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**INFLUENCE OF ORGANIC FERTILIZER SAGO COMPOST ON
ULTISOLS SOIL PHYSICAL PROPERTIES OF TELAGA KODOK
SUB VILLAGE IN HITU VILLAGE OF CENTRAL MALUKU
DISTRICT AND THE CORN (*Zea Mays Ceratina*) CORPS
PRODUCTION**

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Abstract

This study aims to prove that the giving of organic fertilizer sago compost can improve soil physical properties and improve yields of maize crops on Ultisols. This research was conducted in Telaga Kodok Subvillage, Hitu Village Central of Maluku District in April 2016 until its completion. Soil analysis was conducted at Balai Penelitian Tanah Bogor. This research used Factorial Random Block Design which consist of one factor and repeated three times with compost dosage of sago compost is K0 (no compost), K1 (30 ton/ha), K2 (45 ton/ha), K3 (60 ton/ha). Giving the ela sago compost can improve soil physical properties that is able to reduce the bulk density (0.73 g/cm^3), particle density (1.78 g/cm^3) and rapid drainage pores (7.69%) and able to improve/increase moisture content of field capacity (43.91%) and water available pore (17.00%). The ela sago compost as organic fertilizer can increase the yield of corn crop is 89,80 g/plant or 4,28 t/ha. The optimum dosage of ela sago compost as organic fertilizer found to improve soil physical properties and increase the yield of corn crop is 60 t/ha.

Keywords: Organic Fertilizer Sago Compost, Soil physical properties, Ultisols, Corn production

ARTICLES

I. Introduction

Organic farming system is a cultivation system using natural materials without chemicals. This organic farming needs to be developed to improve the quality of the soil in a sustainable manner in improving agricultural productivity for the long term.

Corn production in Maluku Province is targeted to reach 14,930 tons by the end of 2015 [1-5], but in 2014 corn production in Maluku Province reaches only 10,560 tons and in 2015 increased to 13,947 tons [4]. This fact shows that although corn production is increasing every

year but until now the production of maize in Maluku is still below national production targets so that efforts need to be made in order to increase production and self-sufficiency of corn.

Ultisol soil is one of the marginal land in the small island of Maluku which is acidic, so it is less support the growth of plants growing on this land because it has many obstacles, especially from soil physical and chemical properties. Some obstacles of the soil physics are fine texture of the soil and a high clay content causes poor soil porosity thus limiting root plant growth. Well drainages needed by plants that require good aeration such as corn. Well soil aeration causes the availability of oxygen in the

soil enough so that plant roots are able to absorb nutrients and good growing [6-22].

According to **Ref. [21]** it is said that one of the functions of the soil is for crop production. The physical properties of the soil strongly support the production of plants, although a soil type has good chemical properties but is not accompanied by good physical properties then the production of plants will not reach the maximum. Therefore, efforts to improve the physical properties of the soil is absolutely done in an effort to support the growth and production of plants [8].

Efforts to improve the quality of soil have been done, among others, by the giving of organic materials. The use of organic matter on marginal lands with major problems of poor soil physical properties such as high density and penetration resistance and low water retention generally yield better results than fertilizers intended to improve chemical properties only. This is because the giving of organic materials can not only contribute N, P, K and other elements, but also can improve the physical and biological properties of the soil [2].

The organic material used in this research is sago compost, because sago plant is one of the specific plants that grow predominantly on wetlands in the small islands of Maluku (archipelago region). According to Flach (1997) in [13], the area of sago palm in the Maluku Province reaches 60,000 ha, consisting of 50,000 ha grown naturally, and 10,000 ha is cultivated sago plant.

According to **Ref. [19]** sago palm is a subject of both concern and interest in the context of food security because of its high productivity and tolerance to high salt and acid in the soil. So according to **Ref. [19]** however, the compatibility of sago-based agriculture with natural forest has not been sufficiently assessed.

Ela sago which is also referred to as the pith slurry is the remainder of the process of sago starch extraction. Sago starch is the main result as the staple food of the people of Maluku. While the dregs (*ela sago*) has some of the benefits of, for instance as a compost

fertilizer maker [13]. Thus, the Province of Maluku has abundant raw materials as a source of compost (organic material) from sago plants that are useful in the sustainable development of small island farms in Maluku.

Organic matter plays a role in the process of granulation and aggregation so as to form stable soil aggregates and crumbly and lightweight soil structures based on **Ref. [2]**. Organic fertilizers activate many species of soil microorganisms that release phyto-hormones to stimulate plant growth and improve nutrients [16].

From the research results of **Ref. [10]** that the giving of sago compost (*ela sago*) together with SP-36 fertilizer can improve the soil chemical properties of Ultisol, such as the increase of soil pH, P-available soil, P uptake, also can improve the physical properties of Ultisol soil reducing the bulk density and particle density, increases soil porosity, the soil pore size distribution includes slow drainage pore and rapid drainage down, increasing available water pore and improving soil aggregate stability.

Until now, research on soil physical properties in Land Management Study Program of Pattimura University is still lacking, while generally only conducted studies on soil chemical and soil biology, so based on the description above, it is necessary to do research on the influence of giving organic fertilizer sago compost and liquid organic fertilizer to soil physical properties and corn yields on Ultisols, each of which was observed and analyzed at different doses of fertilizers.

The aims of this research are 1) to prove that the giving of sago compost as organic fertilizer can improve the soil physical properties and improve the yield of corn crops; 2) find the optimum dose that can be suggested to improve soil physical properties and improve yield of corn crops. Hypotheses are: giving of organic fertilizer *ela sago* compost, will improve soil physical properties and increase (improve) yield of corn crop.

II. EXPERIMENTAL METHOD

2.1. Place And Time of Research

This research was conducted in Telaga Kodok Sub Village Hitu Village Maluku Tengah District at Maluku Province – Indonesian Country, and started on April 2016 until it was completed.

2.2. Materials and Tools

The materials used in this research are Ultisols soil in Telaga Kodok Sub Village, sago compost as organic fertilizer made from cow dung, PGPR/bioactivator, gamal leaf, rice husk, straw, eggshell, sugar. Besides that, it was also prepared bucket, pesticide solution vegetables, sample plastic bags, Kumala-F1 corn seeds as well as materials for soil profile profile ie soil profile description cards, soil pH papers, H₂O₂ solutions, Soil Munsell Color Charts, meters, name labels and chemicals for laboratory analysis.

The tools used are hoe, shovel, machete, rope, meter, bucket, soil ring sample, chopper machine, scales, measuring cylinders, and soil profile observation equipment ie blade field, abney level, computer and stationery.

2.3. Research Methods

The research treatment was factorial pattern arranged according to randomized block design (RBD) with 3 (three) replications. The factor is the organic fertilizer sago compost factor (K) compound which consists of four dosage levels, namely: (K0) = no compost; (K1) = 30 t/ha; (K2) = 45 t/ha; (K3) = 60 t/ha, of the 4 units of combination treatment and three replications, 12 experimental units were obtained. The parameters measured were soil physical properties analysis, includes : bulk density of soil, soil density, rapid drainage pore, field capacity, water available pore, and crop production ie dry weight kernels in each corn plant. Data were analyzed by univariate variety analysis, with equation: $Y = \mu + \alpha_i + \beta_j + \epsilon_k$; where Y = response

variable; μ = mean value; α_i = the influence of the i th group; β_j = the influence of the j-th *ela* sago compost as organic fertilizer factor; ϵ_k = experimental error k, while differences are tested by LSD test (Least Significant Difference) [20]. In addition, to know the relationship between response variables due to treatment is done by linear regression analysis includes linear and nonlinear correlation with model: $Y_i = \beta_0 + \beta_1 X_{ij} + \epsilon_i$ [6,14]. All data were analyzed using SPSS17 and Minitab16 programs.

The research stages consist of initial work, field work and laboratory analysis. The initial work includes: composting sago compost with a ratio of liquid and solid is 2: 1. Field work includes: observation of soil profile in the field, clearing of land, making beds, planting corn seeds, plant maintenance, intact sampling with ring sample for the measurement of soil physical properties, observation of plant production parameters through measurement of dry weights of corn crops. Further analysis of soil physical properties conducted in Soil Research Laboratory in Bogor, including measurement of bulk density, particle density, rapid drainage pore, field capacity and available water pore, while measurement of dry weight of corn kernels is done in Soil, Water and Plant Analysis Laboratory of Faculty of Agriculture Pattimura University in Ambon.

III. RESULTS AND DISCUSSION

3.1. The Effect of Giving Organic Fertilizer *Ela* Sago Compost on Bulk Density of the Soil

The results of the RBD variety test showed that the composting of sago had significant effect on the decrease of the bulk density of the Ultisols.

After further tests of LSD of *ela* sago compost, as shown in Table 3.1, it is seen that dose increase from 0 t/ha to 30 t/ha has no significant effect on bulk density of Ultisols soil, but if the dose is increased to 45 t/ha will have a significant effect in reducing the bulk density of the soil up to 0.73 g/cm³ and then not significantly different in the treatment of 60 t/ha.

From the table it is also seen that the average of bulk density for all compost treatment is smaller than the field bulk density 0.89 g/cm^3 with K0 (0.84 g/cm^3), K1 (0.85 g/cm^3), K2 (0.73 g/cm^3) and K3 (0.77 g/cm^3) so it can be said that the compost dose of 45 t/ha has produced the lowest bulk density of 0.73 g/cm^3 and is the optimum compared with other treatments in reducing the level of soil density.

Table 3.1. LSD Test Result Effect of Single Factor
Organic Fertilizer Sago Compost Treatment
on Bulk Density of the Soil.

Ela Sago Compost Treatment (t/ha)	Average of Bulk Density of the Soil (g/cm^3)
K0 (0 t/ha)	0.84a
K1 (30 t/ha)	0.85a
K2 (45 t/ha)	0.73b
K3 (60 t/ha)	0.77b

Note: The numbers followed by the same letter, are not significantly different at the 5% significance level accordingly further test of LSD with $\text{LSD}_{0.05}$ value single factor $K = 0.03$.

Figure 3.1.Regression Analysis/Equation of Organic Fertilizer Ela Sago Compost to Bulk Density of the Soil on Ultisols in Telaga Kodok Sub Village.

From the results of laboratory analysis, it is known that sago compost contains nutrients of Ca and Mg which are useful to improve soil structure to produce

more granular soil, which is indicated by decrease of soil density (bulk density of soil). Besides, the compost of sago contains nutrients N, P, K, Ca, Mg, S which play a role in decreasing soil acidity and support growth and development of corn crop at Ultisols in Telaga Kodok Sub Village.

From the results of this study it is known that the *ela* sago compost give a significant effect on changes in the bulk density of the soil content where the higher the *ela* sago compost dose given the bulk density of the soil value will tend to be lower (Figure 3.1). This is indicated by the β_1 regression coefficient = -0.000632 and $\beta_2 = -0.000017$ with P-Value = 0.000^* (significant).

Compost containing colloidal organic material with particle size $<1 \mu\text{m}$ is an adhesive agent between particles in soil aggregate forming process. Colloidal organic matter in *ela* sago compost is the result of activity and reshuffling microbial cells containing mucus (gum) as a binding agent in the aggregation process. Organic polymers that are large molecular weight polysaccharides are derived from the walls of microbial cells forming tissue such as a net that is effective in uniting soil particles. These hydroxyl polymers and the clay-carbon oxygen atoms form hydrogen bonds as binding bridges, while the non-colloidal particles of these polymers act as adhesive glue.

The treatment of *ela* sago compost on Ultisols soil gives a significant effect on the change of bulk density of the soil where the higher the dose of fertilizer given the lower the bulk density of the soil. From the result of the research, it is known that *ela* sago compost treatment with dose 45 t/ha can significantly influence to the change of bulk density of the soil contents in which the existence of organic material on *ela* sago compost play in binding soil particles to form soil aggregate.

This is in line with the opinion of [23-25] that the fiber residues consist of lignin, cellulose and hemicellulose, which can easily generate chemical bonding with electrophiles via hydroxyl groups. This carboxyl group which functions for the formation of soil

structures. So are the opinion in **Ref. [3]** that, complex organic compounds resulting from the decomposition process of organic matter can serve as adhesive cement in the granulation process. This is also supported by research results from **Ref. [23]** who argue that research has shown that bio-char as organic fertilizer application can reduce soil bulk density, improve soil water-holding capacity. In accordance with the opinion based on **Ref. [24]** that organic fertilizer (corn-composite) can reduced the bulk density of tobacco- growing soil.

3.2. The Effect of Giving Organic Fertilizer Ela Sago Compost on Particle Density of the Soil

The results of the RBD variety test showed that the ela sago compost had significant effect on the particle density of the Ultisols.

After further test of LSD test of ela compost, as shown in **Table 3.2**, it can be seen that the increase of ela sago compost dose from 0 t/ha to 30 t/ha and 45 t/ha has no significant effect on the particle density of the soil, and then if dose is increased to 60 t/ha it will have a significant effect on the particle density of the soil. It is indicated by the regression coefficient $\beta_1 = -0.001401$ and $\beta_2 = -0.000092$ with P-Value = 0.004* (significant), as shown in **Figure 3.2**. This is in line with the opinion of Sarief (1989) that the presence of organic matter on the soil causes the value of the particle density of the soil to be lower.

From **Figure 3.2** above shows that the addition of ela sago compost on Ultisols soil will decrease the particle density of the soil where the higher *ela* sago compost content is given then the particle density of the soil be lower, then it is said that the *ela* sago compost will give more influence optimum to the particle density of the soil at treatment at a dose of 60 t/ha.

The results also proved that the addition of ela sago compost can reduce the particle density of the soil with detail are : without treatment with a dose of 0 t/ha is 2.16 g/cm³ to 2.09 g/cm³ (30 t/ha), 1.85 g /cm³ (45 t/ha) and 1.78 g/cm³ (60 t/ha).It was assumed that the particle density of Ultisols soil before treatment was

equal to the general particle density between 2.6 - 2.7 g/cm³ with an average of 2.65 g/cm³. After being given the addition of *ela* sago compost into the soil it can reduce the particle density of the soil. It can be explained that the *ela* sago compost has the potential to decrease the particle density because weight of ela sago compost is lighter than the particle density of clay particle.

Table 3.2. LSD Test Result Effect of Single Factor Organic Fertilizer Ela Sago Compost Treatment on Particle Density of the Soil.

Ela Sago Compost Treatment (t/ha)	Average of Particle Density of the Soil (g/cm ³)
K0 (0 t/ha)	2.16a
K1 (30 t/ha)	2.09ab
K2 (45 t/ha)	1.85b
K3 (60 t/ha)	1.78c

Note : The numbers followed by the same letter, are not significantly different at the 5% significance level accordingly further test of LSD with **LSD_{0.05}** value single factor K = 0.24.

Figure 3.2. Regression Analysis/Equation of Organic Fertilizer Ela Sago Compost to Particle Density of the Soil on Ultisols in Telaga Kodok Sub Village.

Particle density of the each soil type tends to remain where the light weight of the particles is determined by the weathering levels of rocks which require considerable time, but the organic material contained in the *ela* sago compost can reduce the particle density of Ultisol soil in line with the addition of *ela* sago compost doses in each treatment performed. This is in line with the opinion of [18] that the presence of organic matter on the soil causes value of particle density of the soil will be lower.

The research results in Ref. [23-27] show that long-term application of organic fertilizer (manure) to change the composition of different size fractions due to cementation make $< 2\mu\text{m}$ to reduce the content of soil particles, while the content of $2 \sim 10\mu\text{m}$ size fraction was significantly increased, which promote the formation of soil aggregate structure, improve soil physical and chemical properties of positive significance.

3.3. The Effect of Giving Organic Fertilizer Ela Sago Compost on Rapid Drainage Pore of the Soil

The results of the RBD variety test showed that giving the *ela* sago compost was significantly affected to decrease by the rapid drainage pore of the Ultisols.

After the further test of LSD of *ela* sago compost, as shown in Table 3.3 it appears that the giving of *ela* sago compost with dose 0 t/a to 30 t/ha and 45 t/ha has no significant effect on rapid drainage pore, but if this dose increased to 60 t/ha it will have a significant effect in decrease of rapid drainage pore.

The addition of compost at a dose of 60 t/ha will decrease the percentage of the pore of rapid drainage up to 7.69 percent indicating that the more compost provided the water losses due to gravity will decrease so as to allow water to be retained on the soil pore as water is available to the plant.

Regression analysis results as depicted in Fig. 3.3 also showed that the higher the *ela* sago compost dosage that was given, the rapid drainage pores would

tend to decrease. It is indicated by regression coefficient $\beta_2 = -0.003713$ with P-Value = 0.015* (significant).

Table 3.3. LSD Test Result Effect of Single Factor Organic Fertilizer Ela Sago Compost Treatment on Rapid Drainage Pore of the Soil.

Ela Sago Compost Treatment (t/ha)	Average of Rapid Drainage Pore of the Soil(%)
K0 (0 t/ha)	18.11a
K1 (30 t/ha)	14.36a
K2 (45 t/ha)	16.57a
K3 (60 t/ha)	7.69b

Note : The numbers followed by the same letter, are not significantly different at the 5% significance level accordingly further test of LSD with $\text{LSD}_{0.05}$ value single factor K = 6.51.

It needs to be explained that the existence of rapid drainage pore in large quantities, is not good for the stability of water binding in the soil matrix, because in this condition water will quickly disappear from the soil through gravity, infiltration and evaporation, thus becoming unavailable to the plant. Giving *ela* sago compost will help to improve soil structure by decreasing pore size > 29 micron as drainage pore, so soil water is not lost quickly, otherwise it will potentially become available for the plant.

Rapid drainage pores > 29.7 microns where this condition water is unavailable/ useless for plants because the water in this pore moves rapidly and disappears quickly through infiltration or evaporation and gravitational forces. The more rapid drainage pore then it is not good for the plant because the water is quickly lost.

Figure 3.3. Regression Analysis/Equation of Organic Fertilizer Ela Sago Compost to Rapid Drainage Pore of the Soil on Ultisols in Telaga Kodok Sub Village.

This study proves that by giving ela sago compost the water lost by gravity at a pressure of pF 0.0 - 0.2 will not be completely depleted or completely lost but there is still water retained by particles with a strength between 0 - 0.096 atmospheres so water can be available for plants. The more ela sago compost provides, the more water that can be tied to the surface of adsorption complex in the soil. This is supported by research results [17] that the provision of ela sago compost was lowering the rapid drainage pore in the soil.

3.4. The Effect of Giving Organic Fertilizer Ela Sago Compost on Moisture Content of Field Capacity of the Soil

The results of the RBD variety test showed that the giving ela sago compost had significant effect on the increase of moisture content of the field capacity of the Ultisols.

Research results prove that the ela sago compost treatment with dose of 60 t/ha increased the moisture content of the field capacity by 43.91% higher than the moisture content of the field capacity with other compost treatment doses ie without treatment of 38.13%, dose 30 t/ha of 40.47% and dose 45 t/ha equal to 38.54% (Table 3.4). The increase of dose of ela sago compost to

30 t/ha and 45 t/ha was also not significantly different with dose 0 t/ha, but giving ela sago compost with dose 60 t/ha had significant effect compared to other treatment, so it can be said that ela sago compost treatment with dose 60 t/ha is more optimum than the other doses to increase the moisture content of field capacity in Ultisols soil.

Table 3.4. LSD Test Result Effect of Single Factor Organic Fertilizer Ela Sago Compost Treatment on Moisture Content of Field Capacity in Ultisols Soil.

Ela Sago Compost Treatment (t/ha)	Average of Moisture Content of Field Capacity of the Soil (%)
K0 (0 t/ha)	38.13a
K1 (30 t/ha)	40.47ab
K2 (45 t/ha)	38.54a
K3 (60 t/ha)	43.91b

Note : The numbers followed by the same letter, are not significantly different at the 5% significance level accordingly further test of LSD with $LSD_{0.05}$ value single factor $K = 3.78$.

The result of regression analysis in Figure 3.4 also shows that giving ela sago compost can increase the water content of field capacity ie the more ela sago compost given, the moisture content of the field capacity will be higher. This is indicated by the regression coefficient $\beta_1 = -0.04272$ and $\beta_2 = 0.002034$ with $P\text{-Value} = 0.023^*$ (significant).

It can be explained that the moisture condition in the field capacity is the amount of moisture content in the soil after the gravity of the water drops altogether.

Figure 3.4. Regression Analysis/Equation of Organic Fertilizer Ela Sago Compost to Moisture Content of Field Capacity on Ultisols Soil in Telaga Kodok Sub Village.

The pore size of the field capacity is 8.7 microns and the water is held at a pressure of pF 2.54 pF or 1/3 atm. In this condition the soil contains the most water for plants, ie the macro pore is filled by air and water available, while the micro pores are filled entirely by water. The presence of organic materials, especially ela sago compost can improve soil structure, thus increasing the moisture content of the field capacity. This is in line with [18] opinion that the field capacity with high organic content is greater than the field capacity with low organic matter content. It is also supported by [1] that organic matter plays a role in the formation of soil structures and organic materials that begins to decompose has the ability to absorb and retain high water. According to Hendrichson in [9] soil water is available for plants from the field capacity to the permanent wilting point. Plant growth will not be disturbed if soil moisture levels are between the two conditions. In accordance with the opinion of [24] that organic fertilizer (corn-composite) can increased the porosity and water retention capacity of tobacco-growing soil.

3.5. The Effect of Giving Organic Fertilizer Ela Sago Compost on Water Available Pore

The results of the RBD variety test showed that sago compost was significantly affected by the increase of water available pore of the Ultisols.

After further tests of LSD of *ela* sago compost, as shown in Table 3.5 it appears that the increase of *ela* sago compost to 30 t/ha and 45 t/ha has no significant effect on water available pore, but *ela* sago compost 60 t/ha treatment was significantly different from *ela* sago compost treatment with other doses in increasing water available pores on Ultisols soils.

Table 3.5. LSD Test Result Effect of Single Factor Organic Fertilizer Ela Sago Compost Treatment on Water Available Pore in Ultisols Soil.

Ela Sago Compost Treatment (t/ha)	Average of Water Available Pore of the Soil (%)
K0 (0 t/ha)	11.88a
K1 (30 t/ha)	13.37a
K2 (45 t/ha)	11.76a
K3 (60 t/ha)	17.00b

Note: The numbers followed by the same letter, are not significantly different at the 5% significance level accordingly further test of LSD with $LSD_{0.05}$ value single factor $K = 3.25$.

The result of regression analysis as depicted in Figure 3.5 also shows that the higher the ela sago compost dose given, the water available pore will increase. This is indicated by the regression coefficient $\beta_2 = 0.002468$ with P-Value = 0.011* (significant).

Figure 3.5. Regression Analysis/Equation of Organic Fertilizer Ela Sago Compost to Water Available Pore on Ultisols Soil in Telaga Kodok Sub Village.

Such data can be explained that the increased water available pore will increase the moisture content available on Ultisol soil in Telaga Kodok Sub Village. Research results show that the highest available water content is on the ela sago compost treatment with the dose of 60 t/ha is 17.00%. The water available pore size is between 0.2 - 8.7 microns ie at conditions between field capacity and permanent wilting point. In this condition the water can be directly absorbed by the root of the plant that is water with the strength of 0.333 to 15 atmospheres. Water under these conditions will be retained by the meso and micro pores and absorbed by the plant under optimum conditions. Giving the ela sago compost with higher doses results in increased moisture content available due to soil texture of Ultisols are fine with a large surface area and large pore volume that can bind water to the maximum. In accordance with the opinion of [7] which states that fine textured soils have a maximum total water binding capacity but the maximum available water is bonded to medium texture of the soils. In accordance with the opinion of [24] that organic fertilizer (corn-composite) can increased the porosity and water retention capacity of tobacco- growing soil.

Things is supported the research results Xu in [27] show that long-term application of organic fertilizer (manure)

to change the composition of different size fractions due to cementation make $< 2\mu\text{m}$ to reduce the content of soil particles, while the content of 2 ~ $10\mu\text{m}$ size fraction was significantly increased , which promote the formation of soil aggregate structure, improve soil physical and chemical properties of positive significance. The addition of ela sago compost means there is also an increase in the volume of water that is closely related to the availability of water in the soil.

3.6. The Effect of Giving Organic Fertilizer Ela Sago Compost on Dry Weight of Pods Corn at Ultisols in Telaga Kodok Sub Village

The results of the RBD variety test showed that the giving ela sago compost, organic liquid fertilizer and its interaction had a significant effect on the dry weight of corn pods at Ultisols in Telaga Kodok Sub Village.

After further tests of LSD on factor of ela sago compost as organic fertilizer, as shown in **Table 3.6**, it can be seen that the highest crop yield can be achieved in a treatment of K3 (ela sago compost = 60 t /ha) of 89.80 grams compared with other treatment. It is seen that the higher the dosage of ela sago as organic fertilizer given the result of corn crop is increasing.

Table 3.6. LSD Test Result Effect of Single Factor Organic Fertilizer Ela Sago Compost Treatment on Dry Weight of Pods Corn (g/plant).

Compost tratment (ton/ha)	Average of Dry Weight of Pods Corn (g/plant)
K0 (0 ton/ha)	0.00a
K1 (30 ton/ha)	62.31b
K2 (45 ton/ha)	79.26c
K3 (60 ton/ha)	89.80d

Note : The numbers followed by the same letter, are not significantly different at the 5% significance level accordingly further test of LSD with $LSD_{0.05}$ value single factor $K = 7.60$.

Figure 3.6. Regression Analysis/Equation of Organic Fertilizer Ela Sago Compost to Dry Wight of Pods Corn on Ultisols Soil in Telaga Kodok Sub Village.

It can be explained that the giving of *ela* sago compost causes the soil to have sufficient nutrient supply for plant growth especially N, P, K, Ca, Mg and other micro elements. In addition, this treatment contains microorganisms that break down the soil N and donate N to the plant. This means that the soil and plants get a large supply of N nutrients where the roots of the plant will move freely to absorb nutrients from the soil. All these nutrients are essential element that can be available in the soil and are useful to plants in support of better growth and crop production. Giving the *ela* sago compost has also improved the soil physical properties that is decrease of the bulk density, particle density, and rapid drainage pores, increasing the moisture content of the field capacity and water available pore (available moisture content), so that rooting is better to absorb nutrients from the soil. This is in line with the opinion of [26] that the fiber residues consist of lignin, cellulose and hemicellulose, which can easily generate chemical bonding with electrophiles via hydroxyl groups. This carboxyl group which functions for the formation of soil structures.

This is because the giving of organic materials can not only contribute N, P, K and other elements, but also can improve the physical and biological properties

of the soil **Ref. [2]**. Also supported by [15] that the value of positive significant correlation coefficient between available moisture content and soil organic matter content, the higher the organic matter the higher the available moisture content in the soil. In addition, according to [16] that organic fertilizers activate many species of soil microorganisms that release fitohormon to stimulate plant growth and improve nutrition. The soil organism also requires nitrogen for its growth and development. It is also endorsed by [11] that giving *ela* sago compost will improve soil chemistry primarily lowering soil acidity, increasing P-available and soil P uptake. Similarly, according to the study of [12] that the giving of *ela* sago compost independently can increase the dry weight of corn plant in Ultisols. This is also supported by the results of research from [25] that application of organic fertilizer was all alkaline fertilizer, which provide phosphorus and potasium ions, and calcium and magnesium bases as well, contributing to improving acidified soil and apple fruit yield.

Study results of [27] showed that the application of organic fertilizer effectively, will increase soil N and maintain available N, and increase available soil K. as shown in **Ref. [27]** stated that long-term application of organic fertilizer can increase soil Fe-P, the content of Al-P, Ca2-P and organic phosphorus each component.

Recognizing the function and important role of organic fertilizer in increasing corn production, it can be recommended to use *ela* sago compost with dose 60 t/ha so that corn production can reach 4.28 t/ha. It strongly supports the national corn production improvement program targeted to increase 5% per year with the average national corn production currently at 5.05 t/ha and especially in Maluku Province of 3.81 t/ha.

IV. CONCLUSION

4.1. Conclusion

Based on the results and discussion of this study it can be concluded several things as follows:

1. *Ela* Sago Compost can improve the bulk density, particle density, rapid drainage pore, field capacity and water available pore (moisture content available) at Ultisols soil in Telaga Kodok Sub Village.
2. The *ela* sago compost as organic fertilizer was able to increase the yield of corn plants that is 4.28 t/ha.
4. The optimum dosage of *ela* sago compost found to improve soil physical properties of Ultisols is a dose of 60 t/ha. Furthermore, to increase the production of maize, the best treatment as the optimum dose is 60 t/ha *ela* sago compost as organic fertilizer.

4.2. Suggestion

Based on the results of this study it is necessary to suggest several things as follows:

1. To improve the physical properties of Ultisols soil it is recommended only use organic fertilizer *ela* sago compost with optimum doses of 60 t/ha.
2. To increase the production of maize in the Ultisols soil is advised to provide organic fertilizer *ela* sago compost with dosage of 60 t/ha.
3. Need to do continue research on how to apply liquid organic fertilizer, either directly to the soil or through plant leaves to know the effect on soil physical properties and crop production at Ultisols in other location.

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