The Relationship Compost Produced from Material Animals and Plants to Chemical Properties of Ultisol

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ABSTRACT

One of the efforts to improve the chemical properties of Ultisol is the application of compost. The research was conducted from April to August 2022, with the aim of studying the relationship between compost from animal and plant materials and the chemical properties of Ultisol. The research was conducted in a completely randomized design (CRD), with 6 treatments (Control; FC A; FC B; FC C; FC D; and FC E) with 3 replications. The additional ingredients of each compost and its decomposer are different, so the quality, quantity, and effect on the soil are also different. Compost was applied at the equivalent of 5 tons/ha (5 g/2kg) of soil. The parameters analyzed were Organik-C (Walkley and Black); pH H_2O (1:2.5); total-N (Kelshall); P-available (Bray II); K-exchangeable, Ca-exchangeable, Mg-exchangeable, CEC (Ammonium acetate extract 1N pH 7); Al-dd (Volumetry); C/N; total-P, total-K, total-Ca, total-Mg (Wet-soaking); and moisture content. The results showed that KA, pH, total nutrients ($N+P_2O+K_2O_5$), Organic-C, and C/N ratio in compost D had met SNI 7763/2018, and had an effect on increasing pH, P-Available, K-dd, Ca-dd, Mg-dd. For PK A and compost B, it increases soil C-Org, compost C increases soil Total-N, and compost E has an effect on increasing soil CEC. Based on these tests, compost D with chicken manure, husk ash, dolomite, and humic acid is the best.

Keywords: Compost, Nutrient assessment, Soil chemical characteristics, Ultisol

INTRODUCTION

Ultisol is land that is generally colored yellow-brownish until red. Ultisol has own a several number of constraints If managed for land agriculture plant food among them is high acidity [1] because small talk like Calcium (Ca), Potassium (K), and Magnesium (Mg) are washed during the development Ultisol or used by the plants growing on it. Ultisol productive low due to nature its chemistry and properties his physical condition is lacks profitability, so that requires additional fertilizers, especially fertilizer organic like compost [2] Fertilizer compost lots are produced by the group farmer, entrepreneur small-medium, and for sale to society. However Not yet registered with the Ministry of Agriculture and the Ministry of Trade. Some examples are is (1) fertilizer compost (FC) A with material base in the form of dirt cow, charcoal husk, powder sawdust, dolomite, and decomposer DD11. Based on analysis [3] compost own water content 37.8%; pH 9.69; Nitrogen 0.74%; P_2O_5 0.084; K_2O 0.013%; C- Organic 18.14%; Ca-dd 0.564 me/ 100g; (2) FC B with material base dirt chicken , droppings cow , dung goat , dung quail , husk burn , and Trichoderma ; (3) FC C with material base dirt cow , dung goat , titonia , charcoal rice husk , PGPR, dolomite , and DD11 decomposer ; (4) FC D on the packaging fertilizer This has listed nutrient content in fertilizer including Nitrogen 1.8%; P_2O_5 2.7%; K_2O 1.8%; CaO 2.5%; water content 20 -30%; pH 6.5-7%; and C/N ratio 25-30%, with material base dirt chicken , gray rice husk , dolomite , acid humate , and EM4; (5) FC E based on analysis [3] has water content 27.073%; pH 9.07; Nitrogen 1.121%; Phosphorus 0.228%; Potassium 0.648%; C- Organic 11.418%; Ca 1.267%; Mg 2.241%; and C/N 10.19, with material base dirt cow , charcoal husk , powder saw , thitonia , soaking water fiber coconut .Compost the Already for sale buy in the West Sumatra area to Riau. Even fertilizer compost A request reached 1 ton per day, but Not yet There is an SNI number or not registered with the Ministry of Agriculture and the Ministry of Trade. Therefore, the required research is 5 compost (1) FC A, (2) FC B, (3) FC C, (4) FC D, and (5) FC E passed Standard Indonesian National Standard (SNI) no 7763/2018 or no, and how its influence to a several of characteristics chemistry land not yet known. For ensure quality from fertilizer

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organic marketed to public so government make related regulations with all aspect from fertilizer organic. The rules that is Regulation of the Minister of Agriculture No. 01/2019 concerning registration Fertilizer Organic, Fertilizer Hayati, and Soil Improver and Decree of the Minister of Agriculture No. 261/ Kpts /SR.310/M/4/2019 concerning Condition Minimum Technical Requirements (PTM) for Fertilizer Organic, Fertilizer Hayati, and the Fixer Land. So that required study with objective for now connection compost from material animals and plants to characteristic chemistry Ultisol.

MATERIALS AND METHODS

Location and Materials

The study has been implemented from April 2022 to month August 2022, in the soil Chemistry Laboratory, Soil Department, Faculty of Agriculture, Andalas University. The tools used are a 2 kg bucket, Spectrophotometer, AAS, oven, pH meter and others. Materials used Ultisol, 5 (five) types fertilizer compost from different materials. Here ingredients from the five composts: (1) FC A: Manure cow, charcoal husk, powder sawdust, dolomite, and decomposer DD11 (Bali bangda , 2021); (2) FC B: Manure cow, chicken, goat, bird quail, husk burn, and Trichoderma (Personal contact); (3) FC C: Dirt chicken, cow, goat, Thitonia, charcoal rice husk, PGPR, dolomite, and decomposer DD1 (Personal contact); (4) FC D: Manure chicken, gray rice husk, dolomite, acid humate, and EM decomposer [3] and (5) FC E: Thitonia, charcoal chaff, bran smooth, and soaking water fiber coconut (Personal contact).

First field trial

Stage study in the form of: (1) Preparation sample land from garden test Faculty Agriculture University Andalas Padang, which has not yet Once given treatment with vegetation grass, at a depth of 0-20 cm in a bulk composite. Research Experimentally carried out in a Completely Randomized Design (CRD) with 6 treatments and 3 replications. Treatment in the form of: K= Control ; A= Fertilizer Compost A; B= Fertilizer Compost B; C= Fertilizer Compost C; D= Fertilizer Compost D; and E= Fertilizer Compost E. Fertilizer composts the given to the land equivalent to 5 tons/ha or 5g/2kg soil. After a week of incubation sample were taken (7 HSI), was then closed back, which was continued with taking the samples after 2 weeks of incubation (14 HSI).

Laboratory Analysis

Analysis samples in the Laboratory (3) namely, analysis land early, and 7 HSI and 14 HSI, analysis fertilizer. Analysis parameters land in the form of: C- $_{Org}$ (Walkley and Black); pH H_2O 1:2.5 (Electrometric); N- $_{Tot}$ (Kjeldahl); P- $_{Ter}$ (Bray II); K- $_{dd}$, Ca- $_{dd}$, Mg- $_{dd}$, CEC (washing ammonium acetate 1 N pH 7); Al-dd (Volumetric); and C/N ratio. For the analysis parameters fertilizer in the form of: C-Org (ashing) dry); pH H_2O 1 :5 (Electrometric); N- $_{Tot}$ (Kjeldhal); P- $_{Tot}$; K- $_{Tot}$; Ca- $_{Tot}$; Mg- $_{Tot}$ (Ashing) wet); water content (gravimetry); and C/N ratio.

Statistical Analysis

Data Processing, initial soil data compared with criteria characteristic chemistry land and soil after incubation tested F at the level real 5%. If different real to be continued with further testing (DNMRT) at 5% level. The results of the fertilizer analysis were standardized with SNI No. 7763/2018 and Ministry of Agriculture Decree No.261/ Kpts /SR.310/M/4/2019.

RESULTS AND DISCUSSION

Chemical Properties of Ultisol

Characteristic chemistry land beginning Ultisol (**Table 1**), has level low fertility . Caused the existence of intensive washing by rainwater on the land, which that cause land to become acidic (pH 4.81), and nutrients in the soil such as N- $_{Tot}$ (0.12%); P- $_{Ter}$ (5.55 ppm); C- $_{Org}$ (1.44%); CEC (8.58 me/100 g); K- $_{dd}$ (0.39 me/100 g); Ca- $_{dd}$ (0.93 me/100 g); and Mg- $_{dd}$ (13.09 me/100 g) were leached and left element metal as Al (Al- $_{dd}$ 3.57 me/100 g) would cause land become poisonous for plant.

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Table 1. Results of analysis characteristic chemistry land beginning Ultisol

Parameters Measured	Analyst Results Laboratory
pH H_2O (1:2.5)	4.81 $_m$
Al- $_{dd}$ (me/100 g)	3.57
C- $_{Org}$ (%)	1.44 $_r$
N- $_{Total}$ (%)	0.12 $_r$
P- $_{Ter}$ (ppm)	5.55 $_r$
KTK (me/100 g)	8.58 $_r$
K- $_{dd}$ (me/100 g)	0.39 $_r$
Ca- $_{dd}$ (me/100 g)	0.93 $_{sr}$
Mg- $_{dd}$ (me/100 g)	0.95 $_r$

Descriptin: m= sour; r= low; sr= very low

Fertilizer Nutrient Test Compost

Compost nutrient test results are very important for done before for sale buy from the community, because will influence the condition of the soil and plants applied with compost also already regulated by the government about condition of the fertilizer organic solid (compost) must be in accordance with under SNI No. 7763/2018.Nutrient test results for several fertilizer composts (**Table 2**), show that the pH value of all fertilizer compost already fulfilled the criteria, with a range pH value of 8.41 to 9.10. The highest pH value in fertilizer compost D is caused by fertilizer compost D having material base dolomite, which functions for to increase soil pH and pH of fertilizer compost. All water content in compost has been in accordance with SNI 7763/2018 (>25%). Based on the observation field all fertilizer compost has resembled land and also all the materials already mixed up became One. Nutrient test results for several fertilizer, composts showed that the pH value of all fertilizer composts already fulfilled criteria, with a range of the pH values of 8.41 to 9.10. The highest pH value in fertilizer D is caused by fertilizer D having material base dolomite, which functions for to increase soil pH and pH of fertilizer compost. All water content in compost has been in accordance with SNI 7763/2018 (< 25%), and all fertilizer compost has resembled land and also all material Already mixed up becomes One.

Table 2. Results of nutrient analysis of several compost fertilizers

Sample Fertilizer Compost	pH H2O (1:5)	KA	N- $_{Tot}$	P- $_{Tot}$	K- $_{Tot}$	C $_{-Org}$	Ca- $_{Tot}$	Mg- $_{Tot}$	C/N
		…….%.....							
A	8.72	21.6	1.07	0.36	0.35	9.91	0.64	0.81	9.26
B	8.41	17.8	1.90	1.60	0.51	13.00	1.91	2.26	6.84
C	8.55	16.7	1.47	1.03	0.84	24.09	2.00	2.68	16.39
D	9,10	14.8	2.33	1.94	0.90	29.68	7.00	4.01	12.73
E	8.93	18.8	2.01	0.73	0.56	15.18	3.81	1.89	7.55

Nutrients ($N-_{Tot} + P_2O_5 + K_2O$) from compost (**Table 2**). Fertilizer compost A with a number of macronutrients of 1.78 %, so stated Not yet in accordance with SNI 7763/2018. Fertilizer compost other content macronutrients Already in accordance with SNI 7763/2018, with amount FC B macronutrients amounted to 4.01%, FC C 3.34%, FC E 3.30%, and the highest in FC D with a of value 5.17%. The height amount macro nutrients in FC D, caused material base making compost from dirt chicken that has content macro nutrients

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taller from dirt cattle others [4]C- $_{Org}$ analyst results fertilizer compost also varies. Only C and FC D meet SNI 7763/2018 with C- $_{Org}$ values of 24.09% and 29.68%. The height C- $_{Org}$ content in FC C is influenced by impurities goat, dung chicken, and titonia which have high nutrient content. For the C/N ratio, all fertilizer compost already meets SNI 7763/2018 with a value < 25. C/N ratio, FC C and D are higher tall than the three fertilizer compost others. The lower the C/N value of the material, the time required for composting the faster it is. Of all the analysis parameters then FC D has is in accordance with SNI No. 7763/2018, but the smell Still stinging compared to fertilizer compost others. For That need done addition materials, which are useful for reducing the smell from FC D.

Chemical Properties of Ultisol After Incubation Fertilizer Compost

Ultisol which has been incubated with a number of several fertilizer compost experience improved characteristic chemistry (**Table 3**).

Soil pH

The pH value of the soil at 7 HSI and 14 HSI is stated with criteria sour, with a range value of 4.5-5.5. In Table 3 it can be seen that giving compost is capable increase the pH value in soil. Improvement pH value of soil in control different real to PK A, B, C, D and E treatments 7 HSI and 14 HSI (Figure 1). Administration of fertilizer compost on Ultisol enough is effective in lower-level acidity in the soil [5].

Table 3. Results of Chemical Analysis of Ultisol After Incubation for 1 Week and 2 Weeks

Analysis parameters	Treatment					
	Control	PK A	PK B	PK C	PK D	PK E
pH H_2O (1:2.5)						
7 HSI	4.95 $_a$	5.13 $_b$	5.31 $_b$	5.41 $_c$	5.46 $_c$	5.43 $_c$
14 HSI	5.00 $_a$	5.45 $_b$	5.45 $_b$	5.46 $_b$	5.59 $_b$	5.52 $_b$
C- $_{Org}$ (%)						
7 HSI	1.66	2.00	1.82	1.94	1.86	1.89
14 HSI	1.68 $_a$	2.11 $_b$	2.30 $_c$	2.00 $_b$	2.02 $_b$	2.28 $_c$
N- $_{Total}$ (%)						
7 HSI	0.15	0.18	0.20	0.23	0.18	0.19
14 HSI	0.11 $_a$	0.15 $_b$	0.16 $_b$	0.15 $_b$	0.15 $_b$	0.18 $_c$
P- $_{Ter}$ (ppm)						
7 HSI	10.55	11.63	11.86	11.71	12.05	11.15
14 HSI	10.56 $_a$	12.14 $_b$	12.09 $_b$	11.89 $_b$	12.19 $_b$	11.93 $_b$
KTK (me/100g)						
7 HSI	10.54 $_a$	14.62 $_b$	18.56 $_c$	15.08 $_b$	16.78 $_b$	22.35 $_d$
14 HSI	10.71 $_a$	20.47 $_c$	20.39 $_c$	20.66 $_c$	19.74 $_b$	24.11 $_c$
Ca- $_{dd}$ (me/100g)						
7 HSI	0.99 $_a$	1.06 $_a$	1.10 $_b$	1.12 $_b$	1.23 $_c$	1.11 $_b$
14 HSI	1.00 $_a$	1.08 $_a$	1.15 $_b$	1.15 $_b$	1.29 $_c$	1.12 $_a$
Mg- $_{dd}$ (me/100g)						
7 HSI	1.07 $_a$	1.10 $_a$	1.12 $_a$	1.11 $_a$	1.20 $_b$	1.19 $_a$
14 HSI	1.08 $_a$	1.17 $_b$	1.21 $_b$	1.17 $_b$	1.23 $_c$	1.21 $_c$
K- $_{dd}$ (me/100g)						

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7 HSI	0.44 a	0.46 a	0.45 a	0.48 b	0.52 c	0.49 b
14 HSI	0.44 a	0.47 b	0.49 c	0.51 d	0.54 e	0.51 d

Description: The numbers in the table are followed by letters. The same small different No real according to DNMRT at 5% level

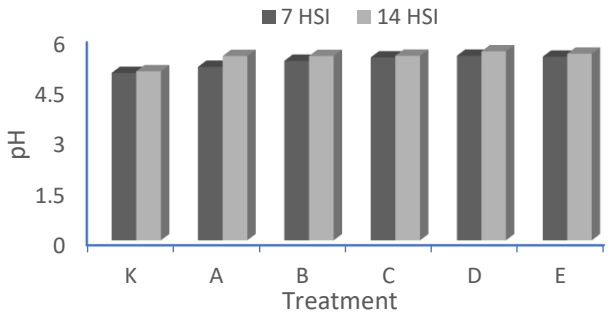
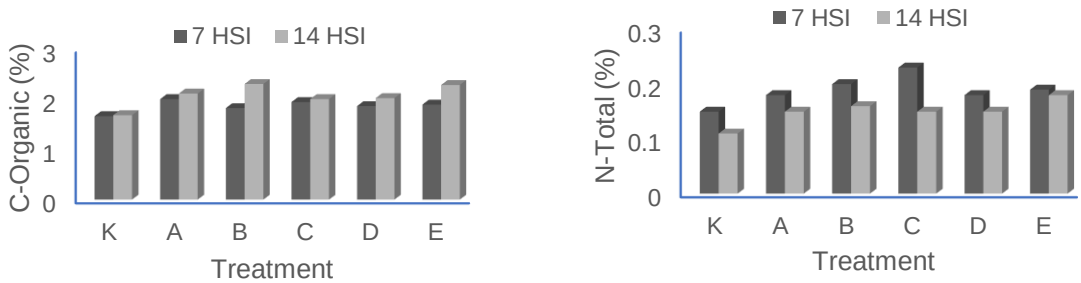


Figure 1. pH values after Incubation

Increasing soil pH happens from 7 HSI to 14 HSI. This is along with the addition material in the form of soil compost. According to [6] the longer the incubation so compost on the soil will the more decompose and improve the material organic on the soil. Fertilizer compost D is capable increase soil pH taller than fertilizer compost others, both 7 HSI and 14 HSI. This is caused by pH FC D is also taller from than compost namely 9.10 (**Table 3**).

C- Organic and N- Total Soil

Additions a number several of fertilizers 7 different HSI composts no real increase in C- $_{Org}$ in the soil. At 14 HSI different FC treatments real to control. This shows that compost in on the soil needs longer incubation for fertilizer compost unraveled perfectly on the ground, so will increase C- $_{Org}$ in the soil



(a) (b)

Figure 2. (a) C- $_{Org}$ (b) N- $_{Tot}$ values after Incubation

C-$_{Org}$ Value land (**Figure 2a**), experienced improvement from 7 HSI to 14 HSI. The difference C- $_{Org}$ value in soil is influenced by the material base making compost, Compost B is made from base dirt chicken, droppings cow, dung goat, dung quail, husk burn and Trichoderma. Dirt chicken own high C- $_{Org}$ levels [7], so will increase C- Organic content in soil. Besides that, FC B also uses Trichoderma, which can speed up the release process of ingredients especially cellulose with the use enzyme decomposer [8] Therefore that nutrients for land and plants will be faster available Nitrogen result show a decline value of 7 HSI to 14 HSI. This is due to N nutrient elements in land is are mobile, so the N nutrient content in the soil very easily lost [9].

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Based on the research [10] decline in N value in soil from 7 HSI to 14 HSI is caused by the increasing activity of microorganisms at 14 HSI. Taking sample land at 7 HSI can also lower the N value in soil because N can be transported moment do taking sample land.

P - Land Available

All treatment compost differently no real to control after 7 HSI (**Table 3**). P- $_{value}$ the highest in the FC D treatment was 12.05 ppm. This is due to giving fertilizer organic in the form of fertilizer pen chicken will influence a real increase in P Ultisol.

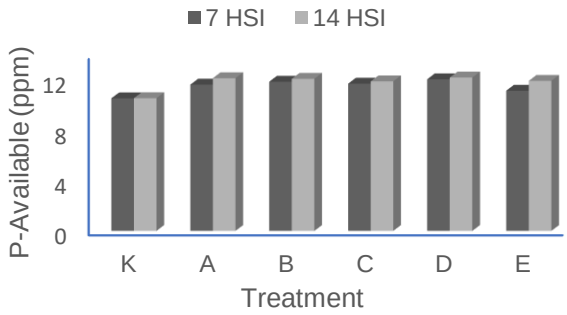


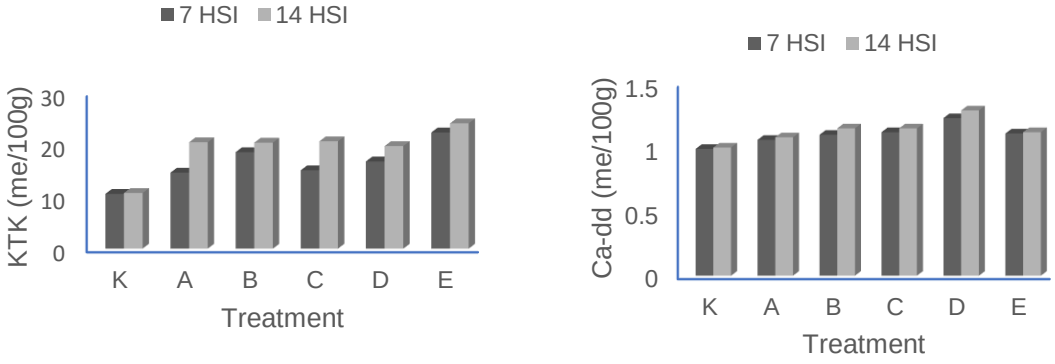
Figure 3. P land available values after Incubation

Giving fertilizer compost treatment increases P - value land compared to with control. Fertilizer organic used contains phosphorus nutrients in the form P_2O_5, which can increase phosphorus nutrient content in land. The occurrence improvement P- $_{Ava}$ content from 7 HSI to 14 HSI (**Figure 3**), will not be too big, the longer the time incubation will increase pH and P-$_{Ava}$ values in the soil.

KTK, Ca- $_{dd}$, Mg- $_{dd}$, and K- $_{dd}$ of Soil

Treatment of fertilizer compost are is different real with controls (**Table 3**). The highest CEC value in the FC E treatment is 22.35 me/100g. The increase KTK value in the land is caused by a load negative increase that comes from group carboxyl (COO^-) and hydroxyl (OH^-) which come from material organic [11].

The height CEC value in the FC E treatment shows that compost E is more Lots add load negatively on the ground than compost A, B, C, and D. The soil CEC value also increased significant from 7 HSI to 14 HSI, this can be due to FC increasing decomposed so that material organic produce compound humic which contributes colloids land so that increase CEC value of the soil [12]. In addition, compost can release One or a number of several type cations from the bond into available ions for plants so that ingredients organic will quickly sort and can be utilized by plants [13].



(a) (b)

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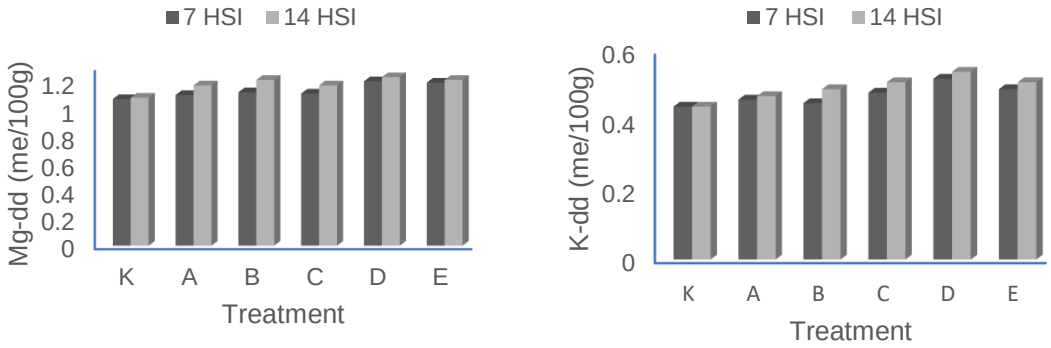

(c) (d)

Figure 4. (a) CEC value; (b) Ca- $_{dd\ value}$; (c) Mg- $_{dd\ value}$; and (d) K- $_{dd\ value}$ land after Incubation

The Ca-dd value in HSI soil has criteria very low with a value of 0.99 me/100g – 1.29 me/100g (**Table 3**). Based on statistical tests fertilizer compost B, C, D, and E treatments are different real with control with relative value the same, but B, C, and E are different No real 7 HSI. This is due to the high content of Calcium in composts B, C, D, and E than in compost A (**Table 3**), so that granting fertilizer compost to the land is influential. Improvement Ca- $_{dd}$ value highest namely in FC D with Ca-dd value 7 HSI 1.07 me/100g and 14 HSI 1.13 me/100g. The height Ca- $_{dd}$ value in FC D is influenced by the height content material organic and Ca nutrients in compost D so that compost D more Lots donate Ca- $_{dd}$ elements in soil compared to with compost others. According to [14], the high of material organic land will increase available Ca content Because results decomposition from of material organic.

The Mg- $_{dd}$ value in soil at 7 HSI and 14 HSI has criteria low with prone to value 1.07 me/100g – 1.23 me/100g (**Table 3**). Based on statistical tests on 7 HSI, FC D and E treatments were different real to control. However, fertilizer compost A, B and C treatments are different and no real to control. While 14 HSI treatments fertilizer compost A, B, C, D, and E were different real to control with mark relatively the same Mg- $_{dd}$ value highest found in FC D treatment, with values of 1.20 me/100g 7 HSI, and 1.23 me/100g 14 HSI (**Table 3**). The elements Ca, Mg, and K, in land increase because of the existence increase sour-sour organic by compost. The high of the Mg- $_{dd}$ FC D value is also influenced by the high Mg- $_{Tot}$ content in compost D compared with compost others (**Figure 4**). [15] Material organic that has is undergoing a decomposition process can increase be availability of K, Ca, and Mg so that can be available for soil and plants. Results of K- $_{dd}$ analysis show that K- $_{dd}$ levels range between 0.44 me/100g – 0.54 me/100g, classified as criteria low until moderate (Table 3). Based on the statistical test FC A and B are different No real with control.

While fertilizer compost C, D, and We are different real with control. This is because Composts C, D, and We have content more potassium big than compost A and B (**Table 2**), so composts C, D, and E are able to can replace donate potassium bigger from 2 composts other. Improvement in K-dd value from 7 HSI to 14 HSI (**Figure 4**), however not too big. Increase the biggest by only 0.03 me/100g on fertilizer compost B and C. Improvement this is caused by the increasing addition of fertilizer compost to the soil microorganisms in the soil. Microorganisms as catalysts and their activities will be very influential to in the improvement content potassium [16]. Potassium can be tied and stored in cells by bacteria and fungi.

CONCLUSION

Compost from a material different animals and plants own different influences to characteristic chemistry Ultisol. The fertilizer compost D's nutrient content is higher tall rather than fertilizer compost A, B, D, and E. The fertilizer compost D nutrient test is in the form of water content, pH, amount of nutrients ($N+P_2O^5+K_2O$), C- $_{Org}$, and C/N ratio have meets SNI 7763/2018, based on Ministry of Agriculture Decree No.261/ Kpts /SR.310/M/4/2019. Four composts other not yet all elements in accordance with SNI and Cementin above. Fertilizer compost A increases C- $_{Org}$ soil 7 HSI. Compost B increased C- $_{Org}$ at 14 HSI. Fertilizer compost C

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increased N- $_{Tot}$ 7 HSI and 14 HSI. Fertilizer compost D increased soil pH, P- $_{Ava}$, K- $_{dd}$, Ca- $_{dd}$, Mg- $_{dd}$ 7 HSI and 14 HSI. Fertilizer compost E increased soil CEC 7 HSI and 14 HSI.

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