A Comparative Study of Makeshift Rice Husks Fertilizer and Eggshells Fertilizer to Urea Fertilizer and No Fertilizer on Home-Based Sweet Potato (*Ipomoea batatas*) Gardening

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Abstract

This study aims to provide a basis for households that relates the effectiveness of sustainable fertilizers to the vegetation growth of sweet potatoes. The proponents analyzed the vegetative growth results of sweet potato using 100g, 200g, and 300g of eggshells and 158g, 316g, and 474g of rice husks, comparing it to commercially available urea fertilizer with 11.34g and no fertilizer. The factors used to measure sweet potatoes' vegetative growth were Vine Length, Leaf Length and Width, and their overall acceptability through taste test surveys. Using the Kruskal-Wallis Test and ANOVA Single Factor, results showed that the highest amount of Eggshell and Rice Husk fertilizer, 300 g, and 474 g, respectively, produced the highest mean value of leaf and width, as well as vine length. However, among the four fertilizers, there is no statistically significant difference in the overall vegetative growth of the sweet potato. Also, in the sensory evaluation, results suggest no statistically significant difference in using any fertilizers on the color, taste, aroma, mouthfeel, and overall acceptability of the Sweet Potato Tops. However, the Kruskal-Wallis tests indicate urea fertilizer has the highest rating regarding mouthfeel and overall acceptability. Finally, the Eggshell, Rice Husk, and no fertilizer received the highest mean rating in color, taste, and aroma. With this, the proponents recommend studying the right and proper usage of Urea Fertilizer to ensure its safety and effectiveness as it had the most favorable results.

Keywords:
Eggshells, Rice Husks, Urea, Home Gardening

1.0 Introduction

The Philippines has abundant agricultural land. Food availability is affected by both controllable and uncontrollable external interruptions. In 2020, the FAO reported the three-year average number of moderately and severely food insecure Filipinos. In 2017-2019, 55.3% of the Filipino population, or 59 million people, were moderately or severely food insecure. The country suffers from longtime neglect of the agriculture sector and unprecedented hunger and economic hardships due to COVID-19. Natural disasters contribute to Filipino food insecurity. Due to its location, the country is prone to strong typhoons and droughts. The typhoon Goni in 2020 devastated Catanduanes' fisheries, rice, and vegetable plantations threatening the farmers' food security, nutrition, and livelihoods (Food and Agriculture Organization, 2020). Extended displacement due to catastrophic occurrences has become more common, affecting the poor and vulnerable who lack options or means to keep them out of congested evacuation centers without enough food and sanitation, threatening their nutritional well-being.

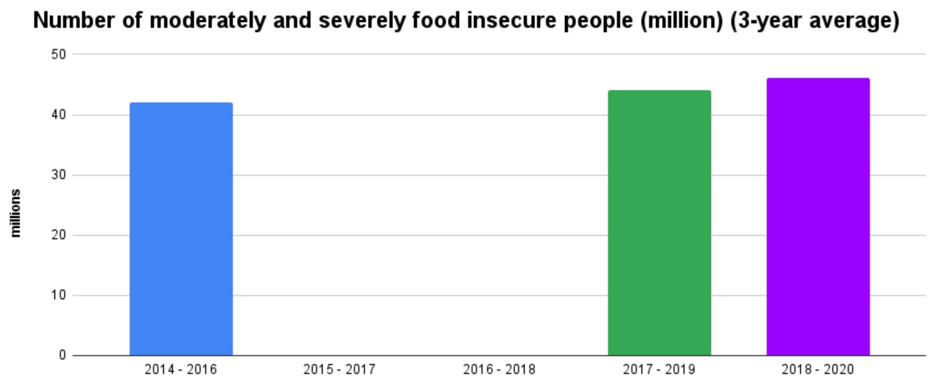

Figure 1. Philippines Average Number of Moderately and Severely Food Insecure People. (Source: UN-FAO, 2020)

Research by the Philippine Center for Postharvest Development and Mechanization (2018) highlighted agricultural waste and byproducts. Crop wastes can be used to combat food security and environmental issues. Composting or integrating agricultural wastes can improve nutrient recycling and soil fertility. Rice husks are a good source of silica or silicic acid for plants (Thiyageshwari et al., 2018). Greger et al. (2018) report that silica acid boosts plant tolerance to drought, harmful metals, UV-B radiation, salt stress, pests, and infections. Caparino (2018) found that rice husk makes up 22% of the country's 17 million tons of rice. Singh (2018) found that burning rice husks as garbage contributes to air pollution. Eggshells include calcium and potassium (Gaonkar & Chakraborty, 2016). Additionally, the Philippines agro-industries produce 4.24 million tons of eggshell waste. This domestic scrap contributes 4,020 metric tons of daily garbage (Ongo et al., 2016, pp. 51-60).

The Philippines' pandemic and quarantine impeded food distribution, customers, business operations/close, under/unemployment, and revenue. Food-producing provinces wasted aside masses of produce during the 2020 lockdown. Stringent and ineffective checks hinder farmers' food supply to Luzon families (Rivas, 2020). Due to low supply and great demand, only those with enough money can afford healthy meals. Even though the wealthy and privileged are constrained, they can consume full meals and preferred food. Those with lower earnings and income disruptions must settle for something cheaper or perhaps nothing. Food is one of the most fundamental human necessities. According to the World Bank (2021), childhood undernutrition can result in a staggering loss of a country's human and economic potential. It promotes sickness, mortality, and generational transmission. Second, undernutrition causes stunting, which is associated with cognitive delays and worse educational performance. Worker productivity and adult earnings will fall. Undernutrition increases health care and social safety net costs and lowers educational results.

The National Capital Region of the Philippines consumes 2.37 kg of sweet potato per person. Figure 2 shows that sweet potato demand will rise from 2011 to 2020. (PSA, 2016).

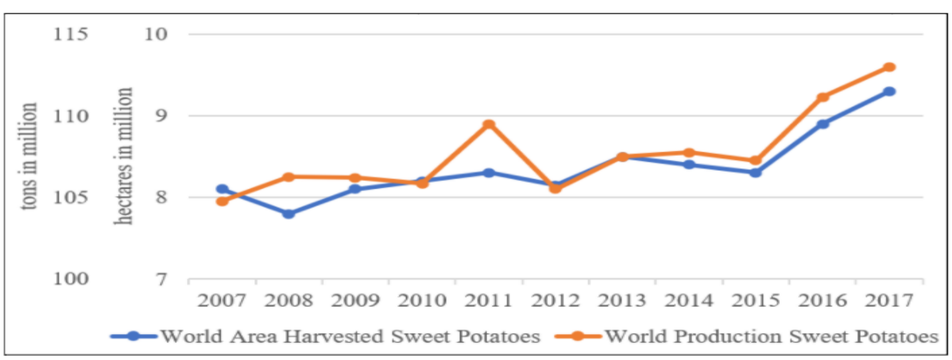

Figure 2. World Area of Harvested and Produced Sweet Potatoes (source: FAOSTAT, 2019)

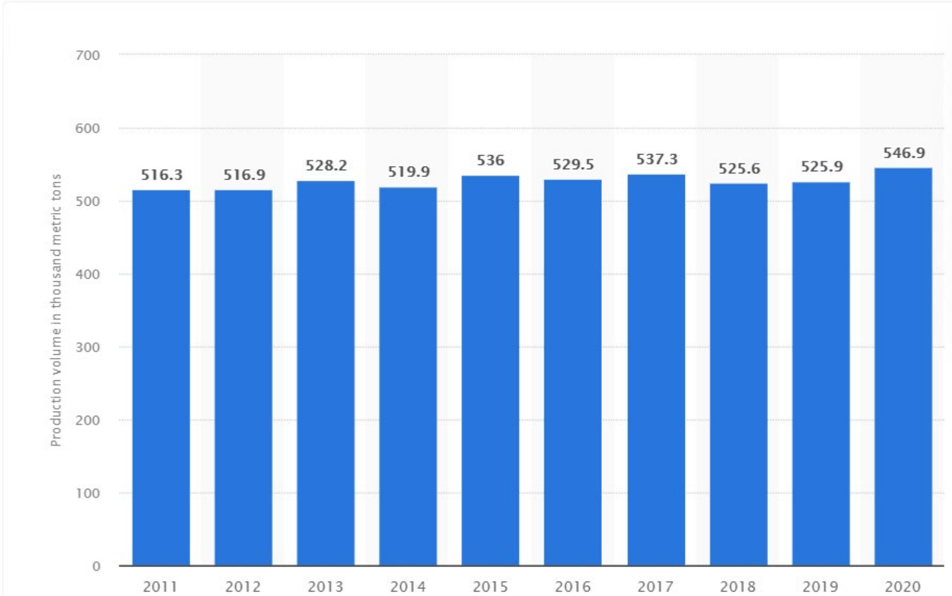

Figure 3. Demand for Sweet Potatoes in the Philippines from 2011-2020 (source: Statista, 2021)

However, in terms of volume and area harvested, sweet potato production has fallen since the 1980s due to pests, poor cultivation, preservations, and postharvest storage (Abidin et al., 2016, FAO, 2018). In 2017, the average domestic wholesale price of sweet potato in the Philippines was ₱22.73 per kilogram, up 54% from 2008. In the last decade, sweet potatoes' potential to alleviate hunger and malnutrition and as value-added animal and human goods has become more widely known. (Figure 3)

As the proponents seek to combat malnutrition in the Philippines, sweet potatoes have proven to be a rich source of vitamin A (beta-carotene), a crucial nutrient for vision, vitamin B6 for brain development and immune system, vitamin C for immunity, and others (Julson, 2019). According to Rankine et al. (2017), sweet potatoes may be grown in diverse agro-ecological situations, which promotes disaster readiness and resiliency of households facing climate change. Lirag (2019) discovered that sweet potato has a high profitability rate and 144 percent financial return to farmers. With the pandemic, accessible, affordable food is more important than ever. Managing agricultural wastes promotes sustainable waste and natural resource management, increases food security, and helps restore local agricultural ecosystems. Homegrown food can be harvested, processed, and fed to family members, boosting food security. Locally available planting supplies enable inexpensive gardening. In times of stress, such as COVID-19 unemployment and family health problems, the garden may become the primary source of food and income.

1.1 Objectives

This study aims to provide a basis for households that relates the effectiveness of sustainable fertilizers to the vegetation growth of sweet potatoes. The proponents also aim to combat food insecurity, a nutritional food within arm's reach through home gardening, while minimizing agricultural wastes through sustainability and providing livelihood opportunities for households as they can sell it through retail.

2.0 Literature Review

Eggshells comprise two parts: the shell, mostly calcium carbonate, and the membrane, which is a proteinaceous structure. According to Balaz et al. (2021), Calcium carbonate's primary component, calcite, is commonly reported to be 94-97%, making it suitable for use as an organic fertilizer for plants. Eggshells' high calcium content can help trigger the production of root and seed hairs and strengthen stems. (Anugrah et al., 2021). On the other hand, rice husks contain silica, which is quite beneficial for plants as, according to Sekifuji et al. (2019), it increases phosphorus (P) efficiency, leaf size, chlorophyll content, and alleviation of aluminum, iron, and manganese leading to the healthy growth of plants.

The great demand for sweet potatoes on the market requires efforts to increase their production, and one of these is to improve fertilizer usage efficiency. Fertilizer is added to any plant to meet the nutrients needed to reproduce well; it has two types, namely organic and inorganic fertilizers. Currently, organic fertilizers are highly recommended in agriculture instead of inorganic fertilizers to avoid their adverse effects if the latter is given continuously (Anugrah et al., 2021). Using inorganic fertilizers or chemical fertilizers accumulates toxic chemicals in the human body instead of good plant characteristics (Chandini et al., 2019). The excessive use of nitrogen fertilizers, such as urea (46% N), Anhydrous Ammonia (82% N), Ammonium Nitrate (33.5% to 34.5% N), and others posed severe threats to the human body (Ahmed et al., 2017). They also added that the consumption of high nitrate contents leads to various kinds of human cancers, thyroid conditions, diabetes, and neural tube defects.

Chandini et al. (2019) listed down the effects of inorganic fertilizers on the environment such: (1) the deleterious effect of the chemical fertilizers will start from the manufacturing of these chemicals, whose products and byproducts are some toxic chemicals or gasses like NH4, CO2, CH4, and others. Which will cause air pollution, (2) disposed untreated wastes from these industries into nearby water bodies will cause water pollution, which includes the most devastating effect of chemical waste accumulation in the water bodies, which is water eutrophication, and (3) when added to soil, its continuous use degrades the solid health and quality hence causing the soil pollution". The adverse effects of inorganic fertilizers on the environment and human health can be reduced by adopting new agricultural practices. One alternative is to shift chemical fertilizers to organic fertilizers by deriving human excreta, animal matter, or vegetable matter - compost or manure.

Additionally, examples of agricultural and household waste that can be used as an alternative to inorganic fertilizers are rice husks and eggshells. A study conducted by Wazir et al. (2018) showed that treatments of eggshells using tea waste and banana peel increase both plant growth and yield in terms of the number of pods and tubers of pea crops and potatoes, respectively. In addition, results also showed that potato crop with the treatment of eggshell powder increases the plant height due to additional soil calcium level as eggshell is a source of calcium. On the other hand, results from the study of Prakash and Singh (2016) showed that plant growth of tomatoes, in terms of length and fresh weight of shoot and root, increased gradually with a progressive increase in rice husk levels up to 40% but detrimental to root-knot nematode, a plant-parasitic. They also added that its addition to the soil increases the supplementation of cations with surplus quantity duly accompanied by macro and micronutrient availability, probably via fast mineralization and humification of the rice husk in the soil.

Furthermore, Zhang and Sun (2017) stated in their study that technology for composting and carbonizing organic wastes is gaining popularity as an environmentally friendly disposal method. A C-rich substance known as carbonized rice hulls (CRHs) has improved soil quality. The C in CRH's is hypothesized to build very stable structures in soil that assist mitigate global warming by reducing the release of CO2 (Zhang & Sun, 2017). They also suggested that increased agricultural yields can be achieved by adding CRH to the soil and that microorganisms and plants are less likely to be exposed to soil contaminants when used. Their study compared soil properties and peanut production in soil amended with composted green waste (CGW) and carbonized rice hulls (CRH), either alone or in combination. This research showed that combined usage of organic wastes CGW and CRH can improve soil physical and chemical qualities, microbial biomass, enzyme activity, and peanut growth and yield.

In the Philippines, rice husk is one of the most abundant agricultural wastes, with 1.8 million metric tons and 4.24 million tons of eggshell wastes (DOST & Vinluan, 2002.; Ongo et al., 2016). According to Anugrah et al. (2021), once the eggshells and rice husks are separated from their insides, they are already considered of no economic value. Since high quality and lesser costs are associated with the purchase and transportation of these two products, they might as well be used as organic fertilizers. These fertilizers can be created independently, which minimizes the weight of biodegradable and mineral waste and allows the household to save money and encourage organic farming (Ciesielczuk et al., 2017). As it is a century of innovation, agricultural waste as fertilizers should be acknowledged to create a healthy natural environment and ecosystem for the present and future generations.

As sweet potato has a growth cycle from 3.5 to 7 months and produces satisfactory yields under adverse climate and soil conditions, it has the immense potential to be grown in any household. In creating a home-based fertilizer, incorporating organic matter in the soil, namely eggshells and rice husks, which are agri-based wastes, provides water holding capacity and promotes microbial growth and activity. Eggshell wastes have a fibrous structure that decreases nutrient loss in crops. It is very rich in calcium phosphate and magnesium carbonate. Additionally, Rice Husks significantly affect the retention of nutrients in crop growth. It contains potassium, phosphorus, calcium, magnesium, sodium, silicon, iron, and sulfur, which enhances soil properties for better yield and growth (Wang et al., 2020).

3.0 Research Methods

3.1 Research Design

3.1.1 Independent Variables

The proponents used comparative analysis using experiments for the makeshift fertilizer from agricultural and household waste, rice husks and eggshells fertilizer to the controlled set-up which has the required amount of the commercial fertilizer, urea, and no fertilizer at all. The different variables will used for the study are: (Table 1)

Table 1. Independent Variables

VARIABLE	AMOUNT	DEFINITION OF VARIABLE AND DESCRIPTION OF VARIABLE	REFERENCE
Controlled Amount of Urea Fertilizer	90.72 g: 9.29 sq/m 11.34 g per pot	In the study of Traunfeld (2021), sweet potato is considered to be a medium feeder. The recommended amount of urea fertilizer is 2 lbs. per 1,000 square feet. With the amount of land available, the ratio is 90.72 g to 9.29 sq/m.	Traunfeld, (2021)
Varying Amount Eggshell Fertilizer	100 g	In the study of Wijaya, V., & Teo, S. (2019, May 3), the ratio of the experimental amount of the eggshell fertilizer is 1:2. The study started at 100g and increased the amount by 100g.	Wijaya, V., & Teo, S., (2019)
	200 g		
	300 g		
Varying Amount of Rice Husk Fertilizer	158 g	In the study of Harahap, F. S., Rahmaniah, R. O., & Arman, I. (n.d.), the recommended experimental amount of Rice Husk Fertilizer in plants is 158 g.	Harahap, F. S., Rahmaniah, R. O., & Arman, I., (2020)
	316 g		
	474 g		

3.1.2 Dependent Variables

To be able to measure if the makeshift fertilizers are effective in growing sweet potatoes, the proponents will use these dependent variables that are as follows:

- Vine length
- Leaf quality in terms of its length, width, and number of leaves
- Sweet potato leaves in terms of its color, taste, aroma, mouthfeel, and its overall acceptability for the tuber and quality.

3.2 Sampling Plan

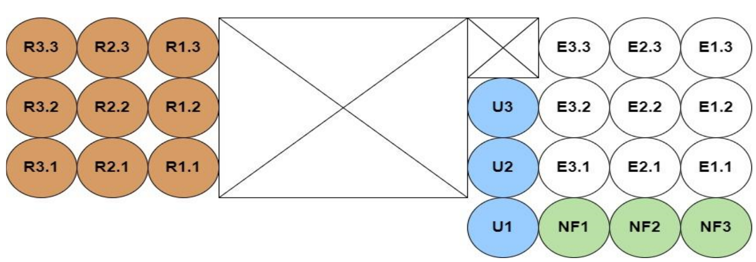

Figure 4. Plot Area

One Way ANOVA requires that the sample size for each group should be 15 or greater. However, due to the researcher's limited resources, each variation of each fertilizer group would only have three (3) samples each. In summary, with four (4) groups, two of which have three (3) variations, with three (3) samples each, the experiment had 24 samples. One of the parameters in the analysis is the taste of the leaves. Similarly, the proponents used One Way ANOVA to analyze the results of a survey sent to the respondents of the taste test. The number of respondents was based on the minimum number of samples required to use One Way ANOVA with four (4) groups is 15 or greater. (Figure 4)

3.3 Data Gathering Procedure

The data gathering procedure of this study involves preparation of materials, measurement of the varying amounts of fertilizers, a mixture of the varying amounts of fertilizer with the soil, planting of sweet potato vine in the soil mixture of fertilizers, observation of the plant, and analysis of the data collected through observation. Moreover, with the survey questionnaire distributed to the respondents, boiled samples of Sweet Potato Tops were given to respondents. The procedure started with harvesting sweet potato tops, boiling Sweet Potato Tops, and placing the boiled Sweet Potato Tops in a container for a taste test.

3.4 Mode of Data Analysis

The following statistical tool that was used for the analysis of vine length, leaf, and tuber quality is the Kruskal-Wallis test, with a significance level of 0.05 which indicates a 5% risk of concluding that a difference exists when there is no actual difference. This tool was used to determine whether there are any statistically significant differences between the means of three or more independent groups. Additionally, with the small sample size, the proponents are limited with data, thus yielding insufficient power to provide valuable results. On the other hand, for the answers of the respondents regarding sweet potato tops' color, taste, aroma, mouthfeel, and overall acceptability, the proponents utilized Kruskal-Wallis Test, given that the responses are categorical in nature. To be able to provide a more comprehensive statistical analysis of the data that was gathered, SPSS 24 software was utilized.

Additionally, for the first stage of data analysis, the proponents analyzed which amount, one each for the three (3) varying amounts of eggshells and rice husks, had the most significant effect on the vine length and leaf quality of sweet potato on week 12. After which, the two (2) chosen amounts of fertilizers for both the eggshells and rice husks will be analyzed together with the urea fertilizer and no fertilizer, which is stage 2 of the study that basically involves one amount each for the eggshells, rice husks, urea, and no fertilizer were analyzed from sample 1-3. Lastly, the variables or samples from stage 2 were used for the taste-test survey.

3.5. Assumption for Kruskal-Wallis Test

3.5.1 Independent Variable

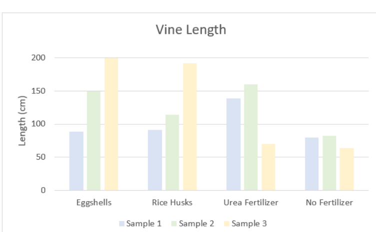

Figure 5. Vine Lengths of Sweet Potato in four different fertilizers

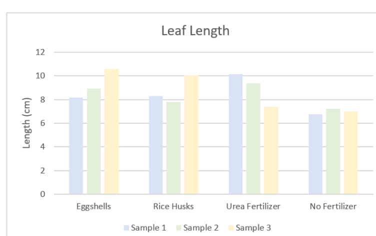

Figure 6. Leaf Lengths of Sweet Potato in four different fertilizers

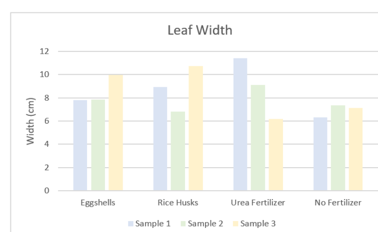

Figure 7. Leaf Widths of Sweet Potato in four different fertilizers

The proponents used a Bar Chart from Microsoft Excel to show the visualization of the variables' independence. The graphs above Figures 5, 6 & 7 show that independent variables of Eggshells, Rice Husks, Urea, and No Fertilizer are plotted on the x-axis. The four (4) fertilizers are unchangeable by the proponents. On the other hand, the dependent variables of Vine Length, Leaf Length, and Leaf Width are potentially changed by which the independent variable is assigned. In other words, the Vine Length, Leaf Length, and Leaf Width depend on the independent variables, whether the fertilizer is Eggshells, Rice Husks, Urea, or No fertilizer, which means that the assumption of independent variables is satisfied.

3.5.2 Ratio Scale

The Ratio Scale is defined as a variable measurement scale that not only produces the order of variables but also makes the difference between variables known along with information on the value of true zero. Some examples of ratio scales are height and ruler measurements which this study's scale belongs and satisfies the measurement scale assumption.

3.5.3 Independent Observation

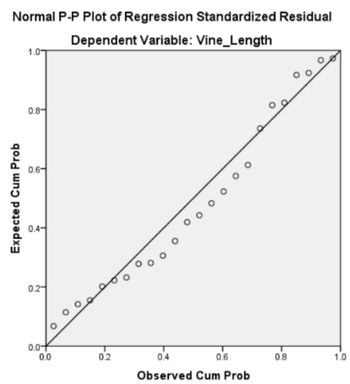

Figure 8. Normal P-P Plot of Regression Standardized Residual of Vine Length

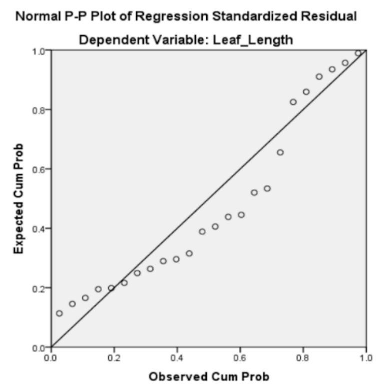

Figure 9. Normal P-P Plot of Regression Standardized Residual of Leaf Length

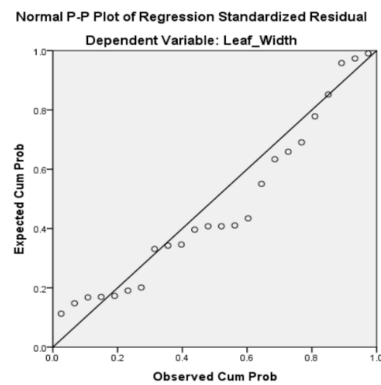

Figure 10. Normal P-P Plot of Regression Standardized Residual of Leaf Width

The Figures 8, 9 & 10 above show that the three Normal P-P Plot of Regression Standardized Residual have a linear relationship between the independent and dependent variables, and the variance of the dependent variable does not change with the value of the independent variable. Moreover, the graphs show that the data points are somehow clustered. Thus, the independent observations assumption is satisfied.

3.5.4 Normal Distribution

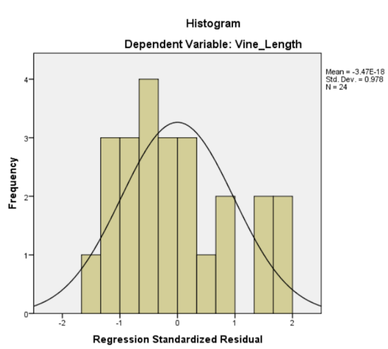

Figure 11. Histogram of the Vine Length

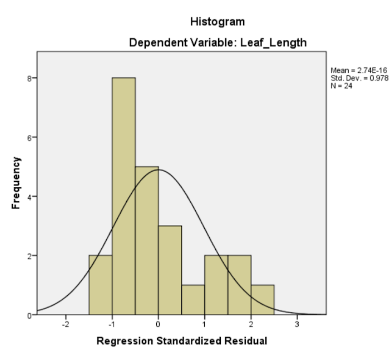

Figure 12. Histogram of the Leaf Length

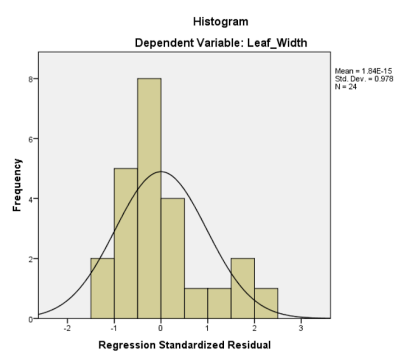

Figure 13. Histogram of the Leaf Width

Lastly, using the histogram, the proponents created a graphical representation of the data distribution; as shown Figures 11, 12 & 13 above, all the three (3) graphs show a bell-shaped pattern which usually presents a normal distribution.

4.0 Results and Discussion

The experiment focuses on three (3) stages of hypotheses to discuss the winning sample from the homemade fertilizer, the winning sample from the first stage versus the commercially available fertilizer and no fertilizer, and the winning sample according to the taste test.

Stage 1:
The first stage identifies the sample with the highest mean value to be considered as the winning group.

Table 2. Eggshell Fertilizer Mean Value

Eggshell	Vine Length	Leaf Length	Leaf Width
100 g	182.79	0.25	0.13
200 g	963.50	0.99	0.30
300 g	3,090.33	1.53	1.54

Table 3. Rice Husk Fertilizer Mean Value

Rice Husk Fertilizer	Vine Length	Leaf Length	Leaf Width
100 g	182.79	0.25	0.13
200 g	963.50	0.99	0.30
300 g	3,090.33	1.53	1.54

Tables 2 and 3 show that the winning sample for each homemade Eggshell and Rice Husk fertilizer is the highest amount – 300 g and 474 g, respectively. These amounts yield the highest mean vine length, leaf length, and lead width. This data will compare the homemade fertilizer to the commercially available fertilizer and no fertilizer.

Stage 2:
The second stage compares the winning sample from the first stage to the commercially available fertilizer and no fertilizer. The proponents used a non-parametric test, Kruskal-Wallis, to compare the data showing significant effects on each factor.

Table 4. Kruskal Wallis Test of Eggshells (300g), Rice Husks (474g), Urea Fertilizer (11.34g), and No Sweet Fertilizer on the Vine Length, Leaf Length, and Leaf Width

Fertilizer Type	N	Mean Rank		
		Vine Length	Leaf Length	Leaf Width
300 g Eggshell	3	9.33	7.67	7.00
474 g Rice Husk	3	5.33	7.67	7.67
11.34 g Urea Fertilizer	3	7.67	8.67	7.67
No Fertilizer	3	3.67	2.00	3.67

Table 4 presents the summary of results for each factor considered in the experiment. In the Vine Length factor, the 300 g Eggshell has the highest mean rank compared to the other types of fertilizer and no fertilizer. The Leaf Length factor, 11.34g Urea, has the highest mean rank compared to the other types of fertilizer and no fertilizer. Lastly, the Leaf Width factor, 474 g Rice Husk and 11.34 g Urea have the same and highest mean rank compared to the other types of fertilizers.

Stage 3:
The third and final hypothesis testing stage focuses on the Sweet Potato Tops taste. The proponents used five (5) factors: color, taste, aroma, mouthfeel, and overall acceptance. The data was processed using Kruskal-Wallis Test.

Table 5. Kruskal Wallis Test of Color, Taste, Aroma, Mouthfeel, and Overall Acceptability on Eggshells (300g), Rice Husks (474g), Urea Fertilizer (11.34g), and No Sweet Fertilizer Potato Tops

Fertilizer Group	N	Mean Rank				
		Color	Taste	Aroma	Mouthfeel	Overall Acceptability
300 g Eggshell	14	30.93	24.32	25.29	26.61	24.54
474 g Rice Husk	12	24.71	23.04	30.04	24.5	26.13
11.34 g Urea Fertilizer	12	25.08	27.29	24.17	27.33	28.92
No Fertilizer	12	20.38	27.54	22.54	23.38	22.58

The Kruskal-Walli's test of comparison of the four types of fertilizer in terms of color shows that the EGGSHELL FERTILIZER has the highest mean rank of 30.93, compared to Rice Husk fertilizer, Urea Fertilizer, and no Fertilizer. In terms of Taste, NO FERTILIZER has the highest mean rank of 27.54, compared to Eggshell fertilizer, Rice Husk Fertilizer, and Urea Fertilizer. For the Aroma, RICE HUSK FERTILIZER has the highest mean rank of 30.04, compared to Eggshell Fertilizer, Urea Fertilizer, and No Fertilizer. Regarding the mouthfeel, UREA FERTILIZER has the highest mean rank of 27.33 compared to Eggshell Fertilizer, Rice Husk Fertilizer, and No Fertilizer. Lastly, for the Overall Acceptability of the Sweet Potato Tops, UREA FERTILIZER has the highest mean rank of 28.92, followed by Rice Husk at 26.13, Eggshell at 24.54, and No Fertilizer at 22.58. (Table 5)

In conclusion, two out of five factors (mouthfeel and overall acceptability) conclude that the commercially available urea fertilizer has the highest rating. The factors such as color, taste, and aroma have Eggshell Fertilizer, No Fertilizer, and Rice Husk Fertilizer as the highest rating. In a study by Wijaya and Teo (2019), eggshells were used as a fertilizer in the form of crushed eggshells and eggshell tea. The eggshell tea was made into different concentrations, which were diluted in water in different volumes: 10x, 20x, 30x, 40x, no dilution, and control. In comparing the results of the height of the basil plant, the eggshell tea with a concentration of 20x had the most significant effect on growth in the plant. It is worth mentioning that the soil used in the experiment was garden soil which already contains nutrients which means the plant could grow well. However, the addition of eggshell tea served as an additional nutrient for the plant. The study shows that, despite the 30x or 40x having a higher concentration, the 20x had the more significant effect. This effect could be possible due to over or fertilization which could affect plant growth (Albornoz & Lieth, 2015; University of Massachusetts, 2017).

5.0 Conclusion and Recommendations

In this study, the most significant amounts of Eggshell and Rice Husk Fertilizer, 300 g, and 474 g, respectively, resulted in the highest mean value of leaf length, width, and vine length. Using samples with the highest amounts of eggshell and rice husk fertilizer, commercially available urea fertilizer, and samples with no fertilizer, the study found no statistically significant difference in any fertilizers' effects on vine length, leaf length, and leaf width. Using Kruskal-Wallis, Urea fertilizer had the greatest mean rank in leaf length and width, while Rice Husk fertilizer had the same mean rank as urea in leaf width. In terms of vine length, eggshell fertilizer ranks top.

The sensory evaluation found no statistically significant differences in color, taste, aroma, mouthfeel, and overall acceptability of Sweet Potato Tops. According to Kruskal-Wallis tests, urea fertilizer has the highest rating in mouthfeel and overall acceptability. Finally, the eggshell, no fertilizer, and rice husk fertilizer had the highest mean rating in color, flavor, and aroma, respectively.

The proponents recommend employing specialists to improve Sweet Potato Tops' food appeal. Alternate cooking methods can improve its acceptability. Since Urea Fertilizer had the best outcomes, it is recommended to study the right and suitable usage to ensure its safety and effectiveness.

6.0 Areas for Further Study

This study identifies areas for further research on organic fertilizers. Further studies may spend more time planting and nurturing sweet potatoes or use high-yielding plants that can be developed faster. It can also be explored to determine whether to grow it in the dry or wet season. Studying sweet potato growth and customer preference in a controlled or varied environment is also suggested. Moreover, further study can ensure homogeneity by using same-day tests and a single supplier. Since most eggshells and rice husks generated the best outcomes, utilizing alternative fertilizers can be studied to see whether an even higher amount will produce better results. The proponents also suggest utilizing more bottomless pots to give plant roots more space, making growth easier. It is proposed to use eggshell tea, composted rice husk, and complete fertilizer with 14-14-14 NPK content since eggshell tea fertilizer performs better than crushed eggshell in a short period (Wijaya, 2019) and composted rice husk fertilizer is a nutrient-dense, biodegradable product (Badar, 2014). A greater sample size of sweet potato plants would yield more accurate and representative results. This lets researchers use approaches other than Kruskal Wallis.

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