COMMONWEALTH HIGH SCHOOL

EFFECTIVENESS OF ORANGE PEEL BIOCHAR AS SOIL AMENDMENT FOR PECHAY (BRASSICA RAPA SUBSP. CHINENSIS) GROWTH

A PRACTICAL RESEARCH PAPER

Presented to the Senior High School Department

Commonwealth High School

In Partial Fulfillment

of the Requirements for Senior High School

STEM Strand

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Approval Sheet

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Finally, we want to express our deepest appreciation to so many people who helped us complete our research project. The group would like to thank each and every one of you.

Dedication

We were all hesitant at first because none of us had any knowledge of biochar. Is it possible? We tend to doubt ourselves when we begin our study, but then we encourage one another, assuring that everything will work out.

As time went by, we were unaware of how much work we had done in order to complete our studies. We are grateful to everyone who assisted us in completing our research study, and we are positive that the outcome will benefit not just us but also a lot of peope.

The group would like to dedicate this study to our family and friends, who have never stopped supporting us in any way they can. Next, we dedicate this to Ms. Lynji S. Pedrosa, our III teacher and adviser, for always doing her best to guide us since the beginning of our research and for assisting us in achieving the best results. Also, we dedicate this research to Mrs. Deceree Mae Remeticado, our Work Immersion teacher and validator, for lending us some of her time to evaluate our research and for encouraging us.

The group would also like to dedicate this study to the students at Commonwealth High School, as well as every youth, for them to inspire, encourage, and love agriculture. The researchers also like to share this idea/study with people who enjoy planting and want to improve the physical structure of their plants in their backyards.

Above all, we dedicate our research to God, who provided us with the strength, knowledge, and dedication that we needed as we worked while physically and mentally drained.

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Abstract

Agricultural waste such as fruit peels can be a potential bio-resource for agricultural resources by transforming it into biochar that helps improve soil quality which is beneficial to plant growth. For some studies, orange peels can be a useful material to improve soil fertility because of its high percentage of nitrogen that aids in the nutrition uptakes of plants. It is also rich in a variety of elements that provide a quick nutrient boost to houseplants and is also effective in changing the PH level of the soil. To examine its effectiveness, the researchers utilized an experimental research design where they will be observing two sets of plants, with and without biochar and will focus on the growth of pechay plants for 7 weeks using two independent samples t-test.

Upon observing its effectiveness to pechay plants and the computed data gathered from the study, a significant difference between the two sets of plants had been observed in terms of number of leaves and height of plant that made researchers conclude that the application of orange peel biochar on natural soil helps improve the growth of pechay plant. And to have more accurate results, the researchers recommended observing the experiment in a longer time frame and increasing the set of samples. They also added the use of pyrolysis process in making the biochar and to observe its effects when applied at the beginning of planting the pechay seeds. It will also be much better to use different kinds of plants for the experiment and compare the orange peel biochar to other types of biochar and its effects to different kinds of soil. The researchers also suggested observing the effectiveness of biochar as an additive to fertilizers to improve the growth of plants.

Chapter 1

THE PROBLEM AND ITS BACKGROUND

Background of the Study

Biochar is a cost-effective and environmentally friendly agricultural material that helps improve soil quality, plant growth, and energy production (Mahmuda et al., 2019). Abundant waste such as fruit peels can be a potential bio-resource that can be used for agricultural resources instead of being dumped in landfills (Su et. al 2018). The safe disposal of the huge amount of orange peel waste generated each day might raise economical and ecological problems, but after conversion into biochar using the pyrolysis process, it could be utilized as a perfect soil supplement. Agricultural soil fertility is starting to have its constant decline due to the continuous application of chemical fertilizers and lack of organic amendment. In some studies, the application of chemical fertilizers combined with organic amendments is highly beneficial to crop growth, grain yield, and root traits as it improves soil fertility. In particular, when the nutrients are being recycled through the conversion of organic waste into biochar and applied as soil amendments is a sustainable practice for plant nutrient requirement and root traits (Sial et. al., 2019).

Biochars have been utilized as a major contributor to plants' source of nutrients (Muhammad et al., 2019). Nitrogen (N) is an essential nutrient for plant growth and development. Biochar has been proposed to be a soil amendment that helps plants access minerals and keeps nutrients in the soil by adsorbing them, including nitrogen and carbon. A research conducted by Devens et al., 2018, aimed to determine the characterization of orange peel biochar through converting the organic

wastes into biochar in a process called pyrolysis. Biochar from citrus showed high values of carbon and nitrogen which suggests its viability in soil amendment (Devens et al., 2018). Plantitos and plantitas would love this low-cost adsorbent that reduces soil's characteristic to emit greenhouse gases specifically to pechay (brassica rapa subsp. chinensis) that can thrive in tropical climates. The major constraints to the application of orange peel biochar are whether the biochar can act as a potential soil amendment to soil fertility and its effectiveness on pechay growth.

The researchers in this study looked at how to make biochar from orange peels and how beneficial it would be as a soil amendment for pechay (Brassica rapa subsp. chinensis) growth. Biochar is a carbon-rich item acquired when biomass or natural material goes through warm deterioration under a restricted supply of oxygen. It has been utilized for various purposes, including soil conditioner with expanding crop yield (Hall & Bell, 2015), and minimizer of manure costs and ecological effects on soil and water. Furthermore, it moderates environmental change through carbon sequestration and lessens ozone-harming substances, recuperation of polluted regions, water treatment, and fertilizing the soil (Parmar et al., 2014). The properties of biochar make it a reasonable choice to be utilized as a soil enhancer that further develops the soil’s fruitfulness. When applied straightforwardly to the soil, biochar has high carbon content, which adds to the soil's carbon content and further develops soil fertility. As a soil enhancer, biochar is suitable for holding water and supplements in the dirt.

The purpose of this study is to see how effective orange peel biochar is as a soil amendment for pechay development. Also, to raise public awareness of the benefits of biochar to plants, particularly among farmers, agriculturists, future agriculturists, and home gardeners, including those who became one as a result of the pandemic. This is

a relevant and significant issue since it will be beneficial to students, teachers, farmers, and future researchers to understand the importance of using biochar as a nutrient source for crops. Also, orange peels may be found at home and can be used as a soil amendment for growing plants to save money and reduce waste in the environment.

Research Paradigm

The researchers looked at the physical growth of the pechay (Brassica rapa subsp. chinensis) plants that were grown in natural soil and soil with orange peel biochar. This study used a control and experimental group to determine whether the orange peel biochar has a significant effect on pechay growth. The following figure shows the variables present in this research.

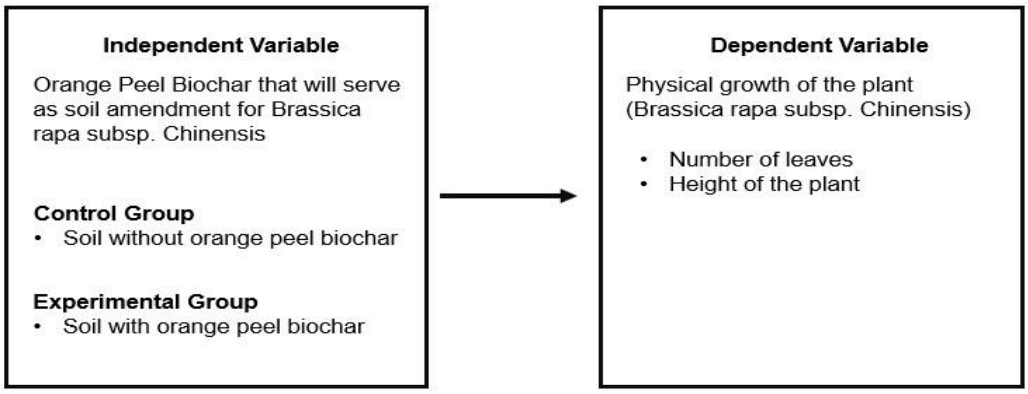

Figure 1. Paradigm of the Study

The figure depicts the concept of this research study entitled "Effectiveness of Orange Peel Biochar as Soil Amendment for Pechay (*Brassica rapa subsp. chinensis*) Growth". The independent variable is the orange peel biochar that will serve as a soil amendment for Brassica rapa subsp. Chinensis. The dependent variable is the physical growth of the plant in terms of the number of leaves and height.

Statement of the Problem

This study determined the effectiveness of orange peel biochar as a soil amendment for pechay growth.

Specifically, it sought answers to the following questions:

1. What is the growth performance of pechay on natural soil in terms of:
   1.1. number of leaves
   1.2. height of the plant
2. What is the growth performance of pechay on soil with orange peel biochar in terms of:
   2.1. number of leaves
   2.2. height of the plant
3. Is there a significant difference between the number of leaves of pechay planted on natural soil and those that are treated with orange peel biochar?
4. Is there a significant difference between the height of pechay planted on natural soil and those that are treated with orange peel biochar?

Hypotheses

A research hypothesis is a prediction and expected results that will be put to the test through the study. A null hypothesis states no relationship between the variables. On the other hand, an alternate hypothesis states that there is a relationship between the variables. The following are the hypotheses of the study:

Null Hypotheses

1. There is no significant difference between the number of leaves of the pechay planted on natural soil and those that are treated with orange peel biochar.
2. There is no significant difference between the height of the pechay planted on natural soil and those that are treated with orange peel biochar.

Alternative Hypotheses

1. There is a significant difference between the number of leaves of the pechay planted on natural soil and those that are treated with orange peel biochar.
2. There is a significant difference between the height of the pechay planted on natural soil and those that are treated with orange peel biochar.

Significance of the Study

This study will help to provide information about the effectiveness of orange peel biochar as a soil amendment for pechay growth. Furthermore, this study could be highly beneficial to the following:

Students. This study will be beneficial to students as it contains useful information that they can apply for future agricultural activities.

Educators. This study will be beneficial to educators as it will expand their knowledge about creating biochars from organic materials that can be added as additional information that their students can gain from them.

Horticulturist. This study will be beneficial to horticulturists as it discusses how soil will be enhanced with the use of orange peel biochar which they can apply to improve plants' growth.

Community. This study will be beneficial to the community most especially to people who have a passion for engaging in different agricultural activities focusing on planting crops as it will give them an idea on how to create effective biochar from orange peels which has a good effect on pechay growth.

Future Researchers. The result of this study will provide useful data and be a reliable source of information to our future researchers who want to study the same topic. The information presented in this study may be used also in conducting new research and testing the validity of other related studies.

Scope and Delimitations

This study primarily focused on how effective orange peel biochar is as a soil amendment for pechay (Brassica rapa subsp. chinensis) growth. Its effectiveness was assessed based on the number of leaves and height of the plants. This research was conducted at Barangay Commonwealth in Quezon City in the school year 2021-2022.

Therefore, this study did not address the effectiveness of orange peel biochar on other plants. Moreover, the researchers did not observe the properties of the soil and difference in the plants' nutritional value. Other variables that have not been stated were also excluded from the study.

Definition of Terms

The key words used in this study have been defined for the sake of clarity. The terms are as follows:

Biochar. Biochar is a charcoal-like material produced from biomass through a regulated process known as pyrolysis (Regeneration international, 2018). Biochar is the soil amendment material that we are generating in this study to improve plant growth.

Combustion. Combustion is a chemical process in which a substance reacts rapidly with oxygen and gives off heat (NASA, 2021). This study will make use of this process to create the orange peel biochar.

Growth. Growth is one of our purposes in making this study. The growth of plants in this study would be measured by their length and mass. It is defined as the process of increasing physical size (Oxford Learners Dictionaries, n.d.).

Orange (Citrus sinensis). Orange fruit is any of several species of small trees or shrubs of the genus Citrus of the family Rutaceae (Britannica, 2022). This study made use of the orange peel to make the biochar for the growth of pechay.

Pechay *(Brassica rapa subsp. chinensis)*. Pechay is one of the most often used vegetables in Filipino cuisine, thus the researchers selected it as the plant to study to see how biochar affects its development (Pinoy Entrepreneur, 2010).

Plantitos/Plantitas. It is a new social media jargon used to describe someone who loves, likes, appreciates, and is fond of different kinds of plants (Sunga & Advincula, 2021).

Soil Amendments. A soil amendment is any material added to a soil to improve its physical properties, such as water retention, permeability, water infiltration, drainage, aeration, and structure (Davis & Whiting, 2013). Soil amendment is used in this study to improve the quality of the soil and its ability to hold added organic matter (orange peel biochar) – which will eventually allow a slow release of nutrients into the soil.

Soil Fertility. As per Food and Agriculture Organization, soil fertility refers to a soil's capacity to support plant development by supplying required plant nutrients and a suitable environment for plant growth (Food and Agriculture Organization of the United Nations, n.d.). In this study, it is defined as the ability of soil to provide sufficient quantities of nutrients to plants for their growth and development.

Chapter 2

REVIEW OF RELATED LITERATURE & STUDIES

This chapter includes a broad review of related literature and related studies, both foreign and local. The ideas and concepts of the included studies and literature give credibility and justification to the information given in the previous chapter.

Related Literature

Since the COVID-19 pandemic began, there has been a remarkable increase of interest in community and home gardening (Kampman et al., 2021). Home gardening surged in popularity in both rural and urban settings. The terms "plantito" (male) and "plantita" (female) refer to people who appreciate caring for plants (Sunga & Advincula, 2021).

Biochar is a charcoal-like substance created by burning organic waste from agriculture and forestry in a controlled process known as pyrolysis (Spears, 2018). Rawat et al. (2018) summarized the properties of biochar, its relations with soil microflora, and its role in plant growth promotion when added to the soil. Adding biochar to the soil can be one of the most effective techniques for overcoming biotic stress and increasing crop output. According to the comprehensive review, biochar remediates polluted agricultural soil, improves soil fertility by lowering acidity and increasing nutrient availability.

Many home gardeners think adding orange peel can damage their plants and compost pile. According to the blog of redemption permaculture (2022), orange peels are useful for the compost pile and composting process to help minimize waste while also providing nutrient-rich soil for the plants as long orange peels are utilized in

moderation. Moreover, because the orange peel is acidic, adding too much will throw the compost's pH balance off. Furthermore, orange peels are high in nitrogen and aids in nutrition uptake by plants because the citrus fragrance repels hazardous scavengers and destructive insects, which can help keep pests away from the compost pile.

According to Eden Indoors, a blog intended for home workers, using natural nutrient sources to help your houseplants grow and prosper is a safer and budget-friendly alternative, and this includes adding organic material to your plant's potting soil, such as the discarded skin of citrus fruits. Orange peels are rich in sulfur, nitrogen, calcium, magnesium, and a variety of other elements that can provide a quick nutrient boost to houseplants. Aside from plant-boosting nutrients contained in orange peels, they are also effective in changing the pH level of the soil. Many common houseplants prefer slightly acidic soil pHs, which can be accomplished by adding a few citrus peels to the mix (Dosser, 2021).

Nitrogen is the most essential nutrient plant needed. Once orange peels are mixed into the soil, they will release their nitrogen content, decrease the acidity in the soil, and make the soil rich in nutrients that plants will love. As the orange peels degrade, they release more nutrients, and this process acts as a natural fertilizer while also reducing organic waste (Anderson, 2018).

Pechay can be cultivated throughout the year but makes their best growth and good quality if planted in cooler climate (Jimenez et al., 2016). It can be sown directly in the ground or transplanted (Business Diary PH, 2019). When plants are kept in a tiny container, their development might be hindered. Because the roots fill up the pot and have nowhere to go, the plant doesn't grow as much as it should, and if it's a blooming plant, it may cease blossoming. By just moving up to a little larger container, the roots

will have more room to migrate and the plant will begin to grow (Crocker Nurseries, 2019). Pechay is one of the vegetables which need to be transplanted after a short period of time (Rockets Garden, 2019). A seedling is grown enough to plant out in the garden when it has three to four true leaves, according to the common rule of thumb (Holmes, 2022). Additionally, one may manage the environment in which seeds develop by growing them first in paper pots, modules, or seedling trays. Controlling soil, moisture, fertility, and heat while providing protection from the weather and garden pests (Murphy, 2017).

Furthermore, nutrients released from the burned material, which includes dead plants and animals, return to the soil faster than if they had deteriorated slowly over time. Fire enhances soil fertility in this way, an advantage that farmers have used for ages (National Geographic Society, 2022). Fires can reduce the pool of nutrients stored in plant residue and organic matter and release a flush of plant available nutrients. Available nitrogen (N) is especially increased after low intensity fires, even though a portion of N and sulfur (S) is lost to the air (Montana State University, 2019).

Related Studies

Biochar manufacturing is an agro-business waste management solution that is frequently utilized to absorb carbon and improve soil fertility. Fruit wastes, which are high in soluble sugars, pectin, and polysaccharides, have been infrequently employed but are commonly available. In the study, “Characterization of untreated and composted biochar derived from orange and pineapple peels”, the researchers investigated if composting can eliminate toxicants and improve biochar characteristics. They used pyrolysis to make biochar from orange and pineapple peels, and they studied the physical and

chemical features of untreated and composted biochars. The untreated biochar has a high soluble salt and C content, as well as an alkaline character and high porosity, according to the tests. The findings show that orange and pineapple peels are good source materials for making biochar, but they should be composted first before being used as soil amendments (Garcia et al., 2020).

As orange (Citrus sinensis) is a popular fruit in west Africa that generates residues from its consumption, Adeniyi et al. (2020) conducted an experiment to assess thenature, quality, and features of biochar made from orange peels, as well as orange albedo, to determine the product's appropriateness for a number of eligible applications. They sundried both biomasses until crisp, removing all moisture. An updraft biomass conversion reactor with retort heating was then used to make the biochar. The prospective uses of the biochars were examined based on the outcomes of the analysis. Their findings revealed that orange peel biochar contained more carbon than orange albedo biochar. They also discovered that the biochar they created included functional groups such as alcohol, esters, ketones, aldehydes, carboxylic, ether, and phenols. Because biochar contains these groups, it has the potential to be utilized as an adsorbent for aquatic contaminants as well as a soil amendment. Carbon-rich biochar has uses in greenhouse gas emissions and carbon sequestration in soils, in addition to its ability to remediate contaminants in water. Both biochars had a greater carbon content than some of the agricultural wastes evaluated in the past, indicating that they can be used as biochar feedstock (Adeniyi et al., 2020).

Additionally, biochar production is one of the many ways to convert biomass into valuable goods useful to agriculture and waste management solutions. It has sparked a lot of attention due to climate change concerns and the need to upgrade soil quality in a

sustainable method. In the study, “Production and Characterization of Biochars from Slow Pyrolysis of Different Biomass Materials to Evaluate Properties as Soil Amendments” by Pangga (2020), they investigated the morphological, physical, and chemical aspects of biochar formed from various biomass sources, including rice straw , water hyacinth, etc. as a result of slow pyrolysis. The biochars made from rice straw and water hyacinth showed higher concentrations of essential plant nutrients such as nitrogen, phosphorus, and potassium. These characteristics and minerals are then utilized to support their use as a soil amendment (Pangga, 2020). According to the findings, using biochar as a soil amendment improves soil porosity, acid levels, cation exchange capacity, water retention capacity, and nitrogen levels, all of which increase soil fertility and, as a result, crop development. When using biochar to improve soil fertility, it is best to apply it near the soil's surface in the root zone, where the majority of nutrient cycling and absorption by plants occurs (Major, 2010).

The continuous growth of economic citrus productivity produces large quantities of solid wastes. Huge amounts of waste are simply left to rot exerting serious environmental consequences. However, the recycling of nutrients and the reintroduction of organic matter to soil through the use of industrial orange wastes as organic fertilizer could be a long-term solution (Maksoud et al., 2015). The study entitled “Industrial Orange Wastes as Organic Amendments in Citrus Orchards” aimed to study the effects of industrial orange wastes as potential soil amendments on fruit set and yield of “Valencia” orange trees. Results showed that orange wastes (peels and pulp) had a positive effect on the growth of the plants. Furthermore, long-term use of orange waste as an organic fertilizer resulted in yields comparable to mineral fertilizers. It may be inferred that employing orange wastes as an organic fertilizer could be a long-term

solution for recycling nutrients, resolving environmental issues associated with the citrus processing industry, and lowering disposal costs.

Orange fruits are one of the most cultivated fruit products in Brazil. In accordance, coconut shells and orange peels are converted to biochar in a process called pyrolysis. Brazil at the present is the top contributor of orange juice owning more than half of the said juice industry, with that being said the country's citrus residue is myriad (including their seeds, peel, and bagasse) (Devens et al., 2018). Possible mitigation was instigated through reusing orange peel residue by turning them into biochar, and furtherstudying their characterization. The results show that orange peel biochar had high values of fixed carbon and volatile matter indicating their effect on the enhancement and amendment of soil. Its volatile matter shows a high possibility of immediate effect on soil fertility, however, fixed carbon is deemed recalcitrant (somewhat biodegradable or non-biodegradable). Aside from the agricultural effect of fixed carbon and volatile matter, the porous structure of orange peel biochar led to the possibility of its use as low-cost adsorbents.

In a study conducted entitled "Characterization of Biochar Derived from Three Types of Biomass", the three biomass that were examined were orange peel, residual wood, and water treatment sludge (Oh et al., 2011). The researchers used these as raw feedstock to make biochar which is produced through the pyrolyzing process. They also conducted a physical and chemical analysis to determine the basic properties of both raw feedstock and biochar. They examined the amount of their carbon, hydrogen, and nitrogen content using an elemental analyzer while oxygen content was determined by a mass balance. And as a result of their study, they confirmed that orange peel contains predominantly calcium and potassium oxides with measurable

levels of sulfur, iron, and phosphorus oxides. It is also rich in carbon and has a carbon content of about 42% and can be used as proper feedstock for biochar production which can be used safely for agricultural purposes such as soil amendment.

Additionally, most farmers all over the world, especially here in the Philippines, depend on the use of fertilizer due to its benefits on growing plants and crops (Salceda et al., 2020). In their study, they used coconut husk ash together with pulverized orange peel as an alternative fertilizer in pechay as it contains potassium and carbon which are both good for compost. As stated by the researchers, orange peelings contain phytochemicals that are necessary to a plant's survival as it gives it a certain color and appearance and helps the plants protect from predators. It also has d-limonene which is a natural chemical that destroys the waxy coating on insects that causes them to suffocate and die.

Moreover, in the last ten years, there has been an increase in interest in industrial waste reduction, resource conservation, and by-product utilization, transforming 'waste' into a resource to be used rather than discarded. In the study “Industrial Orange Waste as Organic Fertilizer in Durum Wheat,” it was hypothesized that it is possible to reuse orange wastes as organic fertilizer and this could represent a more sustainable approach to nutrient recycling and reintegration of soil with organic matter (Tuttobene et al., 2009). A two-year research project was carried out to study the effects of dried orange waste on the growth and production of durum wheat to assess the potential reuse of industrial orange waste as organic fertilizer. The study showed that organic fertilization gave similar yields to mineral fertilization. Organic fertilization with orange waste leads to both direct and indirect effects on durum wheat growth and productivity. The organic and mineral fertilization showed comparable results in the first year, whereas combining the

highest dose of organic fertilization with the residual one produced an early end of the biological cycle due to premature senescence. This concluded that the appropriate use of dried orange waste as fertilizer can help to alleviate some of the environmental issues associated with citrus fruit processing.

The Food and Agriculture Organization of the United Nations (2015) described a continuous increase in the production of oranges worldwide, the orange peels became a major agricultural waste fraction. Nowadays, a large portion of the orange peel is used for animal feeding, whereas a small portion is used in composting and extraction of bioactive substances. Nevertheless, these methods are unfavorable due to specific orange properties such as bitterness, low pH, and economic reasons. However, Satari et al. (2017) and; Negro et al. (2018) come up with a comprehensive life-cycle assessment of orange peel and examined the new management options. In view of the fact that orange peels have a high content of moisture, the authors suggest wet treatment methods such as co-digestion with manure instead of pyrolysis or incineration. As a result of the study, utilizing Hydrothermal Carbonization of orange peel is an ideal alternative technique, with the use of orange peel the soil properties show a great improvement. Even so, the researchers suggested further assessment on removing the phytotoxic effects of orange peels (Kalderis et al., 2018).

Relevance to the Study

Biochar has been a great tool for the agricultural industry because of its unique ability to help build soil health, increase physical properties of soil, conserve nutrients, reduce fertilizer requirements, serve as the most preferred habitat for microbes, and more (Stella Mary et al., 2016). Moreover, the results from the related studies show that

biochar made from orange peels had high levels of fixed carbon and volatile matter, indicating that it can be used to improve and amend soil. There are also various ways to apply it depending on how it will be used. Using biochar as a soil amendment improves soil porosity, acid levels, cation exchange capacity, water retention capacity, and nitrogen levels, all of which increase soil fertility and, as a result, crop development (Pangga, 2020). Considering the chemical composition of orange peels stated in the related literature, the researchers used the orange peel biochar as a soil amendment and observed its effectiveness. In this study, orange peel biochar was applied near the plants' root zone to maximize its full benefit.

Additionally, it was also stated by Maksoud et al. (2020) that employing orange wastes as an organic fertilizer could be a long-term solution for recycling nutrients, resolving environmental issues associated with the citrus processing industry, and lowering disposal costs. Also, considering the people who started home gardening as their coping mechanism during this pandemic was one of the reasons why the researchers initiated to conduct this study.

To summarize, the reviewed literature and studies in this chapter discuss ideas and concepts that are relevant to the study. Such ideas include the chemical components of orange peel and its potential as an organic soil amendment, organic wastes as fertilizer, agricultural benefits of biochar, fruit peel wastes in the industry, biochar manufacturing, and the use of organic materials as fertilizer in home gardening. These pieces of information will provide credibility as well as reliability to the information this research will come up with.

Chapter 3

METHODOLOGY

Research Design

The purpose of this study was to examine the effectiveness of orange peel biochar as a soil amendment for pechay (Brassica rapa subsp. chinensis) growth. This study utilized an experimental research design, with two groups, the control group and the experimental group. In the control group, the pechay plant was planted on natural soil and was not treated with orange peel biochar. On the other hand, in the experimental group, the pechay plant was planted on soil with orange peel biochar. The statistical results of the control and experimental group were compared to determine the effectiveness of the orange peel biochar on the growth of the pechay plants. Analyzing the statistical data was based on the number of leaves and height of the plants.

Research Locale

The experiment took place in the home garden of one of the researchers in Barangay Commonwealth, Quezon City. The garden was chosen as it provides a favorable environment and necessary equipment for the natural growth of plants such as pechay (Brassica rapa subsp. chinensis).

Figure 2. Research Locale Map

Materials

The materials used for this experiment were orange peels, clay soil, cornstarch, pechay (*Brassica rapa subsp. chinensis*) seeds, loam soil, and pots.

Methods/Procedures

The researchers had allotted a lot of time, effort, and cooperation in developing and adapting independent variables. The experiment was carried out using several steps and procedures. The following were the various procedures used in this study:

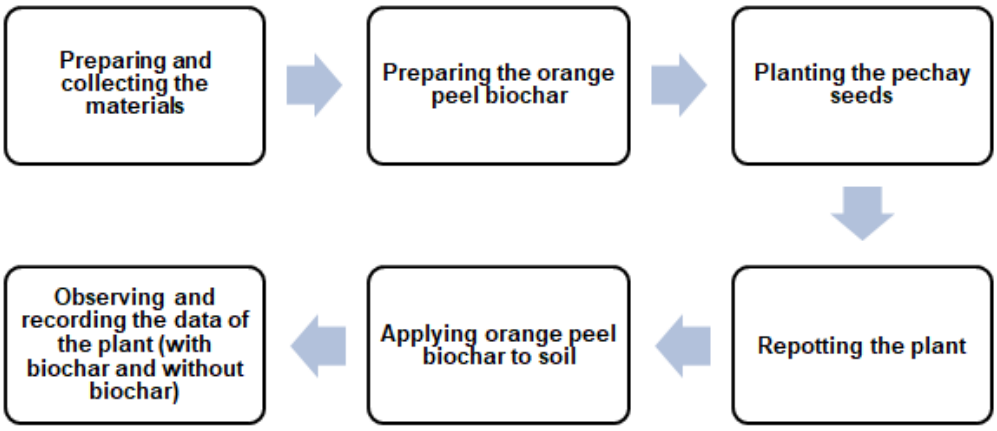

Figure 3. Research Methodology Flowchart

A. Preparing and collecting the materials

For the plant pots, the researchers made use of available pots from one of the researchers. On the other hand, materials such as pechay (*Brassica rapa subsp. chinensis*) seeds, cornstarch, and clay soil were bought from Commonwealth Market. For the soil, stock loam soil was used. Lastly, the orange peels were collected from the members of the group.

B. Preparing the orange peel biochar

Combustion process was used to produce the biochar which includes collecting orange peels, drying, and burning them. The researchers made sure that the orange peels were not fully burned down. After that, burnt orange peels were collected and pulverized. Next, clay soil was also pulverized and then mixed with the pulverized orange peels. Cornstarch was then prepared and heated with water until it was ready to be used. After boiling, it was poured and mixed into the pulverized orange peel and pulverized clay.

C. Planting the pechay seeds

Planting pechay (*Brassica rapa subsp. chinensis*) seeds was challenging because of their smooth texture, small size, round shape, and susceptibility to insects. Therefore, the researchers left one small hole in the soil inside each pot during planting, each hole containing three seeds.

D. Repotting the plants

After three (3) weeks of growth, the sprouts were repotted and the stems were buried in a bigger pot, leaving 1 cm above the soil with the leaves visible.

E. Applying orange peel biochar to soil

After dividing the sprouts into two (2) sets containing five (5) sprouts each, one set was treated with orange peel biochar. The biochar was applied into the plant's root zone – the part of the soil surrounding a plant's roots.

F. Observing and recording the data of the plant (with biochar and without biochar)

After the plants were repotted, the researchers started to record the weekly growth of the two (2) sets of pechay plants (Brassica rapa subsp. chinensis), each containing five (5) plants, one with orange peel biochar and one without orange peel biochar. The following were the components the researchers observed and analyzed:

1. number of leaves
2. height of the plant

Experiment Setup

Figure 4. Seed Germination

Figure 5. Repotting of the Sprouts

Figure 6. Applying the Orange Peel Biochar

Data Analysis

The data analysis process is a way of examining previously obtained data. The data analysis focused on the growth of the pechay plants (*Brassica rapa subsp. chinensis*) for 7 weeks using two independent samples t-tests. The data was analyzed based on the findings on the difference between the effects of orange peel biochar and without the orange peel biochar on the growth of the pechay plants (*Brassica rapa subsp. chinensis*).

Data Gathering

Data collection is a systematic method of collecting accurate information to support findings or provide evidence. This study used an observational approach to gather data. The researchers observed the physical characteristics of the pechay plant (Brassica rapa subsp. chinensis) with and without orange peel biochar, which includes the number of leaves along with its height. Moreover, the researchers provided a table to track the plants' growth.

Data Processing

The data collected were interpreted and tabulated using two independent samples t-test. The following were the steps used in data processing.

1. Tabulated and tallied the mean of the final week measurements of the height of the pechay plants in the control and experimental group.
2. Tabulated and tallied the mean of the final week measurements of the number of leaves of the pechay plants in the control and experimental group.
3. Transferred all the tabulated data collected from the plants that received orange peel biochar into Microsoft Excel.
4. Transferred all the tabulated data collected from the plants that did not receive orange peel biochar into Microsoft Excel.
5. Used Microsoft Excel's Analysis ToolPak to compute the mean, standard deviation, t-test value, and t-critical value of the control group.
6. Used Microsoft Excel's Analysis ToolPak to compute the mean, standard deviation, t-test value, and t-critical value of the experimental group.
7. Compared the computed t-test value and t-critical value of the two setups in terms of height and drew a conclusion.
8. Compared the computed t-test value and t-critical value of the two setups in terms of the number of leaves and drew a conclusion.

Statistical Treatment of Data

The independent variables collected by the researchers in this study were analyzed using two independent samples t-test. The statistical process data evaluated were the growth performance of plants in terms of the number of leaves and height in natural soil and soil with orange peel biochar, where the reseachers compared the significant difference of each group mean.

The following formula was used to compute the experimental data.

Formula:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}}}$$

Where:

$\overline{x_1}$ - mean of sample 1

s_1 - standard deviation of sample 1

N_1 - sample size of sample 1

$\overline{x_2}$ - mean of sample 2

s_2 - standard deviation of sample 2

N_2 - sample size of sample 2

Chapter 4

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This chapter contains detailed presentation and discussion of data analysis and the results of this study. The findings will be demonstrated through the tabular method as stated in the statement of the problem.

1. What is the growth performance of pechay on natural soil in terms of:

1.1. Number of leaves

Table 1. The average number of leaves of pechay planted in natural soil

Plant	Number of leaves (pcs)						
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
1	0	2	2	4	4	4	5
2	0	2	2	4	4	4	4
3	0	2	2	4	4	4	4
4	0	2	2	3	3	3	4
5	0	2	2	3	3	4	5
						Average:	**4.4**

Table 1 shows the average number of pechay leaves planted in natural soil from week 1 to week 7. As seen in the table, the number of leaves increases gradually every week, rising from an average of 2 to an average of 4.4 leaves.

1.2. Height of the plant

Table 2. The average height of pechay planted on natural soil

Plant	Height (cm)						
	Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**
1	0	4.6	5.8	2	2.1	3.3	6.8
2	0	4.2	5.7	1.8	2	3	6
3	0	4.2	5.3	1.8	2	2.5	5.3
4	0	4	5.2	1.5	1.8	2.8	5
5	0	3.8	5	1.4	1.6	2.4	4.7
						Average:	**5.56**

Table 2 shows the average height of five pechay plants planted on natural soil from weeks 1 to 7. The plants' height in weeks 2 and 3 increased. However, in the fourth week, the height decreased as the stems of the sprouts were buried into the ground, leaving the leaves on the top. Nevertheless, based on the overall seven-week measurement, the pechay plants' height on natural soil gradually increased.

2. What is the growth performance of pechay on soil with orange peel biochar in terms of:

2.1. Number of leaves

Table 3. The average number of leaves of pechay planted on soil with orange peel biochar

Plant	Number of leaves (pcs)						
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
1	0	2	3	4	4	5	5
2	0	2	2	4	4	4	6
3	0	2	2	4	4	5	5
4	0	2	2	4	4	4	5
5	0	2	3	4	4	5	6
						Average:	**5.4**

Table 3 shows the average number of leaves on continuous growth of pechay leaves planted on soil with orange peel biochar from weeks 1 to 7. As can be seen in the table, the pechay leaves increased from the average number of 2 leaves in the second week to 5.4 leaves in the seventh week.

2.2. Height of the plant

Table 4. The average height of pechay planted on soil with orange peel biochar

Plant	Height (cm)						
	Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**
1	0	4.5	6.1	2	2.2	4	8
2	0	4.3	5.8	1.9	2.1	3.4	7.6
3	0	4	5.8	1.7	2	3.2	7
4	0	3.7	5.4	1.4	1.7	3	6.8
5	0	3.6	5.1	1.2	1.6	2.5	5.9
						Average:	**7.06**

Table 4 shows the average height of pechay planted on soil with orange peel biochar from weeks 1 to 7. In the first three weeks, since the pechay plant was planted in natural soil, an increase in plant's height is noticeable. However, in the fourth week, the plant's height decreased as the plants were moved into a bigger pot and most of its stem was buried into the ground but the height still gradually increased every week as seen in the table.

3. **Is there a significant difference between the number of leaves of pechay planted on natural soil and those that are treated with orange peel biochar?**

Table 5. Comparison between the number of leaves of pechay with and without orange peel biochar

	Count	Mean (pcs)	SD	T-test value	T-critical value	Decision
Without biochar	5	4.4	0.55	- 2.89	2.31	Reject H_O
With biochar	5	5.4	0.55			

Table 5 compares the mean and standard deviation of the number of leaves of pechay (Brassica rapa subsp. chinensis) plants planted in soil with and without orange peel biochar. The table also shows the computed t-test value and t-critical value for the number of leaves in both control and experimental group. The two setups have different mean—5.4 for the experimental group while 4.4 for the control group. However, the same standard deviation was computed for both groups. This signifies that the data values in both sets are distributed around the mean in the same way. On the other hand, the absolute value of the t-test value is 2.89, which is higher than the t-critical value which is 2.31. This means that the null hypothesis for the number of leaves is rejected. Based on the result, the orange peel biochar holds a significant effect on the number of leaves. The experimental group had grown leaves efficiently compared to the control group, which shows the effectiveness of the orange peel biochar.

4. **Is there a significant difference between the height of pechay planted on natural soil and those that are treated with orange peel biochar?**

Table 6. Comparison between the height of pechay with and without orange peel biochar

	Count	Mean (cm)	SD	T-test value	T-critical value	Decision
Without biochar	5	5.56	0.84	- 2.89	2.31	Reject H_O
With biochar	5	7.06	0.80			

Table 6 shows the comparison between the mean and the standard deviation of the height of the pechay plants in both control and experimental groups. The table also includes the computed t-test and t-critical value. After the 7-week experiment, the experimental setup, or the pechay plants planted in soil with orange peel biochar, showed an average height of 7.06 cm. On the other hand, the control group only came up with an average height of 5.56 cm. The computed standard deviations for the two groups were almost the same—0.80 for the experimental group and 0.84 for the control group. The absolute value of the t-test value is 2.89 which is higher than the t-critical value which is 2.31. This means that the null hypothesis is rejected, implying that there is a significant difference between the pechay plants planted in natural soil and those that are planted in soil with orange peel biochar.

Summary

Table 7. Summary

Number of leaves						
	Count	**Mean (pcs)**	**SD**	**T-test value**	**T-critical value**	**Decision**
Without biochar	5	4.4	0.55	-2.89	2.31	Reject H_O
With biochar	5	5.4	0.55			
Height						
	Count	**Mean (cm)**	**SD**	**T-test value**	**T-critical value**	**Decision**
Without biochar	5	5.56	0.84	-2.89	2.31	Reject H_O
With biochar	5	7.06	0.80			

Table 7 presents the summary of data using two independent samples t-test of the number of pechay leaves and height of pechay planted in natural soil with and without orange peel biochar. The table shows the mean, standard deviation, t-test value, and t-critical value of the control and experimental group. The table was matched to the independent samples t-test, which determines if there is a significant difference between the means of two groups. The orange peel biochar holds a significant effect on the number of leaves and height of the pechay plant than the control group. When compared to the control group, the experimental group grew leaves and height more efficiently, which shows the effectiveness of the orange peel biochar. Nonetheless, the outcome of each configuration varies significantly, rejecting the null hypotheses.

Chapter 5

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents the summary of the findings, conclusions and recommendations based on the data analyzed in the previous chapter. The conclusions were drawn based on the purpose, research questions and results of the study. The implications of these findings and the recommendations will also be explained. Recommendations were based on the conclusions drawn and purpose of the study.

Summary of Findings

The following findings are presented based on the accumulated data:

1. The results of the data collection for pechay growth on natural soil. During the 7 weeks of monitoring, the average number of leaves steadily rose from 0 to 4.4 pieces. The same can be said about height, which increased from an average of 0 to 5.56 centimeters.
2. For the findings of the data for the performance growth of pechay plant with orange peel biochar. The average mean of the number of leaves is 5.4 in the seventh week, while the average mean of the height of the plant is 7.06 in the seventh week.
3. The average mean of the data acquired in the two settings differs in terms of the number of leaves on the plant. The control group's average mean for the number of leaves is 4.4, whereas the experimental group's average mean is 5.4. The standard deviation for both setups is 0.55. Meanwhile, the t-test value is -2.89, while the t-critical value is 2.31.

4. The average mean of the data collected in the two setups in terms of the height of the plant differs. The average mean for the height of a plant without biochar is 5.56, while the mean for the plant with biochar is 7.06. The standard deviation of the plant's height without biochar is 0.84. Meanwhile, the standard deviation of the pechay with orange peel biochar is 0.80. Both setups have a t-test value of -2.89 and a t-critical value of 2.31.

Conclusion

The purpose of this study was to determine the effectiveness of orange peel biochar as a soil amendment for pechay (Brassica rapa subsp. chinensis) plant. The effectiveness was assessed by observing the physical growth response of the plants in terms of height and number of leaves. Based on the data gathered, the following conclusions were drawn:

1. In the pechay plants that were not treated with orange peel biochar, the growth performance in number of leaves and its height is about average. For the number of leaves, the growth was steady as observed with the data from week 1 to 7. There is also a constant rate of growth in height of the plants, however, the height diminished at week 4 when the Pechay plants were repotted and moved to a bigger pot during week 3. The height of the plants gradually increased in the following weeks.
2. In the experimental group, the growth performance of the pechay plants showed a gradual progression. For the number of leaves, the growth was stable—growing another leaf every two weeks. The height of the plants also exhibited a steady performance from week 1 to week 3. The height decreased at week 4

after the plants were transferred into bigger pots, burying the stems into the soil. However, in the last week, the plants showed a sudden increase in height, almost doubling the recorded height from the past week.

3. Based on the computed data and findings of the study, there is a significant difference between the pechay plants that were planted on natural soil and plants that have been treated with orange peel biochar. The number of leaves of plants in the control group exhibited a moderate development. It was observed that the number of leaves remained constant for an average of three weeks before growing another one. On the other hand, the plants in the experimental group showed higher values in terms of the number of leaves. The plants had grown a leaf every two weeks which is a little faster than the control group. Considering the computed data, the researchers concluded that orange peel biochar has a significant effect on the growth of pechay plants in terms of the number of leaves, rejecting the null hypothesis.
4. The experimental group exhibited a better performance. The pechay plants planted in soil with orange peel biochar showed higher values in terms of height. The height of pechay in the control and experimental group exhibited gradual growth in the first three weeks. The repotting of the pechay plants resulted in the decrease of their height as they were moved into a bigger pot with their stems buried into the ground. In the following weeks, constant growth was observed in both the plants in experimental and control groups. However, the experimental group showed higher values in terms of height. The plants had shown a higher level of growth in height even in small margins on the experimental group.

Based on the statistical data collected by the researchers, the absolute value of the t-test value is higher than the critical value, rejecting the null hypothesis. Thus, it is concluded that orange peel biochar has a significant effect on the growth of pechay plants in terms of height.

Recommendations

Based on the conclusion and the findings of the study, here are the recommendations to be considered:

1. To the students, especially those who aspire to improve this study, observe the pechay plants with and without orange peel biochar in a longer time frame and increase the set of samples to provide more accurate results.
2. To the educators, teach students how to be resourceful by recycling organic materials into something that can benefit the society.
3. To the community, the researchers recommend to consider converting organic wastes into fertilizers or organic soil amendment to lessen the environmental wastes.
4. To the horticulturists, the researchers recommend using organic biochar to boost their plants' growth since it is low-cost and helps in reducing wastes.
5. To the future researchers, instead of using the combustion process, use the pyrolysis process in making orange peel biochar. Moreover, aside from observing the physical growth of plants, observe the effects of orange peel biochar on soil property, different types of soil, and different types of plants.

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APPENDICES

APPENDIX A

Experiment Documentation

A. Preparation of Materials

Figure Orange Peel Biochar Preparation

Planting Materials

C. Planting

D. Repotting and Application of Biochar

E. Week 7

With Biochar

Without Biochar

F. Week 10


With Biochar


Without Biochar

APPENDIX B

T-test Tables

A. T-test Table for Number of Leaves

t-Test: Two-Sample Assuming Unequal Variances

	Without biochar	*With biochar*
Mean	4.4	5.4
Variance	0.3	0.3
Observations	5	5
Hypothesized Mean Difference	0	
df	8	
t Stat	-2.886751346	
P(T<=t) one-tail	0.010150047	
t Critical one-tail	1.859548038	
P(T<=t) two-tail	0.020300094	
t Critical two-tail	2.306004135	

B. T-test Table for Height

t-Test: Two-Sample Assuming Unequal Variances

	Without biochar	*With biochar*
Mean	5.56	7.06
Variance	0.713	0.648
Observations	5	5
Hypothesized Mean Difference	0	
df	8	
t Stat	-2.886751346	
P(T<=t) one-tail	0.010333819	
t Critical one-tail	1.859548038	
P(T<=t) two-tail	0.020667638	
t Critical two-tail	2.306004135	

APPENDIX C

Curriculum Vitae

CHARLES KENNETH P. CALUMPIANO
141 San Miguel St., Commonwealth, Quezon City
0956-855-8620/ 0930-672-00085
calumpiano.charles@gmail.com

CAREER OBJECTIVE

To obtain a responsible work position where I can apply my training and abilities to good use while also contributing to the company's success. Aspiring to gain more experience in the field of structural engineering with dedication and eagerness in mind.

PERSONAL INFORMATION

Birthday:	November 27, 2003
Age:	18 years old
Birthplace:	Quezon City
Sex:	Male
Civil Status:	Single
Height:	5'10
Weight:	60 kls.

SKILLS & QUALIFICATIONS

- Competence with innovative thinking and industry skills.
- In-depth knowledge of computer modeling, structural designing, construction, and project management.
- Ability to communicate in a clear and concise way via written reports and correspondence.
- Capability to listen to clients, officials, team members, and other skilled workers to effectively grasp their concerns and requests.
- Work well under pressure as part of a team.
- Strong communication skills to delegate work, collaborate with teammates, and understand the details of a task.
- Ability to keep up with fast-paced work environment.

EDUCATION

Senior High School	Commonwealth High School Academic Track major in Science, Technology, Engineering, and Mathematics Ecols St., Brgy. Commonwealth, Quezon City	2020-Present
Junior High School	Commonwealth High School Ecols St., Brgy. Commonwealth, Quezon City	2016-2020

Elementary School	Manuel L. Quezon Elementary School MRB Compound, Pilot Area, Brgy. Commonwealth, Quezon City	2010-2016

ACHIEVEMENTS

- Batch 2016 Second Honorable Mention
- Grade 7 High Honors Awardee
- Grade 8 High Honors Awardee
- Grade 9 High Honors Awardee
- Grade 10 High Honors Awardee
- Grade 11 High Honors Awardee

TRAINING AND SEMINARS ATTENDED

March 21, 2022	Work Immersion Rules	
March 18, 2022	How to Ace an Interview	
March 16, 2022	Effective Conflict Resolution and Teamwork Skills	Commonwealth High School Work Webinar Series
March 14, 2022	Workplace Rights and Responsibilities	
March 11, 2022	Work Ethics	

CHARACTER REFERENCES:

Mrs. Lynji Pedrosa SHS Adviser Commonwealth High School	**Mrs. Athena Baetiong** Guidance Counselor Commonwealth High School	**Mr. Agapito T. Lera** Principal Commonwealth High School

I hereby declare that all the information contained in this resume is in accordance with facts or truths to my knowledge.

Charles Kenneth P. Calumpiano
Applicant

CHARLES DENISE DEL ROSARIO

30 San Lorenzo Ruit St., Brgy. Payatas A, Quezon City
0956-492-6229
delrosario.charlesdenise30@gmail.com

CAREER OBJECTIVE

Diligent senior high school student who has never failed to meet every project deadline during six years at Commonwealth High School. Aiming to leverage my interpersonal skills, analytical skills and knowledge of the engineering field to land a trainee position at CKI BUILDERS AND ENGINEERING SERVICES' engineering team. Ability to critically think and adjust to any working environment. Certified in Commonwealth High School.

PERSONAL INFORMATION

Birthday:	July 30, 2003
Age:	18
Birthplace:	San Jose Del Monte, Bulacan
Sex:	Male
Civil Status:	Single
Height:	5"8
Weight:	65 kg

SKILLS & QUALIFICATIONS

- Resilience to work and keep up fast-paced in tough working environment.
- In-depth knowledge of process modeling, production planning, and project management.
- Observant to details, capability to delegate the task
- Work well under pressure as a part of a team.
- Successful at working precisely and accurately in an intense environment.

EDUCATION

Senior High School Present	Commonwealth High School Science,Technology, Engineering & Mathematics (STEM) Ecols St., Brgy, Commonwealth, Quezon City	2022-Present
Junior High School	Commonwealth High School Ecols St., Brgy, Commonwealth, Quezon City	2016-2020
Elementary School	Melencio M. Castelo Elementary School Ilang-Ilang, Quezon City	2015-2016

ACHIEVEMENTS

- Grade 7 High Honors Awardee
- Grade 8 High Honors Awardee
- Grade 9 High Honors Awardee
- Grade 10 High Honors Awardee
- Grade 11 High Honors Awardee

TRAINING AND SEMINARS ATTENDED

March 21, 2022	Work Immersion Rules	Commonwealth High School Work Webinar Series
March 18, 2022	How to Ace an Interview	
March 16, 2022	Effective Conflict Resolution and Teamwork Skills	
March 14, 2022	Workplace Rights and Responsibilities	
March 11, 2022	Work Ethics	

CHARACTER REFERENCES:

Mrs. Deceere M. Remeticado
Work Immersion Teacher
Commonwealth High School
0956-754-3557

Mrs. Lynji Pedrosa
SHS Adviser
Commonwealth High School
0956-754-3557

Mrs. Athena Baetiong
Guidance Counselor
Commonwealth High School
0910-554-7265

I hereby declare that all the information contained in this resume is in accordance with facts or truths to my knowledge.

Charles Denise del Rosario
Applicant

HEROEI MANAAY
Blk 08 Lot 07 Adarna Ext. Purok 20 Unit 5,
Commonwealth, Quezon City
0950-145-5259/ 0927-036-2793
manaayheroei@gmail.com

CAREER OBJECTIVE

To obtain a responsible work position where I can apply my training and abilities to good use while also contributing to the company's success. Aspiring to gain more experience in the field of structural engineering with dedication and eagerness in mind.

PERSONAL INFORMATION

Birthday:	August 31, 2003
Age:	18 years old
Birthplace:	Quezon City
Sex:	Male
Civil Status:	Single
Height:	5'4
Weight:	50 kls.

SKILLS & QUALIFICATIONS

- Competence with drafting techniques and the design-making process.
- Creative ability with artistic skill in designing projects and other plates.
- In-depth knowledge of architectural concepts, projects planning, and designs.
- Keen to details.
- Work well under pressure as part of a team.
- Work in polite, respectful, and courteous manners.
- Ability to work in a fast-paced, intense environment smoothly.

EDUCATION

Senior High School	Commonwealth High School Academic Track major in Science, Technology, Engineering, and Mathematics Ecols St., Brgy. Commonwealth, Quezon City	2020-Present
Junior High School	Commonwealth High School Ecols St., Brgy. Commonwealth, Quezon City	2016-2020

Elementary School	Benigno S. Aquino Jr. Elementary Schoo Commonwealth Avenue, Katuparan St., Brgy. Commonwealth, Quezon City	2010-2016

ACHIEVEMENTS

- Grade 7 With Honors Awardee
- Grade 8 With Honors Awardee
- Grade 9 With Honors Awardee
- Grade 10 With Honors Awardee
- Grade 11 High Honors Awardee

TRAINING AND SEMINARS ATTENDED

March 21, 2022	Work Immersion Rules	
March 18, 2022	How to Ace an Interview	
March 16, 2022	Effective Conflict Resolution and Teamwork Skills	Commonwealth High School Work Webinar Series
March 14, 2022	Workplace Rights and Responsibilities	
March 11, 2022	Work Ethics	

CHARACTER REFERENCES:

Mrs. Lynji Pedrosa
SHS Adviser
Commonwealth High School
0956-754-3557

Mrs. Athena Baetiong
Guidance Counselor
Commonwealth High School
0910-554-7265

I hereby declare that all the information contained in this resume is in accordance with facts or truths to my knowledge.

Herbert Manday
Applicant

REAMILYN SORIANO ARABE
332 4th Street Bitoon Circle
Barangay Commonwealth, Quezon City
0921-670-9793
reamilynarabe@gmail.com

PERSONAL INFORMATION

Date of Birth:	March 29, 2004
Place of Birth:	Rosario, La Union
Age:	17
Sex:	Female
Citizenship:	Filipino
Civil Status:	Single
Height:	5'0
Weight:	50 kg.

SKILLS AND QUALIFICATIONS

- Excellent in oral and written communication skills
- Proficiency in Microsoft Office
- Word Processing Skill
- Highly motivated and self-sufficient
- Detail-oriented

EDUCATION

Senior High School	Commonwealth High School Science, Technology, Engineering, and Mathematics (STEM) strand Ecols St., Commonwealth, Quezon City	2020-Present
Junior High School	Commonwealth High School Ecols St., Commonwealth, Quezon City	2016-2020
Elementary School	Commonwealth Elementary School Commonwealth Avenue Commonwealth, Quezon City	2010-2016

ACHIEVEMENTS

- Grade 8 and Grade 9 Honor Awardee
- Grade 10 and Grade 11 High Honor Awardee

TRAINING AND SEMINARS ATTENDED

May 14, 2022	Introduction to Food and Beverage Services	Technical Education and Skills Development Authority (TESDA)
March 18, 2022	How to Ace an Interview and Personality Plus: Dress to Impress	Commonwealth High School Work Immersion Webinar Series
March 16, 2022	Effective Conflict Resolution and Teamwork Skills	Commonwealth High School Work Immersion Webinar Series
March 14, 2022	Confidentiality in the Workplace	Commonwealth High School Work Immersion Webinar Series
March 14, 2022	Workplace Rights and Responsibilities	Commonwealth High School Work Immersion Webinar Series
March 11, 2022	Work Ethics and Safety in the Workplace	Commonwealth High School Work Immersion Webinar Series

CHARACTER REFERENCES

Mrs. Mary Joan D. Bagunu
Grade 10 Teacher
Commonwealth High School

Mrs. Mary Jean Baccay
SHS Teacher
Commonwealth High School

Mrs. Lynji Pedrosa
SHS Teacher
Commonwealth High School

I hereby declare that all of the information contained in this resume is in accordance with facts or truths to my knowledge.

Reamilyn S. Arabe
Researcher

Name: Rosemarie S. Bago

Address: Purok 20 Unit V. Barangay Commonwealth Quezon City

Cell Number: 09473505763

E-mail address: rosemariebago11@gmail.com

PERSONAL INFROMATION

Birthday: September 14, 2003

Birthplace: Quezon City

Age: 18 years old

Sex: Female

Nationality: Filipino

Civil Status: Single

EDUCATION

Senior High School

2020 – Present

Commonwealth High School

Science Technology Engineering and Mathematics

Junior high school

2016 – 2020

Elementary

2010 - 2016

Manuel L. Quezon Elementary School

SKILLS AND QUALIFICATION

- ✓ Cooperation
- ✓ Organizational
- ✓ Attention to detail
- ✓ Data analysis
- ✓ Work in polite, respectful and courteous manners.
- ✓ Work well under pressure as a part of a team or solo.

ACHIEVEMENTS

- ✓ Grade 11 with honor awardee.
- ✓ Batch 2020 junior high school with honor awardee.

TRAINING AND SEMINARS ATTENDED

March 21, 2022	Personality PLUS: Dress to Impress	Commonwealth High School Work Immersion Webinar Series
March 18, 2022	Effective Conflict Resolution and Teamwork Skills	
March 14, 2022	Confidentiality in the Workplace	
March 14, 2022	Workplace Rights and Responsibilities	
March 11, 2022	Work Ethics and Safety in the Workplace	

CHARACTER REFERENCES

Mrs. Mary Joan D. Bagunu	Mrs. Mary Jean Baccay	Mrs. Lynji Pedrosa
Grade 10 Teacher	SHS Teacher	SHS Teacher
Commonwealth High School	Commonwealth High School	Commonwealth High School

I hereby declare that all of the information contained in this resume curriculum vitae is in accordance with facts or truths to my knowledge.

Rosemarie S. Bago

Researcher

BETTE ANJANELLE M. CABARLES

178 Don Fabian Extension, Brgy. Commonwealth, Quezon City
0949-968-8087
betteanjanelle@gmail.com

OBJECTIVE

To be able to train at your company in order to broaden my knowledge and talents, as well as to give my quality service. This would be a valuable learning experience for me, and I want to pursue additional opportunities in the future. I want to face challenges, and accomplishment is my aim.

PERSONAL INFORMATION

Birthday:	February 12, 2004
Age:	18 years old
Birthplace:	Quezon City
Sex:	Female
Civil Status:	Single
Height:	4′ 11″
Weight:	51 kg.

SKILLS & QUALIFICATIONS

- Ability to explain complex instructions and concepts through technical writing.
- Capable of utilizing Microsoft Office applications such as Word, PowerPoint, and Excel.
- Have the ability to analyze and assess a situation or issue before making a decision.
- Capable of communicating with and relating to team members.
- Great time management skills.
- Person who is dependable and trustworthy.
- Willingness and ability to adjust to a new environment.

EDUCATION

Senior High School	Commonwealth High School Academic Track major in Science, Technology, Engineering, and Mathematics. Ecol St., Commonwealth, Quezon City	2020 – Present
Junior High School	Commonwealth High School Ecol St., Commonwealth, Quezon City	2016 - 2020
Elementary School	Manuel L. Quezon Elementary School MRB Compound, Pilot Area, Commonwealth, Quezon City	2010 - 2016

ACHIEVEMENTS

- Grade 11 with High Honors Awardee
- Grade 10 With Honors
- Consistent Junior High School students with Honors Awardee

TRAININGS AND SEMINARS ATTENDED

March 18, 2022	How to Ace an Interview	Commonwealth High School Work Immersion Webinar Series
March 16, 2022	Effective Conflict Resolution and Teamwork Skills	
March 14, 2022	Confidentiality in the Workplace	
March 14, 2022	Workplace Rights and Responsibilities	
March 11, 2022	Work Ethics and Safety in the Workplace	
March 9, 2022	Entrepreneurial Management	

CHARACTER REFERENCES

Dr. Lynji Pedrosa	**Mrs. Deceree Mae Remeticado**	**Mrs. Lorelina G. Morera**
Grade 12 Adviser	Work Immersion Teacher	OIC/Assistant School Principal
Commonwealth High School	Commonwealth High School	Commonwealth High School

I hereby declare that all the information contained in this resume is in accordance with facts or truths to my knowledge.

CABARLES, BETTE ANJANELLE M.
Applicant

DYBEA REIGN C. CABRERA

#253 B Kasunduan Extension Brgy. Comm. Q.C
Contact No.: 09654403448

OBJECTIVES:

To be given admission to a pediatric internship at the postgraduate level, where I may use my patient and medical expertise.

PERSONAL INFORMATION:

Age	:	17 years old
Gender	:	Female
Civil Status	:	Single
Weight	:	99 lbs.
Height	:	5'0
Citizenship	:	Filipino
Religion	:	Roman Catholic

EDUCATIONAL ATTAINMENT:

Senior High	:	Commonwealth High School
Strand	:	Science, Technology, Engineering, and Mathematics
School Year	:	2020-2022
Secondary	:	Commonwealth High School Ecols St. Brgy. Comm. Q.C
School Year	:	2016-2020
Elementary	:	Commonwealth Elementary School Brgy. cor. Katuparan St. District 2, 170, Novaliches, Q.C
School Year	:	2010-2016

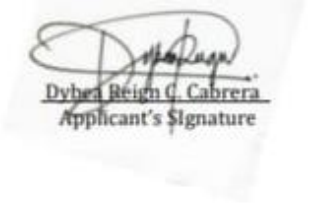
ACHIEVEMENTS:

- 1st Place in Quiz Bee (Araling Panlipunan)
- SPG P.R.O
- 2nd Place best News Presenter
- 2nd Place best in Infomercial
- 2nd Place best in Technical Application
- 2nd Place English Radio Broadcasting

TRAINING AND SEMINARS ATTENDED

March 18, 2022	Effective Conflict Resolution and Teamwork Skills
March 14, 2022	Confidentiality in the Workplace
March 14, 2022	Workplace Rights and Responsibilities
March 11, 2022	Work Ethics and Safety in the Workplace

I hereby that the above information is true and correct to the best of my knowledge and belief.



Dybea Reign C. Cabrera
Applicant's Signature

Elisha Reign Mier

662-B Martan St. Brgy Commonwealth, Quezon City

0945-118-7038

elishamier13@gmail.com

Objective

To obtain a challenging position in a reputable organization to expand my learnings, knowledge, and skills. And to secure a responsible career opportunity to fully utilize my training and skills, while making a significant contribution to the success of the company.

Personal Information

Birthday:	April 2, 2004
Age:	17
Birthplace:	Quezon City
Sex:	Female
Civil Status:	Single
Height:	153 cm
Weight:	54 kg

Skills & Qualifications

- Worked on the publiched campus paper during junior high school as sports writer.
- Can work under pressure with minimal supervision.
- Willing to learn and can adapt to changes.
- Can do digital illustration.
- Deploying and repairing hardware and software.

• Has the ability to utilize critical thinking.

Education

Senior High School	Commonwealth High School Academic track major in Science, Technology, Engineering and Mathematics Ecols St. Brgy Commonwealth, Quezon City	2020-Present
Junior High School	Commonwealth High School Ecols St. Brgy Commonwealth, Quezon City	2016-2020
Elementary School	Manuel L. Quezon Elementary School MRB Compound, Pilot Area Brgy Commonwealth, Quezon City	2010-2016

Achievements

- Grade 11 Academic Awardee
- Grade 10 High Honors Awardee
- Consistent Junior High School with Honors Awardee

Training & Seminars Attended

March 18. 2022	How to Ace an Interview	
March 16, 2022	Effective Conflict Resolution and Teamwork Skills	Commonwealth High School Work Immersion Webinar Series
March 14, 2022	Confidentiality in Workplace and Workplace Rights and Responsibilities	
March 11, 2022	Work Ethics and Safety in Work	
March 09, 2022	Entrepreneurial Management	

Character References

Mrs. Lynji Pedrosa	**Mrs. Deceree Mae Remeticado**	**Mrs. Lorelina Morera**
Grade 12 Adviser	SHS Subject Teacher	OIC/Assistant School Principal
Commonwealth High School	Commonwealth High School	Commonwealth High School

I hereby declare that all the information contained in this resume is in accordance with facts or truths to my knowledge.

Elisha Reign Mier
Applicant

ALTHEA LOUISE PAYUMO

OBJECTIVE

To attain an engaging position in the field of biological research where I can practice my researching skills on biological organisms and serve my abilities to the company I am working for following their goals and objectives. Eagerness to obtain experience on research through examining organisms that will truly help me in my future career; a doctor.

PERSONAL INFORMATION

Birthday:
September 23, 2003

Age:
18 years old

Birthplace:
San Juan City

Sex:
Female

Civil Status:
Single

Height:
5"1

Weight:
57 kg

PERSONAL INFORMATION

Cellphone:
0966-783-2007
1995-7446-364

E-mail Address:
althea.payumo23@gmail.com

EDUCATION

Senior High School
Golden Lamp School of Quezon City
- 2020 - Present
- Academic Track - Science, Techonology, Engineering, and Mathematics
- Ecols St., Brgy. Commonwealth, Quezon City

Junior High School
New Era University
- 2017 - 2020
- 9 Central Ave, New Era, Quezon City, 1107 Metro Manila

Elementary
Golden Lamp School of Quezon City
- 2011 - 2017
- 082 Gold St, Quezon City, 1121 Metro Manila

ACHIEVEMENTS

- **Academic Honor Awardee (2019)**
- **Kalipunan ng Huwarang Kabataan awardee (2019)**
- **Academic Honor Awardee (2020)**
- **Kalipunan ng Huwarang Kabataan awardee (2020)**
- **Academic Honor Awardee (2021)**
- **With High Honor Awardee (2022)**

SKILLS AND QUALIFICATIONS

- **Capable of working under pressure.**
- **Can work well in groups.**
- **Has great leadership skills.**
- **Good communication skills.**
- **A critical thinker.**
- **Good adaptability skills.**

TRAININGS AND SEMINARS ATTENDED

May 10, 2021 | Department of Science and Technology
SCIENTEACH: A Virtual Symposium for the Youth

May 11, 2021 | Commonwealth High School
Work Ethics and Safety in the Workplace

May 14, 2021 | Commonwealth High School
Workplace Rights and Responsibilities

May 14, 2021 | Commonwealth High School
Confidentiality in the Workplace

May 18, 2021 | Commonwealth High School
Effective Conflict Resolution and Teamwork Skills

May 21, 2021 | Commonwealth High School
Personality PLUS: Dress to Impress

CHARACTER REFERENCES

Mrs. Mary Jean Baccay
SHS Teacher
0995-456-9673

Mrs. Lynji Pedrosa
SHS Teacher
0964-581-9957

Mrs. Jhonna Carbonel
JHS Teacher
0967-995-9543

I hereby declare that all information contained in this resume is in accordance with facts or truths to my knowledge.

Althea Louise C. Payumo
Applicant

ROSEMARY EDENWISE R. TURINGAN
Kilyawan St., Brgy. Commonwealth, Quezon City
0927-612-8603
rosemaryedenwiseturingan@gmail.com

OBJECTIVES

To obtain a position that can provide professional growth and opportunity to utilize my knowledge and skills.

PERSONAL INFORMATION

Birthday:	May 09, 2003
Age:	18
Birthplace:	Manila
Civil Status:	Single
Height:	5"0
Weight:	40

SKILLS & QUALIFICATIONS

-Strong leadership skill
-Competitive in fulfilling my duties
-Have strong determination in achieving goals
-Have a knowledge in creating different writing categories.
-Fast learner
-Works well even under pressure

EDUCATION

Senior High School	Commonwealth High School Academic Track major in Science, Technology, Engineering and Mathematics Ecols St., Brgy. Commonwealth, Quezon City	2020-present
Junior High School	Commonwealth High School Ecols St., Brgy. Commonwealth, Quezon City	2016-2020
Elementary	Manuel Luis Quezon Elementary School MRB Compound, Pilot Area, Brgy. Commonwealth, Quezon City	2010-2016

WORK EXPERIENCE

Gintong Dahon
Editor-in-Chief
June-March 2020
Ecols St., Brgy. Commonwealth, Quezon City

Responsibilities:
-Fact checking information in articles
-Reviewing written content for spelling and grammar errors
-Approving publication's layout, design, style, and tone.

ACHIEVEMENTS

-CENTREX Batch 22 Rank 8
-Grade 10 High Honors Awardee
-Highest Top Pointer in Filipino Journalism
-4th Placer in News and Editorial Writing District Competition

TRAININGS AND SEMINARS ATTENDED

March 18, 2022	How to Ace an Interview	Commonwealth High School
March 16, 2022	Effective Conflict Resolution and Teamwork Skills	Commonwealth High School
March 14, 2022	Workplace Rights and Responsibilities	Commonwealth High School
March 11, 2022	Work Ethics and Safety in Workplace	Commonwealth High School
March 09, 2022	Entrepreneurial Mindset	Commonwealth High School
Batch 22	CENTREX	Quezon City Division Office
December 10, 2019	Youth for Truth Caravan	Don Alejandro Roces Science and Technology High School
July 20,2019	Interact District Training Assembly	Don Alejandro Roces Science and Technology High School

CHARACTER REFERENCES

Dr. Agapito T. Lera
CHS Principal
Commonwealth High School

Dr. Lynji Pedrosa
STEM Mendeleev Adviser
Commonwealth High School

Mrs, Deceree Mae Remeticado
STEM WI Aviser
Commonwealth High School

I hereby declare that all the information contained in this resume is in accordance with facts or truths to my knowledge.

Rosemary Edenwise R. Turingan

Applicant