The Use of Banyumas *Centrosema pubescens* Compost and Ajibarang's Phosphate Rock to Kandiudults for Soybeans Amelioration

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Abstract. Kandiudults is intensively weathered soil with low in pH and clay activity, though is high of H^{+} and Al^{3+} activities. Hydrolysis of Al^{3+} affects soil acidity and H^{+} both are increasingly. Change to better chemical properties is key to increase the productivity by decreasing it's positively charge by adding negative functional of "like-humus" organic fertilizer as a one key way technology to adapt climate change. The research was aimed to know effect local *Centrosema pubescens* (*Cp*) compost and Phosphate Rock Banyumas for Kandiudults improvement by increasing it's: (i) chemical properties, (ii) P soils availability and P absorption by soybean though to its quality, and (iii) to find best dose of compost and Phosphate Rock. Research was done under plastic house Fac. of Agriculture – UNSOED, Purwokerto. Materials used: (i) low activity of Krumput Banyumas Kandiuldults, (ii) the *Cp* compost from Krumput, Banyumas, and (iii) Slamet soybean variety. Randomized complete block design was employed with factorial combination by 3x3 with three replicates though it had 27 polybag units. Research result: (i) *Cp* compost effect on soil pH, CEC, and exchangeable-Al, P-uptake by plant and grain soybean protein-N; (ii) Phosphate Rock effect on soil pH, exchangeable-Al, and CEC, it affect P-uptake by plant, grain soybean protein-N, crop dry weight, and grain dry weight. These results were induced that: "like-humus" of *Cp* producing compost was able to manage the negative charge of Krumput's Kandiudults though it meant increasing of its positively charge.

1. Introduction

Now a day we get a rigid information that global climate change become most important to develop a rigid season's change whether to tropical or subtropical countries. On the other hand we received information also that agricultural land change to non-agriculture land which lead to economic reason has been occurred and "likely" could not be stopped. Whilst, a need of crop production to produce sufficient food for very huge population has been proofed. In another side fertilizer stock has been reported declining and more difficult for countries when

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fertilizer supply was low than it demand. This need fullfilness and improvises by local potential fertilizer matter stock and it has to be created. Onto land requirement, *Kandiudult*s are our challenge to be extent used to fulfil need of crops land although it's still undergo lower quality than Inceptisols as general use soil for crop production in tropics. *Kandiudult*s are soils that have undergone intensive weathering [1], due to hot climatic conditions and high rainfall throughout the year in the tropics, causing them to be poor in plant nutrients. The low productivity of *Kandiudult*s is mainly due to their high acidity by the high solubility of hydrogen and aluminum cations in acidic soils. At acid pH (pH < 5.0), aluminum is soluble and takes the form of Al^{3+} and hydroxide-Al [2]; it is readily adsorbed by clay colloids and is also balanced with Al in the soil solution. Hydrolysis of Al^{3+} ions causes acidity and H^+ ions to increase. Banyumas *Kandiudult*s undergo intensive base leaching, one type of that was Kandiudults.

This research was conducted to try to improve the synergism of Phosphate Rock and organic fertilizer that have been tried by many previous researchers to improve the chemical properties of *Kandiudult*s for soybean cultivation, but the results can still be improved by adding compost humic-like materials. The hypothesis proven in this study: compost like-humic material (*Centrosema pubescens*) is able to increase the use of PR to improve the chemical properties of *Kandiudult* while improving its productivity. The puPRose of this study was to determine: (1) the effect of Phosphate Rock and *Centrosema pubescens* compost humic-like materials on the improvement of *Kandiudult* chemical properties, (2) the benefits of humic-like materials to increase Phosphate Rock effect on Kandiudult productivity for soybean, (3) the best dose of ameliorants tried in this study.

2. Materials and Methods

This research is a pot experiment that had been carried out in a plastic house set up in the Faculty of Agriculture (Karangwangkal village experimental garden), Universitas Jenderal Soedirman, Purwokerto. The research included making *Centrosema pubescens* compost for 2 months, potting experiment for 4 months and analysis at the Soil Sciences Laboratory, Faculty of Agriculture, Universitas Jenderal Soedirman for 2 months.

Materials used include: (1) *Kandiudult* (Kandiudults) low activity clay (LAR) soil of Krumput village, Banyumas Regency, (2) *Centrosema pubescens* compost, (3) Ajibarang *Phosphate Rock* deposit, Banyumas Regency, (4) soybean seeds of Slamet variety from Soybean Research Development Center of Jenderal Soedirman University, and (5) chemicals for chemical analysis of soil and plant tissues. Equipment used included: hoes, buckets, polybags as experimental pots, soil and plant tissue chemical analysis equipment (electronic pH meter, spectrophotometer, a set of Kjeldahl apparatus for soil and tissue N analysis, other glassware, and electronic balance.

The treatments tried consisted of *Centrosema pubescens* compost and Ajibarang Phosphate Rock deposit on *Kandiudult*. Biomass of *Centrosema pubescens* was carried out from Krumput Rubber Plantation southern of Purwokerto city District of Banyumas. Deposit of Phosphate Rock was used in this research was brought out from Ajibarang District of Banyumas. The compost was made in advance for 2 months until it reached a C/N ratio = 10. The *Centrosema pubescens* compost dosage levels tested were K0 = 0 t.ha-1 (as control), K4 = 4 $t.ha^{-1}$ (14 $g.pot^{-1}$), and K8 = 8 $t.ha^{-1}$ (28 $g.pot^{-1}$). The Phosphate Rock dosage levels tested were P0 = 0 $t.ha^{-1}$ (as control), P2 = 2 $t.ha^{-1}$ (7 $g.pot^{-1}$), and P4 = 4 $t.ha^{-1}$ (14 $g.pot^{-1}$). The complete factorial treatment design was repeated three times resulting in 27 experimental units (nine treatment combinations).

The experiment was conducted based on a randomized complete block design with 3 repetitions. The experiment was conducted by putting *Kandiudult* Krumput soil into polybags and the soil was then planted with Slamet soybean variety as an indicator plant. The experiment was conducted in a plastic house. The arrangement of pot groups was designed in the north south direction. Observation variables: (i) variable changes in chemical properties of *Kandiudult* Krumput which include: (a) soil pH (pH H_2O) glass electrode method, (b) exchangeable-Al 1N KCl extraction glass method - volumetry, (c) cation exchange capacity (CEC) titration method, and (d) soil P-availability Bray I-spectrophotometric method, (ii) variables of P nutrient uptake by soybean spectrophotometric method and N-protein content in soybean seeds titration method. The percentage of soybean N content was calculated by the formula: % Protein = % N x Multiplier factor. For soybean, the multiplier factor is 5.75, (iii) growth variable is soybean dry weight, and (iv) soybean yield variable is seed dry weight. The analysis measurement of all variables which were done is writing down on the table with its F-probability value and the DMRT's test to all variables measure.

3. Results and Discussion

3.1 The effect of *Centrosema pubescens* compost on Soil and Soybean Variables Measures

The effect of the use of *Centrosema pubescens* biomass as a compost and the use of Phosphate Rock Ajibarang to soil and soybean are tabulated in Table 1.

Table 1. The F-probability and the DMRT's effect of *Centrosema pubescens* compost and Phosphate Rock on various variables

No.	Variable	*Centrosema pubescens* compost dose (ton.ha^{-1})				Phosphate Rock dose (t.ha^{-1})			
		F-prob	0	4	8	F-prob	0	2	4
1.	pH H_20	0.000**	4.58 a	4.61 b	4.69 b	0.000**	4.57 a	4.64 b	4.68 a
2.	Exchangeable Al (cmol $^{(+)}$.kg^{-1})	0.125	0.58 a	0.54 a	0.49 a	0.142	0.56 a	0.54 a	0.47 a
4.	CEC (cmol $^{(+)}$.kg^{-1})	0.000**	13.62 a	14.51 b	15.83 b	0.000**	13.57 a	14.61 b	15.79 c
5.	Soil P-available (ppm P_2O_5)	0.06	3.77 a	4.40 a	3.71 a	0.757	3.82 a	4.13 a	3.94 a
6.	P-uptake by plant (g P_2O_5.plant^{-1})	0.000**	3.25 a	5.25 b	5.82 b	0.024*	4.41 a	4.60 a	5.32 b
7.	N-protein content of soybean seeds	0.000**	28.91 a	39.31 b	37.31 b	0.194	34.28 a	35.82 a	35.70 a
8.	Plant dry weight (g.plant^{-1})	0.005**	4.68 a	7.09 b	8.90 c	0.000**	4.99 a	7.15 b	8.53 c
9.	Seed dry weight (g.plant^{-1})	0.000**	116 a	1.80 b	2.42 c	0.000**	1.22 a	1.91 b	2.24 c
10.	Number of seed	0.000**	25.37 a	37.07 b	39.10 b	0.000 **	24.28 a	35.07 b	42.44 c

No.	Variable	*Centrosema pubescens* compost dose (ton.ha^{-1})				Phosphate Rock dose (t.ha^{-1})			
		F-prob	0	4	8	F-prob	0	2	4
11.	Number of pod	0.000**	13.13 a	19.31 b	19.96 b	0.000**	13.17 a	18.33 b	20.98 b
12.	Dry weight of root (g.plant^{-1})	0.005**	0.56 a	0.91 b	1.06 c	0,000**	0.65 a	0.91 b	0.95 b
13.	Dry weight of root nodule (g.plant^{-1})	0.005**	0.56 a	0.91 b	1.06 c	0,005*	0.04 a	0.14 ab	0.22 b
14.	Number of nodule	0.000**	5.87 a	8.42 a	16.12 b	0,003*	4.30 a	9.96 a	16.16 b

The application of *Centrosema pubescens* compost is able to increase soil pH but the application of compost at 4 t.ha-1 and 8 t.ha-1 has not increased the pH of *Kandiudult* in the agronomic optimum pH range of tropical mineral soils which is around 5.7 - 5.9. The increase in *Kandiudult* pH by 8 tons/ha compost is only from pH 4.58 to 4.69, which is an increase of 0.11. This fact leads to the conclusion that *Kandiudult* requires an increase in the rate of application of *Centrosema pubescens* compost can be up to a dose of about 8-10 t.ha-1 (calculation based on the fit of the quadrater equation). The potential increase is possible because compost organic acids, especially humic like-compost *Centrosema pubescens* has the ability to chelate Fe, Mn, and Al *Kandiudult* forming complex compounds by functional groups carboxyl (-COOH) and hydroxyl (OH-phenolate, OH-enolate, OH-alkoholate, or - C = O [3]. The benefits of humic and non-humic materials from organic matter decomposition are good ameliorants for low productivity soils [4]. As organic soil when it was in turned as part of aggregate would go in turn to improve bacterial producing some beneficial matters to soil productivity as the: phosphate solubilizer [5], humic like acid, and other organic acids [6]. Soil organic matter when origin from vegetation leaf has potentially beneficiary produces secondary metabolite substances as phytohormone [7] and as an elicitor [8]. The *Centrosema pubescens* compost does not differ between doses on changes of exchangeable-Al *Kandiudult* soil. However, compost fertilization at the highest dose of 8 t/ha reduced Exchangeable-Al from 0.58 (cmol (+).kg^{-1}) to 0.49 (cmol (+). kg^{-1}) or decreased by 15.52%. The tendency of *Centrosema pubescens* compost to reduce Exchangeable-Al but not statistically significant is thought to be related to its ability to increase the pH of *Kandiudult* soil only to the range of pH 4.58 to 4.69 (not yet in the range around the optimal pH of tropical mineral soils which is around 5.7 - 5.9), thus the highest dose has not significantly reduced the solubility of aluminum. Aluminium solubility in acid soils is closely related to soil pH [9]; in acid soils with pH, 5.5 aluminium solubility is still high. The *Kandiudult* soil used in this study had a measured Exchangeable-Al of 1.13 (cmol (+).kg^{-1}) before the experimental treatments (*Centrosema pubescens* compost and Phosphate Rock). The result of analysis of variance (Table 1) shows that *Centrosema pubescens* compost is able to increase the CEC of *Kandiudult* soil. The increase in CEC was due to compost dosing from 0 t. ha^{-1} (CEC = 13.62 cmol (+).kg^{-1}) to 14.52 (cmol (+).kg^{-1}) and 15.83 (cmol (+).kg^{-1} respectively with compost doses of 4 t.ha^{-1} and 8 t.ha^{-1}. The 8 t.ha^{-1} dose showed an increase in mineral soil CEC which almost reached the minimum standard of soil CEC for biomass production of 16 (cmol (+).kg^{-1}). The original *Kandiudult* soil CEC is the soil CEC before being used for the experiment (before being treated with *Centrosema pubescens* compost and Phosphate Rock). The increase in soil CEC is associated with an increase in soil pH. In this study, the increase in CEC of *Kandiudult* soil can be said to be due to the addition of negative charges to the soil soPRtion complex resulting from the functional groups of humic and fulvic acids with the release of H^+ ions into the soil solution.

Table 1 showed that *Centrosema pubescens* compost statistically did not significantly increase the level of P availability of *Kandiudult* soil. However, there is a tendency to increase P-availability at the dose of compost from 0 t.ha^{-1} (3.77 ppm P_2O_5) to 4 t.ha-1 (4.40 ppm P_2O_5); at the dose of 8 t.ha^{-1} *Centrosema pubescens* compost causes the availability of *Kandiudult* soil P down to 3.71 ppm P_2O_5. Available phosphate of *Kandiudult* Krumput soil before being used for the experiment (original) was measured at 1.89 ppm P_2O_5. As an explanation for the increase in phosphate availability due to the addition of *Centrosema pubescens* compost on *Kandiudult* Krumput soil is the mineralisation of phosphate from compost through the mechanism of P release from organic complexes [10]. In addition, there is a tendency for the phenomenon of dissolution of P- *Kandiudult* soils from the soPRtion complex (Al and Fe) because organic anions released from compost organic acids chelate Al and Fe [11]. The most rational mechanism for reducing P-availability is the use of P by soil microorganisms that can increase in number and diversity due to the addition of organic acids (energy sources) and minerals so that their performance status becomes active [12]. Under these conditions P in *Kandiudult* Krumput soil becomes immobilised into the body of microorganisms [13]. Soil organic matter consists of: (i) non-humic materials (living bodies, proteins, amino acids, amino sugars, cellulose, lignin), and (ii) humic materials (humates) in the form of humin, humic acid, fulvic acid, hematomelanic acid, and humus [14]. Soil humic substances (humic substances) are part of the organic components of soil that have a complex chemical composition that occurs naturally with a high organic molecular weight [4]. Humic and fulvic acids are active parts of soil organic matter which are very useful for soil aggregation, increasing soil CEC, increasing soil infiltration capacity and so on [15]. Meanwhile, amino acids and amino sugars have great potential as the main "N-pool" in the soil [12], in addition to humic materials in the soil [14].

Centrosema pubescens compost significantly increases the level of P uptake by Slamet variety soybean plants. P uptake in the control (0 t.ha^{-1} compost) was 3.25 grams P_2O_5..plant^{-1}, increased to 5.25 grams P_2O_5.plant^{-1} at a dose of 4 t.ha^{-1} compost, and P uptake became 5.82 grams P_2O_5.plant^{-1} at a dose of 8 t.ha^{-1} compost. The increase in P uptake by soybean due to the dose of *Centrosema pubescens* compost 4 t.ha-1 is 61.54%, the increase by the dose of 8 t.ha^{-1} is 79.07%, while increasing from 4 t.ha^{-1} to 8 t. only increases P uptake by 10.86% only. The increase in P uptake by plants can theoretically be said of the mechanism: (i) the indirect effect, which is related to the ability of *Centrosema pubescens* compost to increase soil pH so that it allows the tendency of *Kandiudult* soil P solubility to increase which causes P uptake by soybean plants to be higher, and (ii) the direct effect, namely organic acids from *Centrosema pubescens* decomposition dissolve P from the Al and Fe sorption complex in *Kandiudult* soil.

The application of *Centrosema pubescens* compost showed an increase in N-protein content in soybean seeds and other plant measurement variables, which can be said to be due to an increase in P uptake by plants (Table 1). P uptake by plants increased between 2.0 - 2.57 g P_2O_5 per plant or 61.54 - 79.07 % per plant. Phosphate is an important nutrient for soybean plants to produce optimal protein levels in the seeds. Therefore, the increase in P uptake by plant in *Kandiudult* significantly increase the N-protein content in the seeds of soybean. It turned out that this increase was followed by a significant increase in other production measurement variables (dry weight of soybean seeds, number of soybean seeds, and number of soybean pods) and followed by an increase in other important measurement variables (dry weight of soybean nodules and number of nodules, dry weight of plant roots, and dry weight of soybean plant stover). The increase in measured variables of soybean root nodules due to the application of *Centrosema pubescens* compost is a very interesting phenomenon in this study. The number of nodules and dry weight of soybean root nodules increased above 150%. It can illustrate the specific role of organic acids from compost that have the ability to block Al and Fe in acid mineral soils [14] and can increase or improve soil physical properties so as to allow the life of soil microorganisms to be better [15] [16]. In addition to the chelation function, organic acids released by compost, especially humic acid and fulvic acid, can have the ability to become regulators of plant growth and show activity like plant growth hormones such as auxins [14]. Compost also contains various nutrients both macro and micro so that in general and specifically it can increase the growth and production of soybean. [17] They found that farmer adaptation through La-Nina 2020-2022 (base on farmer and farmer council survey research, 66 respondents): one of important adaptation value was the use of local organic fertilizer on selected adaptive food crops (cereal and vegetable crops). They gave information that in prolonged three years La-Nina was happened in Banyumas District and it was successfully adaptive well done by farmer use of organic fertilizer to increase their soil to be still productive land for crops. This finding shows that organic fertilizer is important. The FAO, WMO, and BMKG informed the same prediction that crops seasons will rapid change on ultimate climate change, though research on the use of local materials will important to adapt that has led to more easily available. Global temperature projected to increase by 1ºC and though it would be increased natural disaster [18]. The International Panel for Climate Change (IPCC) projected temperature increment on range of 1.8-4°C before 2100 [19].

3.2 Effect of *Phosphate Rock* Application on Soil and Soybean Variables Measures

The results of the analysis of variance (F-test) showed that the application of PR (Phosphate Rock) had an effect on increasing the pH and CEC of *Kandiudult*, P uptake, plant dry weight, number of seeds, seed weight, and number of soybean pods, as well as increasing root dry weight, number and dry weight of soybean root nodules. The application of PR had no significant effect on reducing Exchangeable-Al and increasing the available P of *Kandiudult* soil, nor did it significantly increase the N-protein content of soybean seeds. The probability value of F (F test results) and the results of DMRT further test of the effect of PR application are presented in Table 1.

Natural Phosphate Rock in this study was able to increase the pH of *Kandiudult* Krumput soil from 4.57 (without PR) to 4.64 (PR 2 $t.ha^{-1}$) and 4.68 (PR 4 $t.ha^{-1}$). Increasing the dose of PR from 2 $t.ha^{-1}$ to 4 $t.ha^{-1}$ did not increase the pH significantly, but the doses of 2 $t.ha^{-1}$ and 4 $t.ha^{-1}$ increased the initial pH without PR by 1.53 - 2.41%. It turned out that by giving phospahte rock at doses between 2 - 4 $t.ha^{-1}$, the increase in pH could not be rapid. There is a special phenomenon in this study that *Kandiudult* Krumput soil from the field used for this experiment has an initial pH (before treatment) of 4.20. Thus there has been an increase by the joint influence (outside of phosphate rock), namely by *Centrosema pubescens* compost the single influence of both.

The application of the PR on *Kandiudult* Krumput soil did not have a significant effect on reducing soil excheangable-Al. Table 1 showed that the soil excheangable-Al without PR was 0.56 (cmol (+).kg^{-1}) by applying Phosphate Rock at a dose of 2 $t.ha^{-1}$ only reduced Exchangeable-Al to 0.54 (cmol (+).kg^{-1}), while the PR dose of 4 $t.ha^{-1}$ reduced Exchangeable-Al to 0.47 (cmol (+).kg^{-1}). However, the role of PR in increasing the pH of *Kandiudult* Krumput can be associated with a decrease in soil Exchangeable-Al although not statistically significant. According to Kamprat and Foy (1985), stated that the concentration of Al in soil solution is inversely proportional to soil pH, an increase in soil pH causes the solubility of Al^{3+} ions in soil solution to decrease.

The application of PR was able to increase the CEC of *Kandiudult* Krumput soil, namely the application of 2 $t.ha^{-1}$ PR increases the CEC from 13.57 cmol(+).kg^{-1} to 14.61 cmol(+).kg-

[1] (an increase of 7.66%), while the application of 4 t.ha-1 PR increases the CEC to 15.79 cmol(+).kg^{-1} (an increase of 16.36%). The increase in CEC due to the application of PR is due to the content of Ca and Mg, thus increasing the number of cations in the cation exchange field of *Kandiudult* soil. The Al content of Ultisol ranges 3-9%, the Fe ranges 1.4-4% [20]. On the region wet tropical forest, the base content in A horizon low and those base element goes down to he beneath regolith horizon (B-ton); [21] agree with the condition which the age "ulti" marking the low base saturation in the Ultisol's A horizon. Furthermore [20], wrote that pedogenic ages has marking how lower soil organic content of soil; a lower soil organic content a higher Ultisol ages. In further climate change that can be predicted that a heating in a high radiative force of sun radiation in such of lower or high rainfall would gave significant rapid reduction soil organic matter which need addition of organic compost fertilizer. Phosphate Rock will a need to substitute such base element lost from topsoil whilst compost to rebound aggregation and cation exchange capacity. Estimation of Phosphate Rock effect on Ultisol Krumput CEC is following the best linier curve with linier equation: Y = 13.69 + 0.525 x; F-prob. 0.00; signification of the Phosphate Rock T values was 0.00, whilst T constant was 0,001. Based on that regression though dose of 4.5 t/ha of Ajibarang's Phosphate Rock can increase CEC to 16.05 cmol $^{(+)}$/kg as a stndart of tropical soil's CEC to be fertile soils.

Table 2 shows that Phosphate Rock gave a significant increase in P uptake by soybean plants at a PR application dose of 4 $t.ha^{-1}$, but did not significantly increase the N-protein content in soybean seeds. Its effect in increasing P uptake can be assumed not to be able to have an impact on increasing N-protein content in soybean seeds. Protein content range of soybean seed in this research agree with [22], [23]: The USDA data is 36.49 g/100g.

Tabel 2. T The effect of *Phosphate Rock* and *Centrosema pubescens* compost on P-uptake by plant and N-protein of soybean seed

Variables	F-prob.	Phosphate Rock dose ($ton.ha^{-1}$)		
		0	2	4
P-uptake (g P_2O_5 .$plant^{-1}$)	0.024*	4.41 a	4.60 a	5.32 b
N-protein of seed (%)	0.194	34.28 a	35.82 a	35.70 a
Variables	F-prob.	*Centrosema pubescens* compost ($ton.ha^{-1}$)		
		0	4	8
Available P (ppm P_2O_5)	0.06	3.77 a	4.40 a	3.71 a
P-uptake by plant (g P_2O_5.$plant^{-1}$)	0.000**	3.25 a	5.25 b	5.82 b
N-protein of seed (%)	0.000**	28.91 a	39.31 b	37.31 b

Table 3. The effect of Phosphate Rock on growth, production and rooting variables of soybean

Variables	Probability F	Phosphate Rock dose ($ton.ha^{-1}$)		
		0	2	4
Plant dry plant ($g.plant^{-1}$)	0.000**	4.99 a	7.15 b	8.53 c
Seed dry weight ($g.plant^{-1}$)	0.000**	1.22 a	1.91 b	2.24 c
Number of seeds	0.000**	24.28 a	35.07 b	42.44 c
Number of pods	0.000**	13.17 a	18.33 b	20.98 b
Root dry weight ($g.plant^{-1}$)	0.000**	0.65 a	0.91 b	0.95 b
Root nodule dry weight ($g.plant^{-1}$)	0.005*	0.04 a	0.14 ab	0.22 b
Number of nodules	0.003*	4.30 a	9.96 a	16.16 b

Phosphate Rock gave a significant increase in P uptake by soybean plants at a PR application dose of 4 $t.ha^{-1}$, but did not significantly increase the N-protein content in soybean seeds. Its effect in increasing P uptake can be assumed not to be able to have an impact on increasing N-protein content in soybean seeds. In turns out that above PR use benefit, the increase in P uptake and N-protein content is more due to the application of *Centrosema pubescens* compost; this can be assumed to be good for the application of *Centrosema pubescens* compost on *Kandiudult*s of Krumput for example for soybean land management under rubber plantation soil management. The role of Phosphate Rock on all variables of growth, production, and rooting (Table 3) showed significantly increased; thus the application of Phosphate Rock is really vital for crop cultivation on *Kandiudult*s Krumput's soil. Last but not least it can be asked that Phosphate Rock need efficient use (in dose) and its effective use in soil management that has led to its not huge deposit in Indonesia. On the future Phosphate Rock can be predicted as the most important rarely mineral resources in Indonesia, though its prediction in climate change adaptation model has a privilege research program and organic fertilizer resource as well.

4. Conclusions and Suggestion

4.1 Conclusion

Single treatment of *Centrosema pubescens* compost could increase pH-H_2O, increase *Kandiudult* CEC, P uptake, soybean N-protein content, the dry weight of plant stover and the dry weight of soybean seed. The Ajibarang Phosphate Rock deposit could increase the pH of *Kandiudult* H_2O, increase *Kandiudult* CEC, P uptake, the dry weight of plant stover and the dry weight of soybean seed. *Centrosema pubescens* humic-like compost is likely has ability to synergic to Ajibarang Phosphate Rock to induce increase of the pH of *Kandiudult* H_2O, the N-protein content of soybean seeds, the dry weight of plant stover and the dry weight of soybean seeds.

4.2 Suggestion

We would like to suggest the important study of the effect of N and P liberation of *Centrosema pubescens* compost under Ultisol in rubber plantation land estate, that lead to the plant so easily to nurseries as it function as land vegetation cover. Furthermore, study is advance synergism of humic-like compost to induce functionality of Phosphate Rock to ameliorate Kandiudult.

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