DURIAN (*DURIO ZIBETHINUS MURR.)* PEELINGS: SUBSTANCE TO ENHANCE SOIL QUALITY

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Abstract

This experimental study investigated the effects of durian peelings as enhancer to the soil quality. Multi-case quasi-experimental research design was used in accomplishing the objectives of this study. For four (4) weeks, the subjects were under experimentation where environmental conditions were not controlled. Control and experimental groups were made.

Statistical treatments like Mean, T-test and ANOVA were applied after a month of experimentation. An increase was observed in the soil quality parameters when durian peelings were applied in the soil at different percentages. This means that durian was effective in enhancing the soil quality.

There was a significant difference in the mean of OM, P, K and water holding capacity between the control and experimental set-ups before and the application of durian peelings. This implied that there was a major improvement of all parameters of the soil from a soil without durian peelings to a soil with durian peelings. However, there was no significant difference on the application of different percentages of durian peelings to the soil's OM, K and water holding capacity. This implied that no matter how much percentage of durian peelings were applied in the soil, still the parameters changes significantly.

There was a significant difference on the application of different percentages of durian peelings to the soil's P. This entails that the level of P changes significantly according to the percentage of application of durian peelings in the soil.

Keywords: *Durian, Soil Quality Enhancer, Soil, Organic waste, Compost*

Introduction

The challenge for agriculture over the coming decades will be to meet the world's mounting demand for food in a sustainable way. Declining soil fertility and

mismanagement of plant nutrients due to the use of synthetic fertilizers and degradations have made this task more difficult. This predicament affects everybody. When the soil is uncultivable, food production is impinged on and life processes are at risk.

In developing countries, harsh climatic conditions, population pressure, land constraints, and the decline of traditional soil management practices have often reduced soil fertility (Stoorvogel and Smaling 1990; Tandon 1998; Henao and Baanante 1999; Bumb and Baanante 1996). The International Rice Research Institute (IRRI) and Consultative Group on International Agricultural Research (1996) reported that farms in Thailand, Laos and the Philippines have confirmed the lack of phosphorus in upland farms that limits rice crop yields. Many highly weathered upland soils are inherently low in phosphorous and are acidic.

The National Action Plan (NAP) for 2004 to 2010 identified soil degradation as a major threat to food security. It is reported that about 5.2 million hectares are seriously degraded resulting to 30 to 50 percent reduction in soil productivity and water retention capacity. Because of this, NAP identifies the control of soil degradation as one of the major research priorities for the Philippines. Atienza et al. (2008) reported that there is a need for a coordinated and continual appraisal and protection of soil resources in the Philippines.

Addressing to this dilemma, instead of disposing and ignoring the biodegradable wastes such as the peelings of durian, the primary objective of this study is centered to the determination of enhancing the quality of soil using durian peelings. Focusing on the major concern, the proponent sets the objectives of the study defining the extent to where this investigation is only concerned.

Method

The subject of this study was the top soil found within the vicinity of the St. Mary's College of Tagum, Inc. Using the L-technique in getting the soil sample from the land area of six (6) hectares, the researcher accumulated a sample of 14.4 kilos of soil. There were one point two (1.2) kilos of soil being distributed to the 12 pots and mixed with the given percentages of durian peelings for experimentation. Durian peelings were

used as subjects in this experimental research which were mixed with the soil as quality enhancer. Different percentages of durian peelings were structured to distinguish the quality of soil.

Table 1

Set-ups of the Research Subject

PERCENTAGES OF DURIAN PEELINGS	REPLICATIONS		
	1	2	3
CONTROL SET-UP			
0%	Pot 1	Pot 2	Pot 3
EXPERIMENTAL SET-UP			
15%	Pot 4	Pot 5	Pot 6
30%	Pot 7	Pot 8	Pot 9
45%	Pot 10	Pot 11	Pot 12

This experimental study used the multi-case quasi-experimental research design in accomplishing its primary objectives. For four (4) weeks, the subjects were under experimentation where environmental conditions were not controlled. Hence, it is multi-casing quasi-experimental study. A control and experimental groups were made (Please refer to Table 1). Three (3) observations were taken to establish a baseline; a treatment then occurs, followed by additional observations. The design employed established a baseline measure, described a change over time.

In addition, the researcher utilized laboratory results to obtain data from the set-ups. The *Wilde's Method* determined the organic matter content of the sample. The total phosphoric acid (P_2O_5) was determined by the use of *Olsen's Method* while *H_2SO_4 Hot Sulfuric Extractable* determines the total potassium (K_2O). The water holding capacity was determined by physical characterization and according to soil texture.

Presentation and Analysis of Findings

The quality of soil was determined in terms of its Organic Matter, Phosphorus-Potassium (P-K) content, and Water Holding Capacity. After four (4) weeks of

experimentations, the control set-up and the experimental set-up with different percentages of durian applications were compared.

Quality of Soil in the Control Set-Up Before the Application of Durian Peelings as to Organic Matter, Phosphorous, Potassium and Water-Holding Capacity.

Organic Matter (OM). In this study, the OM decreased from 2.2 to 0.9 since the soil was not given with organic treatment that influenced the presence of the microbes. It directly affects the content of the organic matter because no decomposition took place in the soil (see Table 2).

Phosphorous (P). According to Busman et.al (2002), Phosphate is taken up by plants from soils, utilized by animals that consume plants, and returned to soils as organic residues decay in soils. This could be one of the reasons why there were changes in the amount of P for every replication especially in the second replication where it got the highest P content (see Table 2).

Table 2

Quality of Soil in the Control Group After the Experimentation

Replications	Parameters			
	OM *(%)*	P *(ppm)*	K *(ppm)*	Water Holding Capacity *(%)*
1	2.2	14	270	71.93
2	1.0	22	385	51.63
3	0.9	20	370	47.56
MEAN	1.37	18.67	341.67	57.04

Potassium (K). The amount of Potassium (K) is also affected due to some factors such as higher soil moisture (see Table 2). It usually means greater availability of K. Increasing soil moisture increases movement of K to plant roots and enhances availability.

Water-Holding Capacity (WHC). This result is supported by Agvise Laboratories (2001-2010) which explained that the soil water holding capacity is controlled primarily

by the soil texture and the soil organic matter content (see Table 2). Moreover, the decreasing water holding capacity is also due to the organic matter content in the soil. Since the OM in the control group decreased accordingly from the first to the third replication, the water holding capacity decreased directly.

Quality of Soil in the Control Set-Up After the Application of Durian Peelings as to Organic Matter, Phosphorous, Potassium and Water-Holding Capacity.

It is explained by McGourty and Reganold (2010) that OM accumulation is affected by the following factors climate, soil texture, tillage, cover crop selection, and compost additions. Compost contains long-lived OM similar to humus formed in the soil and it helps build soil OM, particularly in soils with good biological activity. Compost can also stimulate cover crop growth through the N, P, and K it brings to the soil (see Table 3).

The phosphorus exists in soils in organic and inorganic forms. Organic forms of P are found in humus and other organic material. Phosphorus in organic materials is released by a mineralization process involving soil organisms. The activity of these microbes is highly influenced by soil moisture and temperature. The process is most rapid in warm, well-drained soils (see Table 3).

Because of the soil type and environmental conditions, the amount of potassium available is affected for plant use unlike in the first and third replication. Potassium availability is highest under warm, moist conditions in soils that are well aerated with a neutral or slightly acidic pH. Too much water in the soil profile will lower oxygen levels, which in turn decreases plant respiration reducing potassium uptake (see Table 3).

According to Ball (2001), water-holding capacity is controlled primarily by soil texture and organic matter. The type and composition of the soil is the controlling factor in the water-holding capacity (see Table 3).

Table 3

Quality of Soil in the Control Group
After the Experimentation

Replications	Parameters			
	OM *(%)*	P *(ppm)*	K *(ppm)*	Water Holding Capacity *(%)*
1	1.0	24	340	48.89
2	1.0	20	325	49.82
3	1.0	24	395	48.88
MEAN	1.0	22.67	353.33	49.20

Differences of the Soil Parameters between the Control and Experimental Set-Ups Before and After the Application of Durian Peelings

Presented in Table 4 is the result of the quantity of increase or decrease of OM, P-K, and Water Holding Capacity between the control and experimental group is identified. In this regard, the differences between the two groups are obtained. Below are tabular records containing the mean of the constituents to which differences can be extracted.

In OM, the null hypothesis is rejected and deemed to be significant at alpha 0.05. This implies an increase and difference in organic matter content as Durian peelings were applied into the soil. Meaning, the soil OM greatly increased when an intervention was given.

In P, as seen in Table 4, the hypothesis is rejected at alpha=0.05. This implies that there is significant difference between the control set-ups and the experimental set-ups before and after the application of durian peelings. It means that the P changes greatly when durian peelings were applied in the soil.

In K, the hypothesis is also rejected at alpha=0.05. This entails that there is significant difference between the control set-ups and the experimental set-ups. Meaning, the K greatly increased accordingly when durian peelings were applied in the

soil. Moreover, it is explained that increasing the organic matter and humus will have a dramatic impact on the K status.

As for the water holding capacity, the hypothesis is again rejected at alpha=0.05. It means that there is significant difference between the control set-ups and the experimental set-ups. This result is influenced also by the organic matter content which increased more in the soil when durian peelings were applied.

Table 4

Differences of the Soil Parameters between the Control and Experimental Set-Ups Before and After the Application of Durian Peelings

SET-UPS	MEAN	T-value @ *a*=0.05		Decision on Ho	Conclusion on Difference
		Computed	Tabulated		
Organic Matter *(%)*					
Control	1.37	-7.15	2.23	REJECTED	Significant
Experimental	11.13				
Phosphorous *(ppm)*					
Control	18.67	-15.45	2.26	REJECTED	Significant
Experimental	255.00				
Potassium *(ppm)*					
Control	341.67	-13.37	2.26	REJECTED	Significant
Experimental	10,253.33				
Water Holding Capacity *(%)*					
Control	57.04	-6.47	2.20	REJECTED	Significant
Experimental	112.69				

Difference on the Application of Different Percentages of Durian Peelings to the Quality of Soil Parameters

In organic matter (OM), there is no significant difference on the application of different percentages of durian peelings. The information and issue entitled, Decomposing Organic Matter in Soil Makes more Nutrients, explained that an addition of compost usually involves mixing it into the top few feet of soil. No significant difference in soil organic matter content was found between treatments receiving compost and no-compost. However, compost application increased soil cation

exchange capacity (CEC) from 4 to 6 cmol kg. Soil pH was also increased by the compost application (http://www.outdoorgardens.homehydroponics. info/organic-nutrients/why-does-decomposing-organic-matter-in-soils-make-more-nutrients-available.Retrieved: 21 January 2011)

The total mean of Phosphorous increases as the percentage of durian application increases. The hypothesis is rejected at alpha=0.05. It means that there is significant difference on the application of different percentages of durian peelings to the quality of soil parameters particularly the Phosphorus content.

Table 5

Differences on the Application of Different Percentages of Durian Peelings to the Quality of Soil Parameters

PERCENTAGES OF DURIAN PEELINGS	MEAN	F-value @ *a*=0.05		Decision on Ho	Conclusion on Difference
		Computed	Tabulated		
Organic Matter *(%)*					
15%	6.77	.60	7.71	ACCEPTED	Not Significant
30%	11.97				
45%	14.67				
Phosphorous *(ppm)*					
15%	190.00	26.77	7.71	REJECTED	Significant
30%	271.67				
45%	303.33				
Potassium *(ppm)*					
15%	7,553.33	.36	7.71	ACCEPTED	Not Significant
30%	10,966.67				
45%	12,240.00				
Water Holding Capacity *(%)*					
15%	92.43	5.88	7.71	ACCEPTED	Not Significant
30%	112.93				
45%	132.72				

This can be supported by an experimental study entitled, Compost Impacts on Dissolved Organic Carbon and Available Nitrogen and Phosphorus in Turf Grass Soil, conducted by Wright et.al (2008) that the available P increased after compost

application and exhibited cyclical seasonal patterns related to dissolve organic carbon (DOC).

In Potassium, the hypothesis is accepted at alpha=0.05. It means that there is no significant difference on the application of different percentages of durian peelings to the quality of soil parameters especially the Potassium (K) content. It is expounded by the Compost for Soil of Viticulture (Retrieved: anlscape.com.au/LiteratureRetrieve. aspx?ID=66580, February 2011), that the application of compost will generally result in a significant contribution of Potassium in the short-term and in some cases this may be excessive. Not all of the K in the soil is available for uptake, which means that amount of K in the soil does not always correlate with the amount that is used by the plant, and this will depend on the soil type and its chemical properties.

In water holding capacity, the hypothesis is accepted at alpha=0.05. It means that there is no significant difference on the application of different percentages of durian peelings to the quality of soil parameters particularly in water holding capacity. Furthermore, the insignificance is due to the amount of organic matter in the soil in all replications that influenced the amount of water holding capacity.

Conclusion

Before the experimentation, the organic matter content is low and the Phosphorous content is optimum or medium while the Potassium is adequate enough for the soil and water holding capacity is less than the required percentage. After the experimentation with any intervention, the OM remained low, Phosphorous is moderate, Potassium is adequate, and the water holding remained less than the required capacity. Conversely, after a month of experimentation, there are increases in the soil quality parameters when durian peelings are applied in the soil at different percentages.

There is a significant difference in the mean of OM, P, K and water holding capacity between the control and experimental set-ups. On the other hand, there is no significant difference on the application of different percentages of durian peelings to the soil's OM, K and water holding capacity while there is a significant difference on the application of different percentages of durian peelings to the soil's P.

Recommendations

Based on the findings and conclusions of this study, the researcher suggests the following recommendations: (1) The use of at least 30 percent of durian peelings are recommended to be applied in the soil to obtain optimum result as soil enhancer. (2) Other chemical factors that determine the quality of soil such as pH, cation-exchange capacity and nutrient cycling should be included in future studies. (3) In the course of making durian peeling composts, optimal span of time must be increased to ensure complete decay. Also, the experimentation period and replications must be increased so that differences of high reliability can be established more. (4) It is recommended that other parts of durian such as the pulp and the seed be investigated if they could also be used as soil quality enhancers. (5) It is also recommended to conduct a study using durian peelings as soil enhancer with a radish planted in a pot. Since radish normally matures after 35 to 45 days. Observe the difference in plant size, leaf color and taste.

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