PHILIPPINE SCIENCE HIGH SCHOOL WESTERN VISAYAS
Doña Lawaan H. Lopez Campus
Iloilo City

A COMPARATIVE STUDY OF THE EFFECT OF MOLASSES-SLUDGE FERTILIZERS AS JUXTAPOSED WITH COMMERCIAL FERTILIZERS ON THE GROWTH AND FRUITING OF TOMATOES (*Lycopersicon esculentum*)

A Research Paper Presented to the

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In Partial Fulfillment

of the Requirements

In Technology Research II

by

Joseph Benjamin B. de la Torre
Hannah Paula V. Doromal
Michael Patrick M. Padernal

February 2002

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APPROVAL SHEET

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De la Torre, Joseph Benjamin B.; Doromal, Hannah Paula V.; Padernal, Michael Patrick M.; "A Comparative Study of Sludge Obtained from Molasses as Juxtaposed with Commercial Fertilizers for the Growth and Fruuiting of Tomatoes (*Lycopersicon esculentum*)." Philippine Science High School Western Visayas, Iloilo City, February 2002.

Abstract

This study using Pretest-Posttest Control Group Design in a Randomized Complete Block Design, aimed to determine and compare the effects of sludge, obtained from molasses, and that of commercial fertilizers on the growth and fruiting of tomatoes (*Lycopersicon esculentum*). The effects of sludge, both treated and untreated, and the commercial fertilizers were compared in terms of height gain, number of branches, and weight of fruit of the test plant. It was hypothesized that there is no significant difference in the initial and final height and number of branches when enriched with treated sludge, untreated sludge, and commercial fertilizers. It was also hypothesized that there exists no significant difference in the height gain, number of branches, number of fruits, and total weight of fruit of the tomato plant when enriched with treated sludge, untreated sludge, and commercial fertilizers. Results were statistically treated. For the descriptive statistical analysis, mean and standard deviation were be used, while the Oneway Analysis of Variance (ANOVA) and Scheffe test, both set at 0.05 alpha level of significance, were used as inferential statistical tools. Results showed thatv the tomato plants grown in treated sludge, untreated sludge, and commercial fertilizers showed no significant difference in terms of height gain, number of branches, number of fruit, and total weight of fruit. Both treated and untreated sludge, therefore, can be a good substitute to commercial fertilizers. Although the control setup yielded the highest number of fruit and the greatest total fruit weight, the soil was characteristic only to the PSHSWV soil, and not conclusive to all soil types from other various sources.

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Chapter 1

Introduction to the Study

Background of the Study

Sludge is a waste product of molasses from sugar cane. At present they have no use, and often sugar manufacturing companies just throw them away. Many do not know that these wastes only add up to the pollution we have in land.

Since sludge is a biodegradable waste, it could be used as a fertilizer. An alternative to commercial fertilizers, which are actually expensive and harmful to the environment, is possible.

This study aimed to compare the effects of treated and untreated sludge and commercial fertilizers on the growth, number of branches, and weight of fruit of the tomato plants.

In this study, the treated and untreated sludge are the independent variables. They were tested in terms of the height gain, number of branches, and weight of fruit of the plants as compared to the commercial fertilizers. These properties are the dependent variables. The relationship between the variables is shown in Figure 1.

Statement of the Problem and Hypothesis

This study aimed to determine the effects of treated and untreated molasses-sludge and commercial fertilizers on the growth and fruiting of the tomato plant as compared with commercial fertilizers.

This study specifically:

1. determined the effect of (a) treated sludge, and (b) untreated sludge, on the (1) height gain, (2) number of branches, (3) number of fruits, and (4) total weight of fruit of the tomato plants.

2. compared the effects of (a) treated sludge, (b) untreated sludge, and (c) commercial fertilizers on the (1) height gain, (2) number of branches, (3) number of fruits, and (4) total weight of fruit of the tomato plants.

3. determined the significant difference in the initial and final (a) height and (b) number of branches when enriched with (1) treated sludge, (2) untreated sludge, and (3) commercial

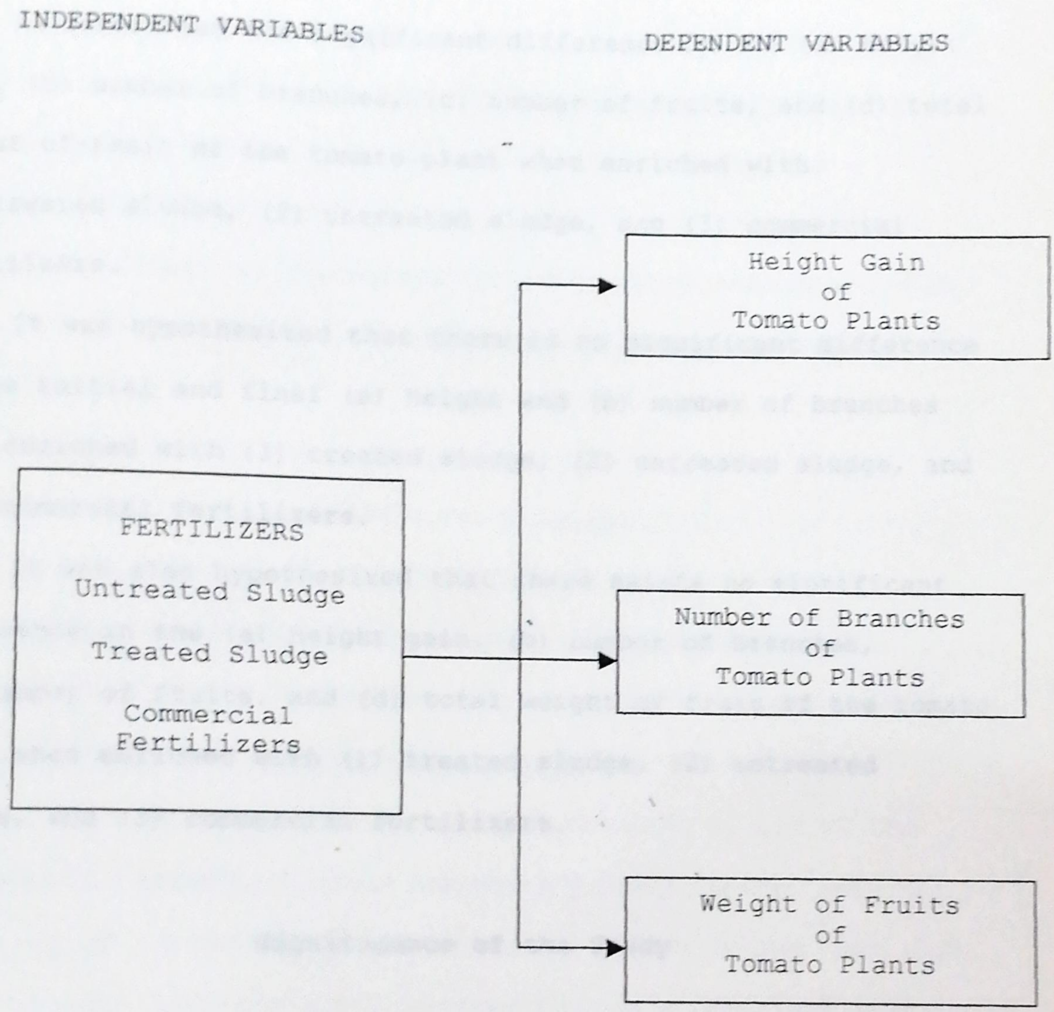

Figure 1. Effects of treated and untreated sludge on the height gain, number of branches, and weight of fruits of the tomato plants as compared with the effects of commercial fertilizers.

4. determined the significant difference in the (a) height gain, (b) number of branches, (c) number of fruits, and (d) total weight of fruit of the tomato plant when enriched with (1) treated sludge, (2) untreated sludge, and (3) commercial fertilizers.

It was hypothesized that there is no significant difference in the initial and final (a) height and (b) number of branches when enriched with (1) treated sludge, (2) untreated sludge, and (3) commercial fertilizers.

It was also hypothesized that there exists no significant difference in the (a) height gain, (b) number of branches, (c) number of fruits, and (d) total weight of fruit of the tomato plant when enriched with (1) treated sludge, (2) untreated sludge, and (3) commercial fertilizers.

Significance of the Study

The feasibility of the sludge as a fertilizer may provide a better alternative to the commercial fertilizers. Since commercial fertilizers are chemically-produced, they are oftentimes harmful to the environment and to humans.

The test of height gain, number of branches, and weight of fruit of the tomato plants are indications that fertilizer from sludge, be it treated or untreated, to some degree, are comparable to the commercial ones.

Since sludge is biodegradable and naturally-produced, the experimental fertilizer is even economically and environmentally friendly.

Definition of Terms

Sludge- is the solid matter that has settled out of suspension in sewage undergoing sedimentation in tanks or basins in sewage treatment (www.britannica.com).

In this study, the term "sludge" referred to one of the independent variables, i.e., the waste product of molasses

Tomato- is the pulpy edible berry, yellow or red when ripe, of a tropical American plant related to the potato, and used as a vegetable (Webster's Illustrated Contemporary Dictionary, 1992).

In this study, the term "tomato" referred to the test plants whose height gain, number of branches, and weights of fruits are measured.

Fertilizer- is a natural or artificial substance containing the chemical elements that improve growth and productiveness of plants (www.britannica.com).

In this study, the term "fertilizer" referred to one of the independent variables, i.e., commercial fertilizer where the effect is compared with the effects of treated and untreated sludge.

Growth- is the stage of development or maturity reached in growing (Webster's Illustrated Contemporary Dictionary, 1992).

In this study, the term "growth" referred to the height and number of branches gained by the tomato plants after the treatment.

Fruiting- is to bear or produce fruit (Webster's Third New International Dictionary).

In this study, the term "fruiting" referred to the number and weight of fruit of the tomato plants.

Effect- is a result or consequence of some cause or agency (Webster's illustrated Contemporary Dictionary, 1992).

In this study, the term "effect" referred to the result or significant change in the height gain, number of branches, and weight of fruit of the tomato plant.

Juxtapose- is a term that means to place close together or to put side by side (Webster's Illustrated Contemporary Dictionary, 1992).

In this study, the term "juxtapose" referred to the comparison between the effects of treated and untreated sludge compared to the effect of commercial fertilizers in the height gain, number of branches, and weight of fruit of the tomato plant.

Molasses- is a thick, dark-colored syrup drained from raw sugar during the refining process (Webster's Illustrated Contemporary Dictionary, 1992).

In this study, the term "molasses" referred to the product from which sludge was acquired.

Scope and Delimitation of the Study

The study covered the span of approximately 60 days, or two months. This included 30 days of growing and cultivating the seedlings, while the last remaining period was dedicated to the application of the different treatments. The growth referred in the research is the height and number of branches gained by the tomato plants after the treatment. The height of the plants was measured by a measuring tape which was limited to only a hundredth of a meter. Fruit weight was measured by an Analytical Balance which could measure up to a hundredth grams.

Atmospheric conditions were out of the researchers' control. The edibility of the fruits that the plants yielded was not included in the scope of the study.

Chapter 2

Review of Related Literature

This chapter comprises of three parts, namely Sludge, Tomato, and Fertilizer. Each part explicitly describes the variables and the test organism used in the study.

Sludge

Sludge is the solid matter that has settled out of suspension in sewage undergoing sedimentation in tanks or basins in sewage treatment.

The activated sludge treatment system consists of an aeration tank followed by a secondary clarifier. Settled sewage, mixed with fresh sludge that is re-circulated from the secondary clarifier, is introduced into the aeration tank. Compressed air is then injected into the mixture through porous diffusers located at the bottom of the tank. As it bubbles to the surface, the diffused air provides oxygen and a rapid mixing action. Air can also be added by the churning action of mechanical propeller-like mixers located at the tank surface.

Under such oxygenated conditions, microorganisms thrive, forming an active, healthy suspension of biological solids (mostly bacteria) called activated sludge. About six hours of detention is provided in the aeration tank. This gives the microbes enough time to absorb dissolved organics from the sewage, reducing BOD. The mixture then flows from the aeration tank into the secondary clarifier, where activated sludge settles out by gravity. Clear water is skimmed from the surface of the clarifier, disinfected, and discharged as secondary effluent. The sludge is pumped out from a hopper at the bottom of the tank. About 30 percent of the sludge is re-circulated back into the aeration tank, where it is mixed with the primary effluent. This re-circulation is a key feature of the activated sludge process. The recycled microbes are well acclimated to the sewage environment and readily metabolize the organic materials in the primary effluent. The remaining 70 percent of the secondary sludge must be treated and disposed of in an acceptable manner.

Tomatoes

French called it "The Apple of Love," the Germans "The Apple of Paradise;" but the British, while admiring its brilliant red color disclaimed the tomato as a food--they believed it was poisonous. This same fear persisted among colonists in the United States until the early 19th century; but in 1812, the Creoles in New Orleans put their cooking on the map with their tomato-enhanced gumbos and jambalayas. The people of Maine quickly followed suit, combining fresh tomatoes with local seafood.

By 1850, the tomato was an important produce item in every American city. People were planting tomatoes in their home gardens, while farmers commercially produced fresh tomatoes throughout the year. When cold weather halted local production, consumers relied on areas with temperate climates to furnish their supply of tomatoes.

Tomatoes are good sources of Vitamin A and are high in Vitamin C.

Recent studies have determined that tomatoes are one of a few food sources of the antioxidant lycopene, which is related to beta-carotene. A study conducted in Italy showed that consuming seven or more servings of tomatoes a week reduced the risk of developing colon, rectal and stomach cancer by sixty percent. Tomatoes also contain the anti-oxidänts p-courmaric and chlorogenic acids.

Fertilizers

A material that contains elements essential to plant growth and that is added to soils to correct plant nutrient deficiencies. The three "primary" nutrient elements, those needed by the plants in greatest mounts, are nitrogen, phosphorus, and potassium. Three that are classified as "secondary" nutrients are sulfur, calcium, and magnesium. A third group of elements, called micronutrients because plants require only very small quantities, consists of boron, copper, iron, manganese, molybdenum, zinc, and chlorine. The other essential elements, oxygen, carbon, and hydrogen, are supplied by air and water.

Animal and plant wastes such as farm manure, dried blood, cottonseed meal, and sewage sludges, are sources of plant nutrients. In some underdeveloped areas, they are the principal fertilizer materials used. However, commercial fertilizers, chemically produced or refined, are being used in increasing quantities in all countries to supplement manure and plant residues and to improve crop yield and quality.

Fertilizers are available in several forms. There are solid materials, such as urea, concentrated superphosphate, and muriate of potash. Anhydrous ammonia, the major source of nitrogen in the United States, is liquefied gas. A variety of basic materials also are available in fluid form. These fluids may be solutions, where the materials are completely dissolved, or suspensions, which are mixtures of completely dissolved materials and some solids.

With increasing efforts to increase the world's food supplies, fertilizers have become an international commodity. One ton of nutrients supplied in fertilizers commonly produce ten tons of grain. Thus it is a very important crop production input. Fertilizers are identified by the amount of nitrogen, phosphorus, and potassium they contain. Weight percentages are calculated as nitrogen (N); as phosphorus pentoxide (P_2O_5), called phosphoric acid or phosphate; and as potassium oxide (K_2O), called potash. A fertilizer labeled 6-24-12 (the grade or analysis) contains 6 percent of Nitrogen, 24 percent P_2O_5 as available phosphates, and 12 percent K_2O as soluble potash. In industry, prices are often quoted on the basis of units of N, P_2O_5, or K_2O, one unit being one percent by weight or 20 pounds (9 kilograms) per short ton.

An official test of the Association of Official Analytical Chemists prescribes nutrient contents in the United States. For example, available phosphate is considered that which is soluble in neutral ammonium citrate and water. The insoluble portion is considered unavailable and therefore is not included in the fertilizer guarantee.

In the United States, all fertilizers are required by state law to have the analysis printed on the bag or on the invoice showing the guaranteed percentage of N, P_2O_5, or K_2O. Additional items also may be included on the label, including instructions on application and sources of nutrients.

Summary

Fertilizers have long been used by farmers in the cultivation of crops. There's a myriad of brands that we can choose from in the market today, however with one common use - to improve the growth and productiveness of the plant being grown.

Fertilizers are undeniably helpful for crops. Moreover, farmers need not think of other ways on how to increase productivity of their crops. However, one thing they have to consider is the cost of the fertilizers to be purchased. With the country's present economic condition, this is a prime consideration in the part of the farmers. This is the very reason why we chose this study.

Sludge is a by-product of molasses, normally found in sugar production plants such as the Distelleria Bago, Inc. located in Bago City in Negros Occidental. Since sludge, after the manufacturing process, contain chemical components that can be considered as essential in the growth of plants. In our study, the target plant organisms are crops. These components found in sludge can have considerable effects in the crops similar to that of the commercial fertilizers. Thus, we consider sludge as a fertilizer, and a cheaper one to acquire, too, once proven its production-increase effects in plants, specifically crops.

Chapter 3

Research Design and Methodology

This study aimed to determine and compare the effects of treated sludge, untreated sludge, and commercial fertilizers on the height gain, number of branches, and weight of fruit of the tomato plants. Specifically, it aimed to determine the significant difference in the height gain, number of branches, and weight of fruit of the tomato plants when enriched with treated sludge, untreated sludge, and commercial fertilizers.

It was hypothesized that there exists no significant difference in the height gain, number of branches, and weight of fruit of the tomato plants after enrichment of treated and untreated sludge, and commercial fertilizers.

Research Design

This Pretest-Posttest Control Group design study, in a Randomized Complete Block Design, was employed in achieving the aims of the study. The height gain, number of branches, and weight of fruit of the tomato plants served as the dependent variables in this study. The treated and untreated molasses-sludge and commercial fertilizers were used as the independent variables in this study.

Before the period of two months, the fully-grown seedlings were grouped into five lots with three pots each, labeled and assigned their corresponding treatments. The first lot received 10% treated sludge with 90% garden soil as their treatment, correspondingly. The second lot received 10% untreated sludge and 90% garden soil; the third group, 10% 14-14-14 fertilizer and 90% garden soil; while the fourth group received 10% 16-20 fertilizer with 90% garden soil, correspondingly. The fifth group of plants served as the control group, and received the same amount of water, sunlight, and air as the other groups.

The mean and standard deviation were used as the descriptive statistical tools in this study. To test the study's hypothesis, the One-Way Analysis of Variance, set to 0.05 alpha level of significance, was used as the inferential statistical tool, while the Scheffe Test was used as the post hoc comparison test.

Materials and Equipment

Testing System

The test subjects, the tomato plants *(Lycopersicon esculentum)*, were placed in pots to guarantee the isolation of the system to other factors that would affect the validity of the results (e.g. pests and components of the soil). Fifteen pots measuring at least 6 inches in height and 5 inches in diameter were used as containers for the subjects.

We used common garden soil found in the experimental site. The treated and untreated sludge were obtained from Distelleria Bago, Inc. in Bago City, Negros Occidental.

Equipment for Obtaining Test Results

Simple tools were used in this study. A measuring tape, with limitations of up to a hundredth meter, measured plant height. This included the measurement of the plant from its base above the soil to the heighest pont reached by its main branch.

Fruit weight was measured by an analytical balance, while simple counting skills measured fruit yield and number of branches.

Experimental Site

The study was conducted at the premises of Philippine Science High School, Western Visayas Campus.

Methodology

Pre-Testing and Preparation of Test Subjects

Plastic cups were prepared for the cultivation of the seedlings. Ordinary garden soil without any fertilizers present was used. The seeds were planted in the same plot, burrowed five millimeters (mm) below the surface of the bed. They were watered every 1-2 days by the researchers. After one month, or until the seedlings had reached a height of ten centimeters, the seedlings were ready for transfer to their respective pots and their initial height and initial number of branches measured.

Treatment

The seedlings were randomly assigned their respective plant pots and grouped into five lots with three seedlings each. Each pot was marked for classification and randomly assigned their corresponding treatments. The first lot received treated sludge as treatment. It received 10% treated sludge with 90% garden soil as treatment. The second lot received untreated sludge as treatment. It received 10% untreatëd sludge and 90% garden soil. The third lot received 14-14-14 fertilizer as treatment. It received 10% 14-14-14 fertilizer and 90% garden soil. The fourth group received 16-20 fertilizer as treatment. It received 10% 16-20 fertilizer with 90% garden soil. The fifth lot, on the other hand, served as the control group. This served as the basis for further results in the study. Each lot were exposed to the same amounts of temperature and sunlight and were given the same amount of water for two months.`

Post-Testing

The final height and height gain were taken using a tape measure and then compared, the final number of branches were counted and compared, the weight of fruit were measured using an analytical balance and the compared, and the number of fruit were taken and compared.

Analysis

After the tomato plants' fruit started to ripen, the lot with the healthiest plants, based on their plant height, number of branches, and fruit weight was regarded as the lot with the best treatment.

Statistical Data Analysis

The mean and standard deviation were used as the descriptive statistical tools in this study. In getting the mean, the average values of the height of each plant, the number of branches, and the weight of fruit were totaled and divided by the number of replicates. This study dealt with three replicates grouped according to their specified tretments.

To test the study's hypothesis, the One-Way Analysis of Variance, set to 0.05 alpha level of significance, was used as the inferential statistical tool, while the Scheffe Test was used as the post hoc comparison test.

Chapter 4

Results and Discussions

This study aimed to determine and compare the effects of treated sludge, untreated sludge, and commercial fertilizers on the height gain, number of branches, number of fruits, and weight of the tomato plants. Specifically, it aimed to determine the significant difference in the height gain, number of branches, number of fruits, and weight of fruit of the tomato plants when enriched with treated sludge, untreated sludge, and commercial fertilizers.

It was hypothesized that there exists no significant difference in the height gain, number of branches, number of fruits, and weight of fruit of the plants after enrichment of treated and untreated sludge, and commercial fertilizers.

Findings

Height Gain of Tomato Plants Grown in Treated Sludge, Untreated Sludge, Commercial Fertilizers and Control Plots

After two months of treatment, tomato plants grown in control plots achieved the greatest mean height gain of 66.833 cm, followed by the plants grown in 14-14-14 fertilizer plots with a mean height gain of 62.167 cm. The mean height gain of plants grown in plots with untreated sludge was 51.167 cm, while those plants grown in plots with treated sludge was 41.167 cm. Those grown in plots with 16-20 fertilizer achieved the lowest mean height gain of 40.000 cm.

Table 1 shows the data.

In terms of mean height gain, the control setup proved to be the most effective. This proved that the soil source, which is PSHSWV ground, is very fertile, and does not need sludge or fertilized treatments. The 14-14-14 fertilizer proved to be effective in increasing the plant height as well as the treated and untreated sludge.

The 16-20 fertilizer yielded the lowest mean height gain, presumably, because it lacks potassium.

Initial and Final Number of Branches of Tomato Plants Grown in Treated Sludge, Untreated Sludge, Commercial Fertilizers and Control Plots

Table 2 shows that the tomato plants grown in plots with treated sludge achieved the greatest mean number of branches (24.333) after two months. The plants in the control and 14-14-14 fertilizer plots also showed a marked increase in the mean number of branches, 20.667 and 20.000, respectively. Those grown in the untreated sludge plot achieved a mean number of 19.000 branches, while those in the 16-20 fertilizer plot achieved the lowest mean number of 15.667 branches.

Table 1. Means of Initial and Final Height of Tomato Plants Grown in different Treatment Setups

Treatment	N	Mean Initial Height	Standard Deviation	Mean Final Height	Standard Deviation	Height Gain
Treated Sludge	3	25.833 cm	1.443	75.000 cm	11.269	41.167 cm
Untreated Sludge	3	29.333 cm	0.289	81.000 cm	8.888	51.167 cm
14-14-14 Fertilizer	3	27.500 cm	4.272	89.667 cm	5.859	62.167 cm
16-20 Fertilizer	3	23.000 cm	1.732	63.000 cm	7.810	40.000 cm
Control	3	30.167 cm	2.466	97.000 cm	33.181	66.833 cm

Table 2. Initial and Final Number of Branches of Tomato Plants Grown in Different Treatment Setups

Treatment	N	Initial No. Of Branches	Standard Deviation	Final No. Of Branches	Standard Deviation
Treated Sludge	3	5.333	1.155	24.333	3.512
Untreated Sludge	3	5.333	0.577	19.000	3.464
14-14-14 Fertilizer	3	6.000	1.000	20.000	3.606
16-20 Fertilizer	3	4.000	1.000	15.667	1.528
Control	3	5.667	1.155	20.667	10.116

Number and Weights of Fruits of Tomato Plants Grown in Treated Sludge, Untreated Sludge, Commercial Fertilizers and Control Plots

After two months, the tomato plants grown in the control plot yielded the greatest number of 29 fruits, followed by those in the 16-20 fertilizer with 20 fruits, while those in the treated sludge and 14-14-14 fertilizer plots yielded a total of 19 fruits. Those grown in the untreated sludge yielded the least number of fruits, which is 10.

Table 3 shows the data.

Although the plants in the 16-20 fertilizer plot yielded only 20 fruits, their total weight was 436.04 g, which is greater than those 29 fruits in the control plants (400.99 g).

In terms of total fruit weight, the 16-20 fertilizer was most effective, while the untreated sludge was the least.

Table 3 shows the data.

Table 3. Total No. of Fruits and Weight of Fruits of the Tomatoes Grown in the Different Treatment Setup

Treatment	N	Mean No. of Fruit Yield	Mean Weight of Fruit Yield
Treated Sludge	3	19.00	352.79 g
Untreated Sludge	3	10.00	218.01 g
14-14-14 Fertilizer	3	19.00	360.13 g
16-20 Fertilizer	3	20.00	436.04 g
Control	3	29.00	400.99 g

Significant Difference in the Initial and Final Height and Height Gain of Tomato Plants grown in Plots with Treated Sludge, Untreated Sludge, Commercial Fertilizers and Control Setup

The t-test showed that there is significant difference in the initial and final height of the tomato plants treated with treated sludge, untreated sludge, and commercial fertilizers.

There is no significant difference in the initial and final height of the tomato plants in the control setup.

Table 4 shows the data.

However, the Oneway ANOVA showed that there is no significant difference in the height gain of tomato plants treated with treated sludge, untreated sludge, and commercial fertilizers and the control setup.

Table 5 shows the data.

Table 4. t-test for Significant Differences in the Initial and Final Height, Initial and Final No. of Branches of Tomato Plants Grown in the different Treatment Setups

Categories	N	Mean	Standard Deviation	t-value	dif	Significance
Treated Sludge						
Initial Height	3	25.833	1.443			
Final Height	3	75.000	11.269	-6.699	2	0.019
Initial No. of Branches	3	5.333	1.155			
Final No. of Branches	3	24.333	3.512	-7.181	2	0.022
Untreated Sludge						
Initial Height	3	29.333	0.289			
Final Height	3	81.000	8.888	-9.759	2	0.015
Initial No. of Branches	3	5.333	0.577			
Final No. of Branches	3	19.000	3.464	-8.200	2	0.010
14-14-14 Commercial Fertilizer						
Initial Height	3	27.500	4.272			
Final Height	3	89.667	5.859	-17.224	2	0.003
Initial No. of Branches	3	6.000	1.000			
Final No. of Branches	3	20.000	3.606	-5.292	2	0.034
16-20 Commercial Fertilizer						
Initial Height	3	23.000	1.732			
Final Height	3	63.000	7.810	-7.947	2	0.015
Initial No. of Branches	3	4.000	1.000			
Final No. of Branches	3	15.667	1.528	-8.030	2	0.015
Control Setup						
Initial Height	3	30.167	2.466			
Final Height	3	97.000	33.181	-3.302	2	0.081
Initial No. of Branches	3	5.667	1.155			
Final No. of Branches	3	20.667	10.116	-2.305	2	0.148

Table 5. One-way Analysis of Variance of Significant Differences in the Height Gain, Resulting Number of Branches, and Resulting Number of Fruits of Tomato Plants Grown in Different Treatments

Categories	Sum of Squares	Df	Mean Square	F	Significance
Height Gain					
Between Groups	776.000	2	338.000	0.891	0.458
Within Groups	2614.000	6	435.667		
Total	3390.000	8			
Number of Branches					
Between Groups	44.667	2	22.333	0.529	0.614
Within Groups	253.333	6	42.222		
Total	298.000	8			
Number of Fruits					
Between Groups	60.222	2	30.111	0.912	0.451
Within Groups	198.000	6	33.000		
Total	258.222	8			

Significant Difference in the Initial and Final Number of Branches of Tomatoes Grown in Plots with Treated Sludge, Untreated Sludge, Commercial Fertilizers and Control Setup

The t-test showed that there is significant difference in the initial and final number of branches of the tomato plants treated with treated sludge, untreated sludge, and commercial fertilizers. There is no significant difference in the init31 and final number of branches of the tomato plants in the control setup.

Table 4 shows the data.

The Oneway ANOVA showed that there is no significant difference in the height gain of tomato plants treated with treated sludge, untreated sludge, and commercial fertilizers and the control setup.

Table 5 shows the data.

Significant Difference in the Height Gain, Number of Branches, and Number of Fruits of Tomatoes Grown in Plots with Treated Sludge, Untreated Sludge, Commercial Fertilizers, and Control Setup

For the height gain, number of branches, and the number of fruits, the Oneway ANOVA showed that there is no significant difference for the tomato plants treated with treated sludge, untreated sludge, and commercial fertilizers and the control setup.

Table 5 shows the data.

Chapter 5

Summary, Conclusions, and Recommendations

This study aimed to determine the effects of treated and untreated molasses-sludge and commercial fertilizers on the growth and fruiting of the tomato plant as compared with commercial fertilizers.

This study specifically:

1. determined the effect of (a) treated sludge, and b) untreated sludge, on the (1) height gain, (2) number of branches, (3) number of fruits, and (4) weight of fruit of the tomato plants.

2. compared the effects of (a) treated sludge, (b) untreated sludge, and (c) commercial fertilizers on the (1) height gain, (2) number of branches, (3) number of fruits, and (4) weight of fruit of the tomato plants.

3. determined the significant difference in the initial and final (a) height and (b) number of branches when enriched with (1) treated sludge, (2) untreated sludge, and (3) commercial fertilizers.

4. determined the significant difference in the (1) height gain, (2) number of branches, (3) number of fruits, and (4) weight of fruit of the tomato plants when enriched with (a) treated sludge, (b) untreated sludge, and (c) commercial fertilizers.

It was hypothesized that there is no significant difference in the initial and final (a) height and (b) number of branches when enriched with (1) treated sludge, (2) untreated sludge, and (3) commercial fertilizers.

It was also hypothesized that there exists no significant difference in the (a) height gain, (b) number of branches, (c) number of fruits, and (d) total weight of fruit of the tomato plant when enriched with (1) treated sludge, (2) untreated sludge, and (3) commercial fertilizers.

Summary

The results of the study are summarized as follow:

1.1. The mean height gain of tomato plants grown in treated sludge, untreated sludge, 14-14-14 fertilizer, 16-20 fertilizer, and control setup were 41.167 cm, 51.167 cm, 62.167 cm, 40.000 cm, and 66.833 cm, respectively.

1.2. The number of branches of tomato plants grown in treated sludge, untreated sludge, 14-14-14 fertilizer, 16-20 fertilizer, and control setup were 24.333, 19.000, 20.000, 15.667, and 20.667, respectively.

1.3. The number of fruits of tomato plants grown in treated sludge, untreated sludge, 14-14-14 fertilizer, 16-20 fertilizer, and control setup were 19.00, 10.00, 19.00, 20.00, and 29.00, respectively.

1.4. The total weight of tomato plants grown in treated sludge, untreated sludge, 14-14-14 fertilizer, 16-20 fertilizer, and control setup were 352.79 g, 218.01 g, 360.13 g, 436.04 g, and 400.99 g, respectively.

2.1. The initial height of the tomato plants grown in treated sludge, untreated sludge, 14-14-14 fertilizer, and 16-20 fertilizer are 25.833 cm, 29.333 cm, 27.500 cm, and 23.000 cm, respectively. The final height of the tomato plants grown in treated sludge, untreated sludge, 14-14-14 fertilizer, and 16-20 fertilizer are 75.000 cm, 81.000 cm, 89.667 cm, and 63.000 cm, respectively.

2.2. The initial number of branches of the tomato plants grown in treated sludge, untreated sludge, 14-14-14 fertilizer, and 16-20 fertilizer are 5.333, 5.333, 6.000, and 4.000, respectively. The final number of branches of the tomato plants grown in treated sludge, untreated sludge, 14-14-14 fertilizer, and 16-20 fertilizer are 24.333, 19.000, 20.000, and 15.667, respectively.

3.1. In terms of height gain, the total plants grown in the control setup achieved the greatest height gain of 66.833 cm, followed by 14-14-14 fertilizer (62.167 cm), untreated sludge (51.167 cm), and treated sludge (41.167 cm). Those grown in 16-20 fertilizer achieved the lowest height gain (40.000 cm).

3.2. In terms of number of branches, the treated sludge achieved the highest number of branches of 24.333, followed by the control setup (20.667), 14-14-14 fertilizer (20.000), and untreated sludge (19.0000. Those grown in the 16-20 fertilizer attained the least number of branches (15.667).

3.3. In terms of number of fruits, the control setup yielded the greatest number of fruits with 29.00, followed by 16-20 fertilizer (20.00), and, treated sludge and 14-14-14 fertilizer (both 19.00). Those grown in the untreated sludge yielded the least number of fruits (10.00).

3.4. In terms of weight of fruit, the 16-20 fertilizer achieved the greatest weight of 436.04 g, followed by the control setup (400.99 g), 14-14-14 fertilizer (360.13 g), and treated sludge (352.79 g). The untreated sludge attained the least weight (218.01 g).

4.1. In terms of height gain, there is no significant difference between the groups when enriched with treated sludge, untreated sludge, and commercial fertilizers.

4.2. In terms of number of branches, there is no significant difference between the groups when enriched with treated sludge, untreated sludge, and commercial fertilizers.

4.3. In terms of number of fruits, there is no significant difference between the groups when enriched with treated sludge, untreated sludge, and commercial fertilizers.

4.4. In terms of weight of fruit, there is no significant difference between the groups when enriched with treated sludge, untreated sludge, and commercial fertilizers.

Conclusions

Based on the above data and analysis, the tomato plants grown in treated sludge, untreated sludge, and commercial fertilizers showed no significant difference in terms of height gain, number of branches, number of fruit, and total weight of fruit. Both treated and untreated sludge, therefore, can be a good substitute to commercial fertilizers.

Although the control setup yielded the highest number of fruit and the greatest total fruit weight, the soil was characteristic only to the PSHSWV soil, and not conclusive to all soil types from other various sources.

Recommendations

Since no significant differences existed in the height gain, number of branches and total number and weight of fruit for the treatment and control set-ups, both the treated and untreated sludge can be added to the soil for enrichment in lieu of commercial fertilizers. Treated or untreated sludge are much cheaper than commercial fertilizers, and they yield the same product potentials in the tomato plants in terms of height gain, number of branches, and number of yielded fruits.

References

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