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THE EFFICACY OF ORGANIC FERTILIZER AND LEAF MOLD TOCONSERVE THE HEALTH AND GROWTH OF MANGO TREE (*MANGIFERA INDICA*)

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Abstract

In Malaysia, 98% of green waste ends up in landfills. Only 2% of its being composted or recycled. Lack of a clear strategy or guidelines for managing green waste is one of the reasons, as well as the fact that it is frequently composed separately because of its size and volume, which typically resulting to higher disposal cost. This research study was evaluated, the health and growth of the mango tree (Mangifera Indica) by using organic fertilizer (OF) and leaf mold (LM). A total of seven samples of soil were gathered respectively: Plot A1 (control), Plot B1 (OF+LM) manual, Plot B2 (OF+LM) manual, Plot C1 (LM), Plot C2 (LM), Plot D1 (OF+LM) automatic and Plot D2 (OF+LM) automatic to evaluate efficacy of compost organic fertilizer (OF) was determined using two different types of medium: OF and LM and to examine the mango trees' growth and overall health. Samples of organic fertilizer (OF) were gathered at intervals of two weeks over a duration of three months. Physico-chemical biological factors that were examined: pH level, phosphorus (P), total nitrogen (N), total potassium (K), and heavy metal concentration. The data obtained revealed that the growth measurements and NPK contents studied were obviously responsive to the purpose of this study. The best performance in this study was observed in D1 and D2, followed by B1 and B2, then C1 and C2. Conversely, the minimum values for the abovementioned parameters were typically observed in plot A1. The result indicates that a combination of OF and LM improves quality of soil and growth of plants, while NPK concentration content could be a promising alternative for different types of applications. Significant observation has shown that composting OF and LM could improve soil conservation, which indicates adequate results and comparable growth trees compared to chemical fertilizers.

Keywords: Mangifera Indica; Organic fertilizer; Leaf mold; Composting

Introduction

The mango, or Mangifera Indica, is considered the 'father' of fruits. It is a member of the Anacardiaceae family and is native to the Indian subcontinent. The majority of people in these countries rely on mangos as a staple food. Mangos are grown in hot tropical regions of the world. Because of its distinct flavor and aroma and high nutritional content, the fruit accounts for around

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half of all tropical fruits grown worldwide, which is a result of the application of various fertilizers [2]. Mango agriculture has historically relied heavily on chemical fertilizers, which typically degrades the fertility and physical qualities of the soil. This could advance to the build up of abundant metals in bulb tissues, which would reduce the fruit's edible quality and nutritional value. Nutrition is widely acknowledged as a critical factor that significantly influences the growth, health, and overall quality of a tree. But one of the biggest problems fruit tree growers and planters have is the high expense of chemical fertilizer. In relation to this, some researchers have recently developed novel techniques for creating organic fertilizers. Furthermore, recent studies have demonstrated the substantial contribution of chemical fertilizers to environmental pollution and health issues [3, 4].

Organic fertilizer (OF) can enhance the physico-chemical biological aspects of soil, making it suitable for application in almost any soil type, allowing for pH adjustments and increased plant solubility [5]. According to S.R. Badr *et. al.* [6] and K.K.A. Dawa & A.H. Bazeed [7], adding OF to the soil promoted the growth of soil microorganisms, raised the number of microbes, and activated microbial enzymes like urease, nitrogenase, and dehydrogenaze. Living organisms known as biofertilizers are those that enrich, retain, and release plant nutrients into the soil. They are crucial for boosting fruit quality, yield, and vegetative growth [8]. In this situation, biologically derived liquid fertilizers and it could serve as an alternative to create organic fertilizers for mango trees.

The efficacy of OF in promoting the growth of mango trees was investigated in this study using a mixture of water, salt, green grass, and leaf mold that has been composted from dry leaves. While improper fertilizer application can deteriorate the soil's physico-chemical biological properties, proper fertilizer application can enhance soil quality [9]. The mango tree was selected after taking several factors, including its abundance near the Universiti Tun Hussein Onn Malaysia (UTHM) campus. Mango trees can with stand alkaline conditions, so the ideal pH range for the soil is between 5.5 and 8.7 [10]. M. Onwuka *et. al.* [11] reported that prior research findings indicated that UTHM soil condition is primarily composed of acidic (pH 6) and silty clay conditions. Moreover, M. Reyes *et. al.* [12] asserts that the pH of the soil influences microbial activities linked to nutrient bioavailability, making it essential for the development of mango trees.

M. Khan and N. Ahmed [13] state that while fungi thrive in acidic environments, the majority of bacteria prefer neutral to alkaline conditions. A pH soil that is excessively alkaline or acidic may have an impact on the benefits that bacteria and fungi provide to fruit crops. For instance, too much acidity in the pH lowers the amount of nutrients available to trees. Conversely, if the pH level is excessively alkaline, the mango tree's quality and growth will suffer due to the lack of trace elements [14]. Thus, in order to enhance the plant's health and growth performance, an appropriate method should be used, proving the method's dependability.

As an alternative to chemical fertilizers, the beneficial effects of OF and LM on soil quality have demonstrated sufficient advantages and A. El-Rahman *et. al.* [15] have talked about some of the dispatch on bulb growth. Thus, the primary objectives of the present research were to evaluate the mango tree's growth, health, and overall well-being as well as the efficacy of organic fertilizer using OF and LM.

Experimental

Green Grass and Dried Leaves Collection

Several phases were devised to attain the best outcome possible with the primary components, which comprised of dehydrated and fresh green leaves for the well-being and growth of the mango tree. During this phase, once every two weeks, the UTHM campus was searched for raw materials, which included dried leaves and green grass. While the dried leaves were collected in the evening, the fresh green grass was picked up from the grass-cleaning crew in the morning. On the UTHM campus, green grass is utilized for the production of OF, while dry leaves are eventually decomposed for the production of LM.

Preparation of Leaf Mold

In order to produce LM, dried leaves were needed. The quantity of dried leaves collected was approximately 5 to 7kg for each sampling procedure. After 3 to 6 months, LM was accumulated under the decay of the dry leaves, and it was used as fertilizer. The collected dried leaves were placed into the selected compost pile situated at the Research Building, UTHM. The compost pile is selected with a wire fence (1×1m), as shown in figure 1. However, in order to achieve the optimum temperature for the decomposition process, the dry leaves were collected in a compost pile with an area of 4 x 4 x 3ft. The compost pile should be constructed in a shady area in order to reducing moisture loss. Furthermore, in order to keep the moisture content and maintain the oxygen level in the pile, the compost pile was watered and turned once a week to enable it to decompose evenly.

Fig. 1. A pictorial view of a processing compost pile for the formation of leaf mold

Preparation of Organic Fertilizer

In this study, LM and fresh green grass were used to produce OF. To improve soil acidification, preserve soil health and achieve organic ecological agriculture, OF should be used instead of chemical fertilizers [16]. However, when it comes to the LM, the leaves contain between 50 and 80 percent of all the nutrients that trees take up from the soil. Consequently, the application of LM made from properly composted dried leaves could enhance the return of nutrients to the soil [11]. Salt, fresh green grass, water and LM were required to produce the OF. P.K. Gupta [37] states that organic fertilizers are typically derived from natural raw materials and have something to do with biodegradable wastes that are breaking down. Paper, leaves, fruit peelings from leftover meals and even fruit juices are some of these wastes. Given that organic fertilizers have biological qualities that impact soil conservation, they are a good addition to high-quality soil.

In contrast, OF does not cause leaching and lowers soil acidity. They enhance the soil's structure, including air circulation, which supports beneficial microorganisms that aid in the release of nutrients into the soil, rather than eliminating the beneficial microorganisms already present in the soil. In this study, OF was prepared and composted for about six months, as shown in figure 2.

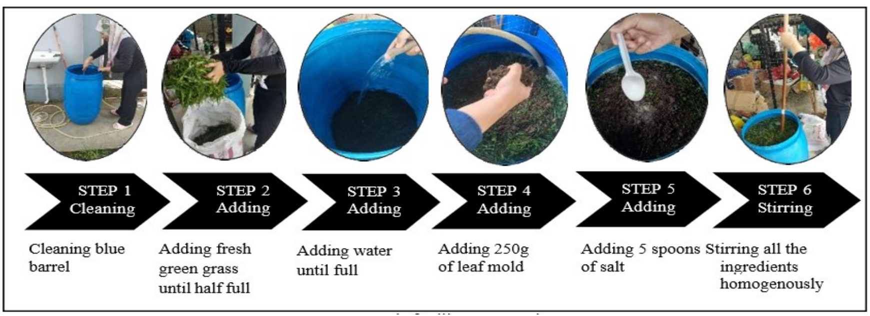

Fig. 2. Organic fertilizer preparation

If the time taken exceeds more than six months, the quality of the organic fertilizer will decrease. P. Nyoman *et. al.* [38], state that the quality of compost is considered good if it exhibits the following characteristics: a) It has a dark brown to black color, similar to that of soil, b) It dissolves in water, c) An appropriate carbon-nitrogen ratio (C/N), which varies according to the raw material used and the degree of wetness, d) It shows an effective effect when applied, e) Composted not exceeds 5 to 6 months. The process of composting is carried out in a 50–100 litre container. The container partially filled with fresh green grass and then partially topped over with water. Additionally, 5-spoons of salt and two handfuls of LM (approximately 250g) were needed to start the composting process. The organic fertilizer needs to be stirred regularly to ensure the mixture is mixed homogenously until it is ready to be used for the mango tree.

Organic Fertilizer Experimental Procedure

Two water containers, with volume ranging from 50-100 liters were utilized as storage containers for the liquid OF. The primary storage container contained a concentrated solution of OF, positioned 1.5ft above the secondary storage container, which contained water. A poly pipe installed between the two containers allowed the concentrated solution of OF from the primary container to flow into the secondary container. The concentrated solution of OF was dilute in secondary storage container with a ratio of 1:10 (concentrated OF: water) for fertilizing the plants, as utilized by a previous study by B.E. Liedl *et. al.* [17]. Dilution factors should be applied appropriately to obtain the correct amount of nutrients and macronutrients in the decomposing medium. R.E. McRoberts *et. al.* [18] suggested that the growth and quality of plants primarily depend on the function of fertilizer applied, the efficacy of solid fertilizer application on growth of plants was found to be less effective than liquid fertilizer, largely due to the presence of minerals that are soluble in water, which plants can easily absorb. Consequently, recently, the concept of reusing biodegradable waste as organic fertilizer to enhance growth in plants is gaining attention [15].

In this study, the dilution process of OF was executed manually and automatically for the application to mango trees, respectively. The automatic flow of diluted organic fertilizer remains for 24h only for every application by using the fertigation dripper that is placed at the end of the microtube which directs the fertilizer to the trees. Before the solution was poured to the Before the solution was poured to the designated mango trees, a disc fertigation water filter was employed to efficiently remove any residue or impurities.

Figures 3 and 4 show the schematic diagram of the designated setup for thefertigation of organic fertilizer, while figures 5a and b show the actual fertigation organic fertilizer system design on site.

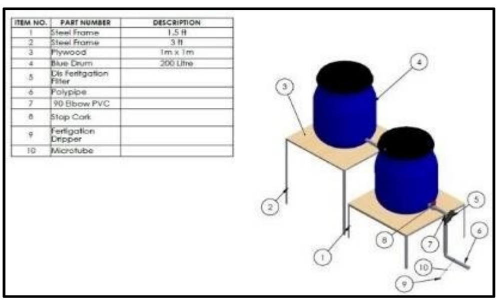

Fig. 3. Schematic diagram of organic fertilizer design for fertigation of organic fertilizer

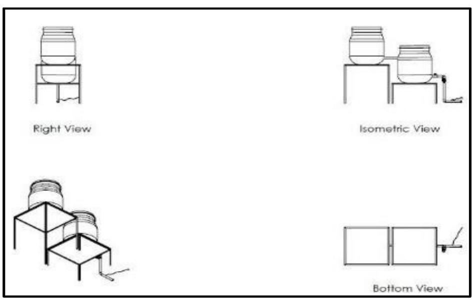

Fig. 4. Orthographic drawing of proposed organic fertilizer design for fertigation organic fertilizer

Fig. 5. Fertigation organic fertilizer system design (a) Right side (b) Left side

Tree Sample Identification

Six identified mango trees were selected and labeled accordingly to monitor their growth and health in this study. One tree acted as a control, whilst duplications for organic fertilizer andleaf mold applications were carried out as follows:

A1: Control, no fertilizers;
B1: 1L OF (Manual) + 250g LM;
B2: 1L OF (Manual) + 250g LM;
C1: 250g LM
C2: 250g LM
D1: 1L OF (Automatic) + 250gLM
D2: 1L OF (Automatic) + 250gLM
Considering that 250g of LM = 2-handfuls of adults.

Analysis of tree physical monitoring using growth parameters

In accordance with growth parameters, the plotted tree was watering with one litre of OF every two weeks. Furthermore, various parameters were systematically recorded and observed throughout the duration of the study. Observation and monitoring methods were employed to identify damage to specific trees in the ecosystem. A diameter tape was used to measure two parameters: the tree's height and the stem's diameter. The parameter monitoring procedure was carried out using both the USDA Forest Health Monitoring Program and the observational procedures.

Analysis of 0rganic fertilizer, leaf mold and soil sample

Every two weeks, samples of organic fertilizer and leaf mold were taken using a soil sampler probe at a depth of 30cm before and 15cm from the tree's stem. The soil samples were divided into six plastic bags containing various soil of sample types. The Analytical Laboratory performed an analysis on the sample. For organic fertilizer, leaf mold and soil samples, factors chemical analysis, such as pH level, total phosphorus (TP), total nitrogen (TN), potassium (P), and heavy metal concentration measurements, was carried out once every two weeks. As soon as the sample was brought into the laboratory, its pH of the substance was determined using a pH meter in accordance with F. Pregl *et. al.* [22] procedure. The DR6000 UV-VIS spectrophotometer, the HACH Method 10072 Persulfate Digestion Method and the modified Micro-Kjedahl method as outlined by R.N. Sah and R.O. Miller [23] were utilized for the chemical analysis of total nitrogen in the samples. The phosphorus content was measured by atomic absorption spectrometry and inductively coupled plasma atom emission spectra (ICP-AES) after being subjected to microwave digestion with nitric acid/hydrogen peroxide [24]. In the meantime, samples of heavy metals and potassium were extracted using nitric acid digestion in accordance with S. Karnchanawong *et. al*. [25] and the samples were examined using an inductively coupled plasma mass spectrometer (ICP-MS) and an atomic absorption spectrometer (AAS). To make sure the experiment's results weren't skewed, each sample was repeated three times.

Results and discussion

Physical Tree Growth Measurements in terms of Heights and Diameter

In response to the different fertilizer treatments of OF and LM, the tree's height (cm), stem diameter (cm), and severity level code were examined. Table 1 displays data collected between May and July of 2023. The results of the differential investigation treatments were evident in this case. The highest subjects to D1 and D2 were mentioned, followed by treatments B1, B2, C1 and C2, all demonstrating significant differences in the experiment concerns. Conversely, A1 is typically accompanied by the lowest values of the physical tree that was recorded.

Table 1. Analysis of physical growth of the tree

Physical monitoring	Month	A1	B1	B2	C1	C2	D1	D2
Height of tree (cm)	May	143.8	141.2	132.7	135.5	135.4	154.1	161.8
Diameter of stem (cm)		15.3	13.6	11.1	12.4	12.9	14.3	13.3
Height of tree (cm)	June	159.6	154.2	142.2	148.8	140.4	164.1	155.7
Diameter of stem (cm)		18.4	19.1	16.1	17.3	17.8	18.2	22.2
Height of tree (cm)	July	165.5	164.1	158.4	159.9	148.6	171.5	176.5
Diameter of stem (cm)		22.0	23.5	20.2	22.4	21.4	23.9	26.9
Code		1, 13, 24, 25	24, 25	24, 25	22, 24, 25	22, 24, 25	21	21
Photo of tree								

Characteristics of fertilizers

The pH, NPK, and heavy metal values for OF and LM are shown in Table 2. The initial pH values for OF and LM were found to be 3.91 and 4.64, respectively, indicating an acidic pH. The pH of the organic fertilizer itself and the creation of NH4+ by nitrogen ammoniation are the reasons why the pH is acidic [26]. Furthermore, according to earlier research, the decarboxylation of anions may be a significant factor because the released organic anions that are adsorbed onto the surfaces of aluminum hydroxide and iron, and some acidic substances are neutralized through the exchange and dissociation of OH ions [27].

Given that the study's total NPK content was within acceptable to optimal limits, namely 0.64 to 1.25%. The NPK of the OF and LM plots experienced a significant value. According to D.G. Masters and A.N. Thompson [28], finished compost typically has total nitrogen contents of 0.5% to 2.5%. This is affected by the excess phosphate in fertilizers, which helps to balance the P and N inputs and prevent overdosing on P. Furthermore, an excessive uptake of K can pose problems because of magnesium antagonists, which can lead to nutrient imbalances that are bad for quality and growth [29]. Thus, for optimal fertilization, the ratio of K to N and P is crucial.

The results for heavy metals revealed concentrations ranging from 0 to 0.6mg/L. The OF ranges were Cd (0.0mg/L), Cr (0.3mg/L), Cu (0.1mg/L), Pb (0.08mg/L), Ni (0.02mg/L), Zn (0.6mg/L), As (0.05mg/L) and Ba (0.05mg/L) respectively, and for LM were Cd (0mg/L), Cr (0.3mg/L), Cu (0.3mg/L), Pb (0.6mg/L), Ni (0.1mg/L), Zn (0.0mg/L), As (0.2mg/L) and Ba (0mg/L) respectively. The concentration values of the eight heavy metals in LM followed the order: Ba<Zn<Cd<Ni<As<Cu<Cr<Pb and for OF were Cd<Ni<Cr<As<Pb<Cu<Ba<Zn. This result indicated that OF samples, Zn had the highest concentration at 0.6mg/L, whereas Cd showed the lowest concentration, 0 mg/L. In LM fertilizer samples, Pb exhibited the highest concentration of 0.6mg/L, while Cd, Zn and Ba showed the lowest content at 0.0mg/L.

Nevertheless, in this study, Pb and Zn demonstrated high concentration in the organic fertilizer. Previous studies indicated that, major factors that affect the concentration of heavy metals are the selection of raw materials used in the compost and the fertilizer processes itself (Table 2). Therefore, it is crucial to establish adequate OF characteristics that able to decrease the transfer rate of heavy metals from fertilizer efficiently. Nevertheless, observation from the findings shown that all heavy metal content in the fertilizer sample is comply within permissible limits.

Table 2. Characteristics of fertilizers.

Parameters	May Type of fertilizers		June Type of fertilizers		July Type of fertilizers	
	(OF)	(LM)	(OF)	(LM)	(OF)	(LM)
pH value	6.10	4.30	5.20	4.38	4.64	3.91
TN (%)	3.87	2.10	1.84	0.67	0.64	0.84
TP (%)	4.30	3.30	2.50	2.80	0.66	0.73
K (%)	0.93	4.10	0.88	2.20	0.75	1.25
Heavy metals (mg/L)						
Cd	0.00	0.00	0.00	0.00	0.00	0.00
Cr	0.11	0.23	0.04	0.33	0.03	0.30
Cu	0.08	0.00	0.16	0.30	0.10	0.30
Pb	0.10	0.90	0.30	0.50	0.08	0.60
Ni	0.00	0.00	0.00	0.12	0.02	0.10
Zn	0.00	0.11	0.68	0.00	0.60	0.00
As	0.00	0.11	0.00	0.04	0.05	0.20
Ba	0.30	0.00	0.00	0.00	0.50	0.00

Analysis of soil samples

The analysis of soil samples A1, B1, B2, C1, C2, D1 and D2 from May to July is shown in table 3. The analysis of soil was examined for following parameters were included: heavy metals, pH, TN, TP, P. This result showed that, chemical analysis of D1 and D2 demonstrated best among all, followed by B1 and B2, and subsequently by C1 and C2. On the other hand, A1 was typically where the minimum values of the aforementioned factors were found. This chemical analysis shows that the health and growth of plants are positively affected by the application of OF and LM.

Table 3. Analysis of soil sample

Month	Parameters	Soil sample						
		A1	**B1**	**B2**	**C1**	**C2**	**D1**	**D2**
May	pH value	4.13	4.21	4.26	4.68	4.68	5.68	5.87
	TN (%)	0.31	0.49	0.50	0.44	0.44	0.69	0.57
	TP (%)	0.58	0.37	0.23	0.86	0.24	0.16	0.15
	K (%)	0.32	0.16	0.20	0.23	0.22	0.40	0.38
	Cd	0.20	0.00	0.00	0.00	0.02	0.00	0.00
	Cr	0.80	0.40	0.30	0.40	0.40	0.30	0.30
	Cu	0.60	0.30	0.30	0.20	0.90	0.20	0.20
	Pb	0.60	0.60	0.50	0.20	0.00	0.30	0.10
	Ni	0.20	0.60	0.10	0.04	0.10	0.10	0.07
	Zn	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	As	0.40	0.30	0.60	0.30	0.50	0.40	0.50
	Ba	0.40	0.30	0.50	0.20	0.00	0.30	0.25
June	pH value	4.34	3.94	5.54	4.79	5.47	6.47	6.33
	TN (%)	0.31	0.20	0.50	0.51	0.55	0.14	0.11
	TP (%)	0.38	0.47	0.47	0.70	0.39	0.74	0.50
	K (%)	0.24	0.25	0.14	0.30	0.17	0.12	0.11
	Cd	0.05	0.00	0.00	0.00	0.00	0.00	0.00
	Cr	0.90	0.40	0.30	0.40	0.40	0.50	0.41
	Cu	0.40	0.30	0.10	0.20	0.20	0.20	0.17
	Pb	1.00	0.50	0.90	0.50	0.70	0.70	0.40
	Ni	0.20	0.09	0.00	0.08	0.08	0.10	0.10
	Zn	0.00	0.80	0.70	0.00	0.00	0.00	0.00
	As	0.80	0.50	0.50	0.40	0.40	0.50	0.33
	Ba	0.00	0.40	0.70	0.40	0.60	0.50	0.70
July	pH value	4.69	3.89	5.10	5.39	5.41	6.80	7.09
	TN (%)	0.83	0.13	0.94	0.10	0.10	0.52	0.48
	TP (%)	0.38	0.57	0.49	0.60	0.60	0.66	0.57
	K (%)	0.18	0.18	0.17	0.17	0.17	0.17	0.12
	Cd	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Cr	0.30	0.40	0.30	0.70	0.30	0.20	0.40
	Cu	0.20	0.40	0.10	0.30	0.10	0.10	0.20
	Pb	0.50	0.60	0.50	0.90	0.40	0.30	0.32
	Ni	0.10	0.10	0.10	0.10	0.10	0.04	0.04
	Zn	0.70	0.90	0.40	0.90	0.50	0.30	0.20
	As	0.30	0.40	0.20	0.60	0.20	0.20	0.20
	Ba	0.00	0.00	0.50	0.80	0.40	0.30	0.35

pH value

When compared to each other, the pH values of D1 and D2 are more neutral. The OF's attitude toward the soil has an impact on this. Numerous investigations have demonstrated that adding fermentation residues could greatly raise the soil pH and increase its nutrient contents [31]. Concurrently, the A1, B1, B2, C1 and C2 recorded pH values ranging from 4 to 5.5, indicating an acidic environment. As per reference [32], the assessment of the microbial environment was contingent upon the pH value. This is further corroborated by [22], which states that pH fluctuates due to the activity of microbes, particularly in the acidic range during composting and that pH is also necessary for the most effective biological breakdown of organic waste [12]. In the course of three months of fertilization, pH values on D1 and D2 were found to range from 5.6 to 7.1. Early in the month, organic acid formation and carbon dioxide production as a result of the decomposition of organic materials may have an impact on the acidic conditions [15]. The pH value can have an impact on the rate of biodegradation. As per reference B.N.S. Murthy and K.P. Sarena [33], the ideal pH level for compost material is range of 6 and 8, as it promotes better biodegradation. It should not be excessively basic or acidic. Nevertheless, the pH values for D1 and D2 at the end of the composting process were between 6 and 7.1, indicating a suitable pH for a matured phase of the organic fertilizer.

Total Nitrogen

The study found that the total nitrogen concentration varied with the amount of composting time in each soil sample. Table 3 records that in the first month of the stage, D1 and D2 had high nitrogen contents of 0.7% and 0.5%, respectively. However, by the end of fertilization, D1 had a nitrogen content of 0.5% and D2 had a little lower value of 0.4%. When compared to other earlier studies, the total nitrogen concentration obtained for this kind of compost.

This could be because of the composting process's high temperature and ammonia volatilization [26]. The range of total nitrogen concentrations obtained from earlier studies was 1.0% to 2.45%. Although there was less total nitrogen measured in this investigation, the findings are comparable to those of [34], which ranged from 0.03% to 0.07%. In the early stages of fertilization, the nitrogen values in the other reactors indicate a middle value of approximately 0.5%. However, by the end of the study, the nitrogen values in each reactor vary, ranging from 0.5% to 0.9%. For each reactor, the overall nitrogen recorded varied from 0.5% to 1%.

Total Phosphorous

Table 3, D1 and D2 exhibit a decline from the beginning of the fertilization month to the second month and an increase until July. In contrast, from early May to the end of July, B1, B2, C1 and C2 showed an increase. According to earlier research, it's also possible that the rise in phosphorus is the result of humification-related drops in water solubility, which further immobilized the phosphorus during decomposition [26]. Phosphorus decreases from May to July, as shown in A1. Overall, the figure shows that the value of the total phosphorus concentration decreases with composting time for all reactors.

Potassium

Potassium is an important composition in composting as it could improve the taste, color, shape, and size of plant [35]. In addition, K could also assist in accelerating photosynthesis and protein synthesis process [36]. Findings in Table 3 shown that D1(0.4%) and D2 (0.38%) indicated the highest K concentrations. Nevertheless, the value seems to fluctuate in the 2^{nd} and 3^{rd} month during the composting process. Decreasing amount of K levels could be attributed to the decomposing materials used as stated by Hasan *et. al.* [8]. On the other hand, the increasing value could be influence by microbes' activity in the composting process. In addition, according to Bassal *et. al.* [9], the raw materials may also increase the K value due to the porosity and the absorption of the moisture content. At the end of the decomposition process, K value seems to decrease steadily with range from 0.1% to 0.32% for all the soil samples.

Heavy Metal

Heavy metals are typically present in composting process due to the composition of its raw ingredients. The study revealed that, the presence of heavy metals in each sample of soil samples which is less than 4% as presented in table 3. The demonstrated value is appropriate and essential for plant growth. In comparison with few different types of commercial organic fertilizer amendment, the levels of heavy metals in this study were low and comparable with other studies [37] thus, it could be an alternative option for organic fertilizer as well as safe and feasible for its applications.

Conclusions

In order to preserve the well-being and growth of the mango tree (Mangifera Indica) at Lake G3 Universiti Tun Hussein Onn Malaysia, this study looked at viable alternative methods for reducing the usage of chemical fertilizers, including organic fertilizers and leaf mold produced from the composting process. The study's findings showed that health and growth of mango trees can be enhanced by physically measuring the diameter and height of stems and applying leaf mold and organic fertilizers. The data obtained suggests that leaf mold and organic fertilizers may be effective in providing the trees with acceptable levels of potassium, phosphorus and nitrogen. Additionally, the value of heavy metals was found to be within desirable limits.

Consequently, in order to increase tree yield while preserving and enhancing soil health, organic fertilizer and leaf mold may be better options than using chemical fertilizers at the same rate.

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