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Compost Quality from Organic Waste and Animal Waste and Its Influence on Plants in Regosol Soil

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***Abstract*—** *Management of organic and inorganic waste is increasingly limited, starting from disposal locations, processing technology, and community participation in overcoming waste problems. Waste management must aim to improve public health and environmental quality and turn waste into a resource. The aim of this research is to determine the quality of compost from organic waste with cattle, goat and chicken waste and its effect on plants in Regosol soil. Research Method used a completely randomized design with treatment: A: Compost 100% organic waste, B: Compost 75% organic waste and 25% goat waste, C: compost 50% organic waste and 25% goat waste and 25% chicken waste , D: Compost 25% organic waste and 25% goat waste, 25% chicken waste and 25% cattle waste. The research parameters consist of: pH, C-organic, total N, available P and available K. Data analysis by comparing Indonesian National Standards (SNI). The research results show that the quality of compost enriched with a combination of goat, chicken and cow livestock waste meets SNI standards according to SNI: Minister of Agriculture Regulation No: 261/KPTS/SR.310/M/4/2019. The best compost quality was achieved in treatment B: Compost 75% organic waste and 25% goat waste. Compost test results for corn plant height and tomato fruit weight were the highest achieved in treatment B and Regosol soil characteristics after treatment with livestock waste in organic waste did not show any increase, with neutral pH, medium C-organic levels, low total N, very available P high, available K is very low and CEC is low.*

***Keywords*—** *Compost quality, organic waste, livestock waste, plants, Regosol.*

I. INTRODUCTION

Waste is a material that is discarded or discarded from a source resulting from human activities or natural processes that does not have economic value. Organic waste from human activities will continue to increase, along with the increase in population, while the management of organic and inorganic waste is increasingly limited, starting from disposal locations, processing technology, and community participation in overcoming waste problems.

According to [1], regarding Waste Management, what is meant by waste is the remains of daily human activities and/or natural processes in solid form. This waste is produced by humans every time they carry out daily activities. A new paradigm in waste management is utilized, which is comprehensive waste management that spans from upstream to downstream. In chapter II, article 4: Waste management aims to improve public health and environmental quality and turn waste into a resource.

Waste management from the source is necessary to reduce waste issues. Waste management is a systematic, comprehensive and sustainable activity which includes reducing and handling waste. From upstream to downstream, waste management must be done thoroughly and holistically in order to deliver financial gains, maintain environmental safety, promote community health, and influence public opinion.

The problem is that compost from organic waste has weaknesses, especially in terms of the quality of its low nutrient content, when compared to inorganic fertilizer, however, organic fertilizer has the advantage of being an ameliorant in improving the physical properties of the soil as a medium for plant growth. Improving the quality of low nutrient levels can be done by adding livestock waste.

The characteristics of Regosol soil are dominated by sandy texture, loose structure, low moisture retention, low element content, so it has problems with low soil fertility levels. Organic fertilizer from organic waste is expected to improve the physical and chemical fertility of Regosol soil. The results of research [2], the characteristics of Regosol soil are low nitrogen levels (0.15%). Available N levels are very low (0.01%). Low KPK (13.57 me%). Low organic C (0.99 %). Neutral pH (6.75) and sandy texture with sand content (44.96%). the size of the fraction is dominated by sand. so it has the problem of low fertility rates. This is because nutrients and water availability are low as a result of the ease with which water and nutrients are leached. Water and nutrients cannot be stored in Regosol soil because the soil porosity is large

Organic waste is a type of waste that consists of materials that come from nature so that naturally the waste can undergo decay or decomposition by microbes such as bacteria, fungi and so on. In general, organic waste can come from various places such as households or residential areas, public or commercial places, industrial areas, and agricultural land. Some examples of organic waste that are often encountered include vegetable waste, fruit, leftover animal and vegetable side dishes, twigs or leaves, and so on [3]. According to [4] organic waste contains various complex compounds such as carbohydrates, proteins, fats, minerals, vitamins, and so on which are naturally easily decomposed by physical, chemical and enzyme influences contained in the waste or microorganisms that live in the waste. Alone. When these complex compounds have undergone decomposition, they can become a source of nutrients or nutrients that are beneficial for the soil and plants.

According to research results [5], compost from urban organic waste contains 0.64% N, 0.33% P2O5, and 1.32% K2O. As the population increases, the amount of waste produced increases. By utilizing machines, the process of processing organic waste into compost will be faster and more efficient. By adding livestock manure, the quality of the compost produced will be better and its use optimal. Livestock manure is waste from the digestion of livestock which consists of solid and liquid feces. As livestock businesses develop, the waste produced will also increase. Animal manure or what is often called manure has characteristics such as shape, color, odor and chemical composition that vary greatly. Livestock manure can be used for various purposes such as organic fertilizer (compost), planting media, alternative energy and others [6], livestock manure is able to improve or increase soil fertility because it contains various kinds of nutrients, both macro and micro [7].

Several types of livestock manure that are often used as ingredients for making organic fertilizer include goat manure, chicken manure and cow manure. The three types of livestock manure have different properties or characteristics, especially in terms of physical and chemical composition. Goat manure has excellent potential to be used as organic fertilizer because in goat manure there are various kinds of microorganisms that can act as decomposers of organic material. The results of the decomposition process will become simple organic materials that can be easily absorbed by plants as nutrients. This is supported by research results [8], that the levels of organic C, Nitrogen and Potassium elements in compost made from goat manure are relatively higher than chicken and cow.

Chicken manure is used as organic fertilizer or compost because it contains various essential macro and micro nutrients. According to [9], fertilizer made from chicken manure is an organic material that affects the physical, chemical properties and growth of plants. [10] also expressed the same thing, chicken manure can have a positive influence on the physical and chemical properties of soil and encourage the development of microorganisms. Chicken manure is known to contain macro nutrients such as phosphorus (P), which is quite high compared to cow and goat manure. Not only that [8].

Cow dung is one of the livestock business wastes that is widely available and has complete nutrient content which can increase soil fertility and improve plant growth and yields [9]. Cow dung is known as one of the livestock manures that has the highest fiber content in the form of cellulose compared to other livestock manure. Apart from that, cow dung also contains various macro nutrients, micro nutrients, colloids, and various microorganisms which are useful for increasing soil fertility, improving soil structure, as well as boosting or increasing the number and types of microorganisms for the soil [11].

The quality of solid organic fertilizer and liquid organic fertilizer from livestock waste, laboratory analysis results show that organic fertilizer produced from cattle waste, both solid and liquid organic fertilizer, has the following characteristics: alkaline pH (7.25 - 8.5) still meets standards. The organic C content of solid organic fertilizer (18.66 – 21.09%) exceeds the standard. but liquid organic fertilizer (7.33 – 10.64%) is below standard. total nitrogen content. P_2O_5 levels. liquid organic fertilizer K_2O levels are below standard [12]. The results of research [13] show that organic fertilizer from cow waste, both solid and liquid organic fertilizer, has the following characteristics: alkaline pH (7.9 - 9) still meets standards. The organic C content of solid organic fertilizer (38.27%) exceeds the standard. but liquid organic fertilizer (0.42%) is below standard. total nitrogen content. P_2O_5 levels. K_2O levels of liquid organic fertilizer are below standard. but the potassium content of solid organic fertilizer meets standards.

Compost is a type of organic fertilizer in the form of material resulting from the decomposition or decomposition of organic materials produced from plants, animals or waste carried out by active microorganisms, such as bacteria and fungi. Compost contains various beneficial nutrients such as nitrogen, phosphorus, potassium and a variety of other elements that are beneficial for soil fertility and plant growth. Compost is a natural material that is formed as a result of the process of breaking down or decomposing organic materials and has many benefits for soil and plants [14].

The aim of this research is to determine the quality of compost from organic waste with cattle, goat and chicken waste and its effect on plants in Regosol soil. It is hoped that this research can improve the quality of compost from organic waste, thereby reducing the use of chemical fertilizers towards sustainable agriculture.

II. Research Methods

The research was carried out in the practical garden and greenhouse of the UPN "Veteran" Yogyakarta Condongcatur campus and chemical analysis was carried out in the Soil Biology Laboratory. Soil Chemistry, Soil Science Study Program, Faculty of Agriculture, UPN "Veteran" Yogyakarta. The research method was carried out descriptively by looking at the decomposition process of organic waste into compost with 4 types of treatment, namely A: Compost 100% organic waste, B: Compost 75% organic waste and 25% goat waste, C: Compost 50% organic waste and 25% goat waste and 25% chicken waste, D: Compost 25% organic waste and 25% goat waste, 25% chicken waste and 25% cattle waste. Compost parameters consist of C-organic. N total. pH. Phosphorus and Potassium. Data analysis uses SNI standards in accordance with Minister of Agriculture Regulations: SNI Permentan No:261/KPTS/SR.310/M/4/2019

III. Results and Discussion

The results of analysis of cattle, chicken, goat and organic waste used to improve the quality of organic waste compost before treatment are shown in the table below.

The quality of livestock manure waste used in research has a characteristic pH of 7.51 – 9.14 which meets SNI standards, the C-organic content of 12.67 – 15.96% does not meet SNI standards, except for goat waste, the levels of Nitrogen + Phosphorus + Potassium are less from 2% so it does not meet SNI standards, this is because the organic waste has not undergone decomposition and has not undergone a mineralization process so the NPK content is still low. Low organic C- levels. The results of research [12] show that organic fertilizer produced from cow manure waste, both solid and

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liquid organic fertilizer, has the following characteristics: alkaline pH (7.25 - 8.5) still meets standards, organic C content of solid organic fertilizer (18.66 – 21.09 %) exceeds the standard, but liquid organic fertilizer (7.33 – 10.64 %) is below standard, total nitrogen content, P2O5 content, K2O content of liquid organic fertilizer are below standard. Chicken manure contains N of 3.22%, P of 9.34%, K of 0.218%, and C-Organic content of 13.11% [15]. The results of research on the effect of various types of livestock waste treatment on organic waste after treatment on compost quality are in Table 2.

TABLE 1. Results of livestock waste analysis before treatment

No	Sample	pH	C-organic (%)	Total Nitrogen (%)	Phosphorus (%)	Potassium (%)	C/N Ratio
1	Cow Waste	8,14	13,79	1,69	0,43	0,059	8,159
2	Chicken waste	9,14	12,67	1,39	1,13	0,043	3,737
3	Goat waste	7,62	15,96	1,91	0,73	0,044	4,081
4	Organic waste	7,51	12,99	1,87	1,21	0,071	3,356
SNI Permentan No:261/KPTS/SR.310/M/4/2019		4 s/d 9	min 15	(N+P+K) min 2			max 25

Table 2. Compost quality from a combination of organic waste and livestock waste

No	Parameters	Unit	SNI Standard	Types of Compost			
				A	B	C	D
1	C- Organic	%	min 15	32,45	39,87	30,41	32.73
2	C/N Ratio		Max 25	13,64	13,58	11,38	13,63
3	Water Content	%	10 - 25	23,36	24,54	21,53	20,64
4	Macro Nutrient						
	Total N	%	min 2	2,49	2,85	2,67	2,4
	P_2O_5	%		3,26	0,22	2,89	1,92
	K_2O	%		3,72	11,44	18,18	18,17
5	Micro Nutrient						
	Total Fe	ppm	max 15.000	36,3	1001,7	26,3	1001,7
	Zn	ppm	max 5.000	303,2	404,9	303,2	404,9
6	pH		4 sd 9	7,6	8,6	9,1	8,7
8	Functional Microbes						
	N Fixation	cfu/g	> 1 x 10 5	0	0	0	4,39x102
	P-Solubilizing	cfu/g	> 1 x 105	6,97x103	6,97x103	1,07x106	1,4x105
9	Heavy metal						
	Hg	ppm	max 1	0,6	0,2	0,2	0

Note: SNI Minister of Agriculture No:261/KPTS/SR.310/M/4/2019

Compost testing from adding a combination of goat, chicken and cow livestock waste to organic waste on the quality of the compost (Table 2), shows that each parameter for each type of compost starts from organic C content, total N, C/N ratio, and others. has met SNI standards according to SNI: Minister of Agriculture Regulation No: 261/KPTS/SR.310/M/4/ 2019. The best compost quality is achieved in treatment B: Compost 75% waste slurry and 25% goat waste with a C-organic content parameter of 39.87 % and total N content 2.85 %

Table 3 shows that increasing the dose of compost for each type of compost can increase the height of corn plants. The greater the dose of compost, the taller the corn plants. The highest increase was achieved in the compost type B treatment with a dose of 15 tonnes/ha. The highest average increase was achieved in compost type B: Compost 75% organic waste and 25% goat waste, with plant height 76.42 cm, this is because compost B has the best quality with the highest levels of organic C and total N.

TABLE 3. Compost test results on corn plant height (cm)

Treatment	Types of Compost			
Dose	A	B	C	D
Control	49,67	50	48,67	44,67
5 Tons/ha	71,33	76,67	63	65,33
10 tons/ha	80,33	85,67	76,33	70,33
15 tons/ha	83	93,33	81,67	79
Average	71,08 b	76,42 a	67,42 c	64,83 c

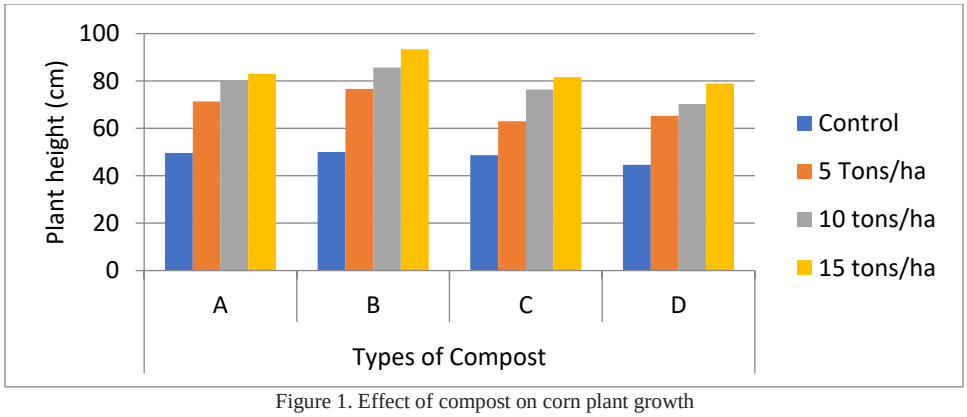

Figure 1. Effect of compost on corn plant growth

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Compost testing from adding livestock waste to organic waste on corn plant height (Figure 1), shows that increasing the dose of compost in each type of compost can increase corn plant height. The highest increase was achieved in the compost type B treatment with a dose of 15 tonnes/ha. The highest average increase was achieved in compost type B: Compost 75% organic waste and 25% goat waste, this was because the levels of C-organic and total N were highest in Compost B can increase plant growth.

Table 4 shows that increasing the dose of compost for each type of compost can increase the weight of tomatoes. The greater the dose of compost, the heavier the tomato fruit. The highest increase was achieved in the compost type A treatment with a dose of 15 tons/ha. The highest average increase was achieved in compost type B: 75 % organic waste compost and 25% goat waste, with the weight of the tomato fruit 478.75 grams.

TABLE 4. Compost test results on tomato fruit weight (g)

Treatment	**Types of Compost**			
Dose	A	B	C	D
Control	265	365	320	135
5 Tons/ha	365	385	335	280
10 tons/ha	390	385	335	360
15 tons/ha	870	780	450	415
Average	472,5 b	478,75 a	360 c	297,5 d

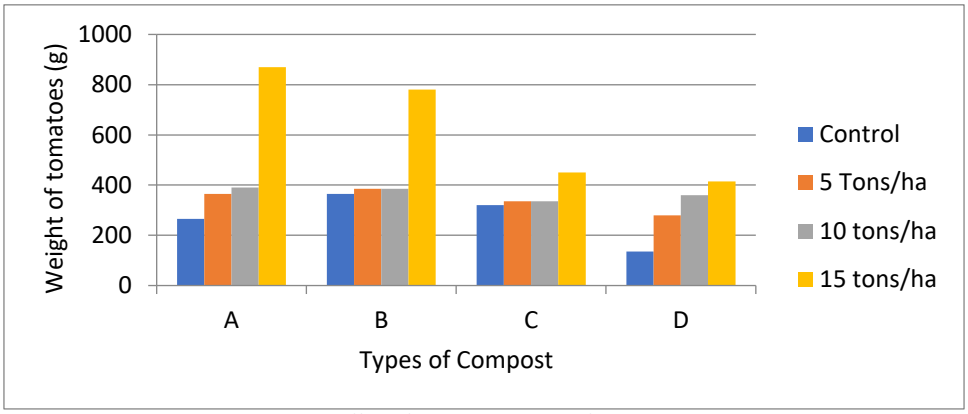

Figure 2. Effect of compost on tomato fruit weight (g)

TABLE 5. Average soil analysis results after treatment

Sample	**pH**	**C-Organic (%)**	**Total N (%)**	**P_2O_5 (ppm)**	**K_2O (c mol/kg)**	**CEC (cmol/kg)**
Soil	7,06 (n)	2.70 (m)	0,11 (l)	94 (vh)	0,48 (vl)	13,04 (l)
Control	7,47 (n)	2,97 (m)	0,12 (l)	147 (vh)	0,39 (vl)	13,46 (l)
A	7,58 (n)	2,68 (m)	0,13 (l)	193 (vh)	0,39 (vl)	13,21 (l)
B	7,58 (n)	2,67 (m)	0,12 (l)	161 (vh)	0,42 (vl)	13,62 (l)
C	7,48 (n)	2,59 (m)	0,12 (l)	164 (vh)	0,41 (vl)	13,93 (l)
D	7,73 (n)	2,77 (m)	0,12 (l)	158 (vh)	0,43 (vl)	10,74 (l)

Source (..) : Balittanah (2009)
Description: (n); neutral, (m): medium, (l): low, (vh): very high, (vl): very low

Compost testing from adding livestock waste to organic waste on tomato fruit weight (Figure 2), shows that increasing the dose of compost in each type of compost can increase tomato fruit weight. The highest increase was achieved in compost type A treatment with a dose of 15 tons/ha, but the highest average increase was achieved in compost type B: Compost 75% organic waste and 25% goat waste.

The soil characteristics after treatment with the addition of livestock waste to organic waste in Table 5 show that there is no increase in the value of each parameter, even compared to without treatment. Soil pH parameters 7.06 - 7.73 (neutral), organic C content 2.59 - 2.97 % (medium), total N 0.11 - 0.13 % (low), available P 94 - 193 ppm (very high), available K 0.39 – 0.48 c mol/kg (very low), and CEC 10.74 -13.93 (low)

IV. CONCLUSION

The research results show that the quality of compost enriched with a combination of goat, chicken and cow livestock waste meets SNI standards according to SNI: Minister of Agriculture Regulation No: 261/KPTS/SR.310/M/4/ 2019. The best compost quality was achieved in treatment B: Compost 75% organic waste and 25 % goat waste.

Compost test results for corn plant height and tomato fruit weight were highest in treatment B: Compost 75% organic waste and 25% goat waste.

The characteristics of the Regosol soil after treatment with livestock waste in organic waste did not show any increase, with neutral pH, medium C-organic levels, low total N, very high available P, very low available K and low CEC.

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