in nitrogen content in the form of ammonia which will be lost in the air (Krismawati and Hardini, 2014). The total N of the soil after harvesting has decreased because the N in the soil has been absorbed by the plants. N-soil has a positive correlation with N-plant uptake with a correlation value of 0.65 which means it is directly proportional.

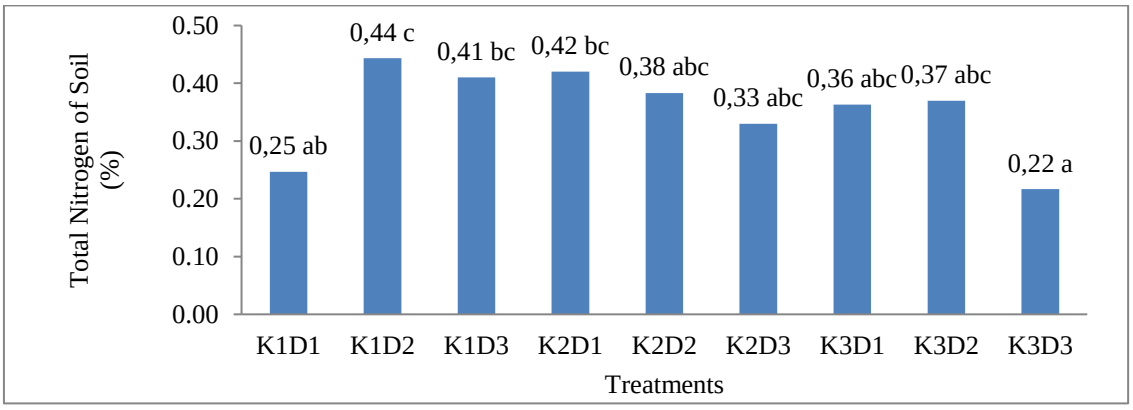

Figure 3. Interaction of kudzu compost application and dosage to soil N-total

The Effect of Kudzu Compost on Mustard Plants

The application of kudzu compost using different types of decomposers in this study aims to determine the effect of this treatment on plants. This is because the quality of the soil used is not good for plant growth and development, so it is necessary to add organic matter to improve soil quality.

Table 5. Results of Diversity Observations of Mustard Plants

	Kudzu Compost	Dosage	Kudzu compost x dosage
Plant Height	3,66*	0,46^{ns}	2,36^{ns}
Fresh Weight	1,84^{ns}	0,84^{ns}	1,00^{ns}
Dry Weight	2^{ns}	0,49^{ns}	0,45^{ns}
N-Absorption	4,31*	2,47^{ns}	3,16*
N-Total	6,2*	1,49^{ns}	6,58*

*) Information : ^{ns} non significnt, *significantly different, ** very significantly different

Plant Dry Weight

Plant dry weight is the total weight of the plant that has removed its water content to determine the nutrient content contained therein. The highest average yield on dry weight was found in the K1D2 treatment of 7.40 grams. The increase in plant dry weight can be caused by photosynthesis and respiration activities. In addition, the availability and absorption of nutrients also affect the dry weight of plants. Plant dry weight has a positive correlation with nitrogen uptake by plants with a correlation value of 0.94. This is in line with the statement of Anastasia et al (2014) that nutrient uptake greatly influences the maximum dry weight of a plant.

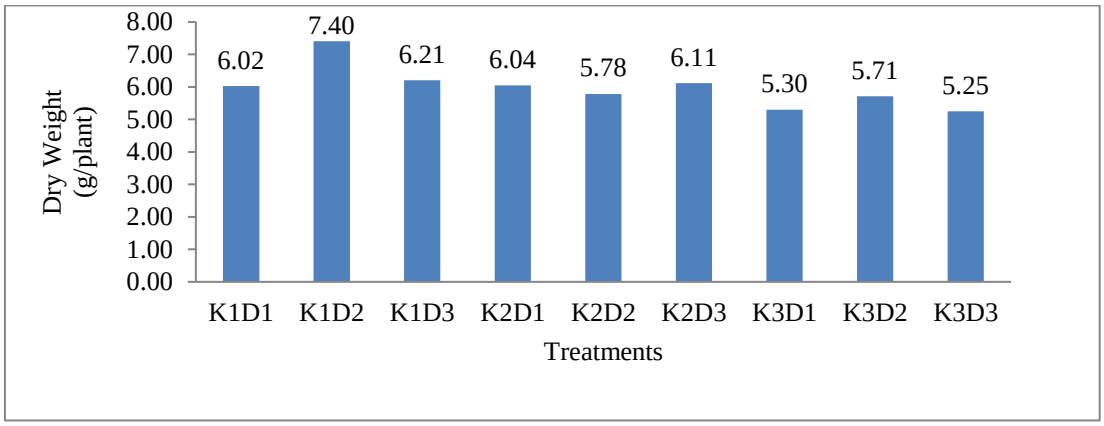

Figure 2. Application of kudzu compost and dosage to plant dry weight

Total Nitrogen of Plant

The application of kudzu compost fertilizer using the type of decomposer and the dose dose to %N-Total plants was significantly different (Table 5). The highest mean total plant nitrogen concentration was found in the K_1D_2 treatment, namely 2.88%. Meanwhile, the lowest total plant nitrogen concentration was found in the K_3D_3 treatment, namely 2.24% (Figure 5). This is directly proportional to the average concentration of Nitrogen in the soil. The increase in Total Plant Nitrogen is closely related to the ability of the soil to supply nitrogen from added organic matter so that it is available to plants. The N-total concentration of plants has a positive correlation with the total N in the soil with a correlation value of 0.795. This is in line with the statement of Prakoso et al (2018), namely the N-Total Plant content is affected by the N content in the planting medium.

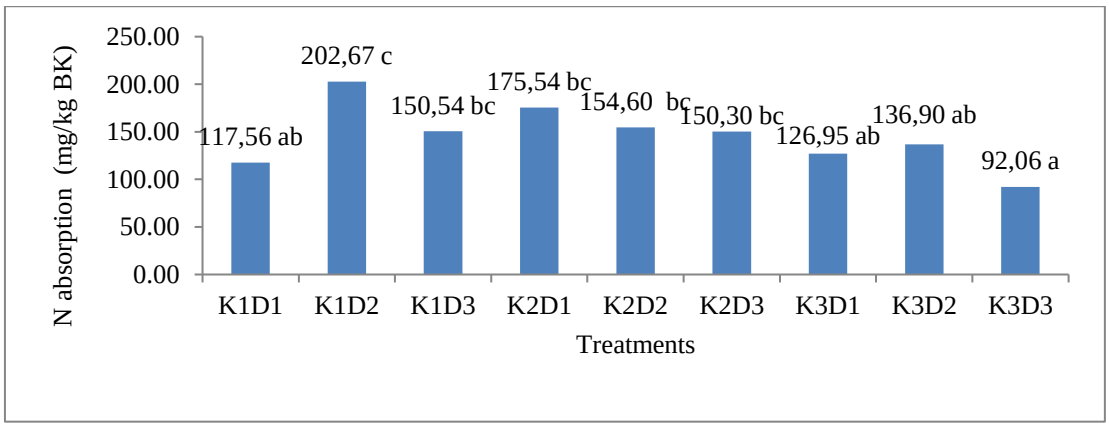

Figure 4. Kudzu compost application and dosage on N absorption

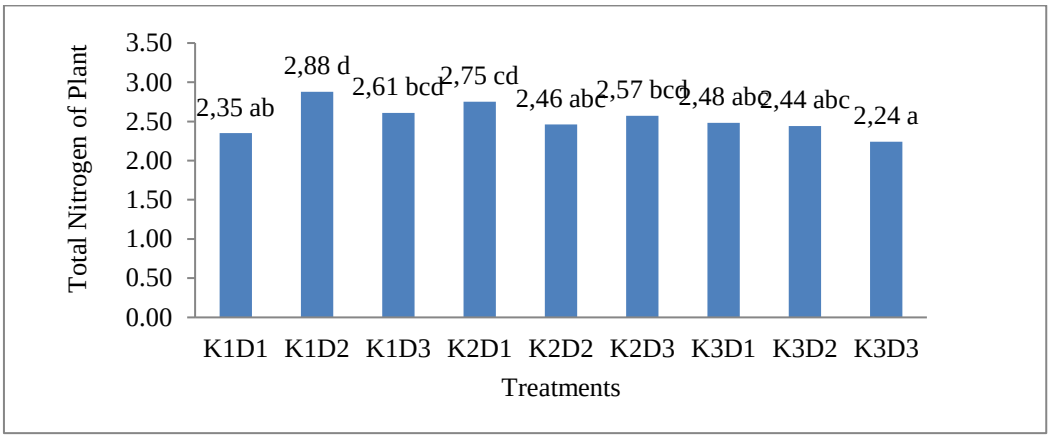

Figure 5. Application of kudzu compost and dosage to total nitrogen of plant

Plant Nitrogen Absorption

The application of kudzu compost fertilizer using the type of decomposer and the dose dose to plant N uptake was significantly different (Table 5). The K1D2 treatment had the highest average N uptake, namely 202.67 mg/plant. Meanwhile, the lowest average N uptake was in the K3D3 treatment, namely 92.06 mg/plant (Figure 4). The average yield of Nitrogen uptake is directly proportional to the average value of total N in the soil with a correlation value of 0.65. Nutrient uptake by plants depends on the concentration of nutrients in the soil. The concentration of nutrients in the soil is affected by the rate of mineralization (Wijanarko et al, 2012). Nitrogen uptake is a parameter of the amount of nitrogen content in plants which will affect the rate of plant development and growth. Lack of nitrogen uptake in plants will cause plants to become stunted, plant biomass decreases, and the color of plant leaves will turn yellow. Meanwhile, if the amount of Nitrogen absorbed is excessive, it will inhibit the rate of plant growth and the quality of the plant will decrease.

CONCLUSION

Based on the research activities that have been carried out, the following conclusions can be obtained:

1. The addition of biostarter to kudzu compost has an effect on N-Total in the soil. Kudzu compost without the addition of boistarter had the highest nitrogen content compared to the treatment using EM4 and Trichoderma.
2. The addition of biostarter to kudzu compost has an effect on N nutrient uptake in mustard greens. Kudzu compost without the addition of biostarter had the best effect on the growth and development of mustard plants compared to the treatment using EM4 and Trichoderma.
3. Kudzu compost without the addition of biostarter at a dose of 7.65 grams (K_1D_2) has a good effect on plant growth and development.

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