COMPARISON BETWEEN SOIL AMENDMENT PINEAPPLE PEELS POWDER AND COMMERCIAL ORGANIC FERTILIZER ON GROWTH PERFORMANCE OF *ABELMOSCHUS ESCULENTUS* (OKRA) SEEDLING

By

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A report submitted in fulfillment of the requirements for the Degree of Bachelor of Applied Science (Agrotechnology) with Honours

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DECLARATION

I hereby declare that the work embodied in this report is the result of the original research and has not been submitted for a higher degree to any universities or institutions.

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I certify that the report of this final year project entitled "Comparison Between Soil Amendment Pineapple peels Powder and Commercial Organic fertilizer on Growth Performance of *Abelmoschus esculentus* (Okra) Seedling" by Nur Ayuni Binti Esa, matric number F14A0227 has been examined and all the correction recommended by examiners have been done for the degree of Bachelor of Applied Science (Agrotechnology) with Honours, Faculty of Agro-Based Industry, Universiti Malaysia Kelantan.

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Comparison between Soil Amendment Pineapple peels Powder and Commercial Organic fertilizer on Growth Performance of *Abelmoschus esculentus* (Okra) seedling

ABSTRACT

Comparison between Soil Amendment Pineapple peels Powder and Commercial Organic fertilizer on Growth Performance of *Abelmoschus esculentus* (Okra) seedling was investigated to decrease the of period of yield and to increase the rate of germination seed by using pineapple fruits peel powder as soil amendement. The objectives of this study was to measure the growth performance of okra seedlings based on several parameters. Secondly was to compare the impact of soil amendment Pineapple peels Powder and Commercial Organic fertilizer on the physical growth of okra seedlings. The study was conducted at UK Agro Resort, Kluang, Johor and has been conducted for 42 days started in the end of February to early April, 2018. The pineapple peels formulations were dried under direct sunlight technique for 20 days. Then it be grinded in the mixer and produced in the form of rough powder form. The experiment was designed in Completely Randomized Design (CRD) with 2 treatments and 15 replication for each treatment. The plants were labelled with Control and Treatment 1. Both treatment were mixed of soil and sand. Pineapple peel were added into planting medium of Treatment 1 while for Control Treatment it only contains of soil and sand. After being mixed between soil and pineapple peels of Treatment 1, the planting medium were left out for 15 days before sown the seeds. The parameters was being observed were the germination rate of okra seedlings, height of plant, number of branches, number of leaves, and survival percentage of okra plant until the end of study. Plants in treatment 1 shows a positive feedback, however, results of Treatment 1 cannot suppress the result of Control Treatment.

Keywords: *Abelmoschus esculentus* (Okra), organic fertilizer, plant growth performance, fruits peel

Perbandingan Antara Unsur tambahan Tanah kulit Nenas dan baja Organik Komersial Ke atas Tumbesaran Biji Benih *Abelmoschus esculentus* (Bendi).

ABSTRAK

Perbandingan Antara Unsur tambahan Tanah kulit Nenas dan baja Organik Komersial Ke atas Tumbesaran Biji Benih *Abelmoschus esculentus* (Bendi) telah di kaji dalam untuk mempercepatkan masa penghasilan dan meningkatkan kadar percambahan benih dengan menggunakan kulit buah nenas sebagai unsur tambahan. Objektif kajian ini adalah untuk mengukur pertumbuhan biji benih pokok bendi berdasarkan beberapa parameter. Seterusnya, untuk membandingkan kesan penggunaan kulit buah nenas sebagai unsur tambahan kepada tanah dan baja organic komersil ke atas ciri fizikal biji benih pokok bendi. Kajian ini dijalankan di UK Agro Resort, Kluang, Johor telah dijalankan selama 42 hari bermula pada hujung bulan Februari dan berakhir pada hujung April. Formulasi kulit buah telah di keringkann di bawah cahaya matahari selama 20 hari, dan telah di kisar di dalam bentuk serbuk kasar. Kajian ini telah direka secara rawak dengan 2 rawatan dan 15 pengulangan setiap rawatan. Pokok itu dilabel sebagai kawalan dan Rawatan 1. Kedua-duanya dicampurkan dengan tanah dan pasir. Kulit nenas dicampur kedalam rawatan 1 manakala Kawalan hanya mengandungi campuran tanah dan pasir sahaja. Media tanaman tersebut di biarkan selama 15 hari sebelum benih disemai. Parameter yang dipantau adalah kadar percambahan biji benih bendi, ketinggian pokok, bilangan ranting, bilangan daun dan peratusan pokok bendi yang hidup sehingga tamat kajian. Pokok Rawatan 1 menunjukkan kesan positif, walaubagaimanapun, keputusan Rawatan 1 tidak boleh menandingi keputusan Kawalan.

Kata Kunci: *Abelmoschus esculentus* (Bendi), baja organik, kadar tumbesaran pokok, kulit buah

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LIST OF ABBREVIATIONS AND SYMBOLS

C	Control
cm	centimeter
CRD	Completely Randomized Design
DMRT	Duncan Multiple Range test
FAO	Food and Agriculture Organization
g	gram
mg	miligram
MoEF	Ministry of Environment and Forest
NST	New Straight Times
OGTR	Office of Gene Technology Regular
°C	degree Celcius
%	percentage
SPSS	Statistical Package for the Social Science
n	Sample size
T1	Treatment 1
N	Nitrogen
P	Phosphorus
K	Potassium

CHAPTER 1

INTRODUCTION

1.1 Research Background

Fertilizers are any organic or inorganic material of natural or synthetic origin that is added to the soil as a supplement to the plants. For growth of plants, one or more plant nutrients is necessary (Mercy, S, & Jenifer, 2014). High amount of antioxidants content in fruit will be very beneficial to our health in many ways (Faria, Calhau, Freitas & Mateus, 2006). The usage of fertilizer may have some advantages and disadvantages depends on the type of fertilizers. Chemical fertilizer contains sulphate of ammonia, they may be processed from quarried mineral. Chemical fertilizer can cause harm toward human, animal and environment (Mercy et al., 2014). While, organic fertilizers which are safer to human, animal and environment. Organic fertilizer is more preferred as environmental pollution can be avoided and also reduce the cost of chemical fertilizers (Bakheit & Elsadig, 2015). The cost of producing organic fertilizers can be reduced as the organic fertilizer can be prepared by own and it can use the food waste or fruit peels.

Plant is the primary producer of food that feeds the whole world human population and the animals through their photosynthesis process (Strange, 2006). Plants are generally multicellular, autotrophic living organism where they also shows reaction towards the effect of fertilizer on plant growth performance. Plants will show a positive

feedback if the fertilizer influences their growth rate. In previous studies, it is shown that the application of fertilizer can promote the plant growth.

Tropical fruits are defined as fruits that are grown in hot and humid regions. Tropical fruit trees are a major source of carbohydrates and vitamins for much of the developing world population. The world production of the major tropical fruits from trees is expected to reach 65 million tons for the year 2010, with 98% of the global production by developing countries (Borrone, Tondo, Kuhn, & Irish, 2012) and based on National Agrofood Policy (DAN) forecast stated that the increased demand of tropical fruits and the demand for local tropical fruits will increase to 2.7 million metric tonnes by 2020 with 2.3% growth rate per annum (Rozana, N.M.M, Suntharalingam & Othman, 2017) . Malaysian tropical fruits have faced heightened competition from other Asian countries such as The Philippines, Thailand, India, China and Indonesia. These countries produce and trade similar fruits as Malaysia, making them Malaysia closest competitors.

The purpose on choosing *Abelmoschus esculentus* (Okra) plant in this research is because there is a few research about the effect of organic fertilizer from fruit peels on plant growth performance and in previous study, Mercy et al (2014) conducted a research about fruit peels as natural fertilizer on plant growth. In the research, it tested on several seeds such as fenugreek, rice, mustard and Rye. *Abelmoschus esculentus* (Okra) is chosen because of the high demands for vegetables. Malaysian horticultural industry is one of the sector which is contributing fresh fruits and vegetables to the population. According to Samah (2007) in food balance sheet 2006 shows okra is one of commodities vegetables in Malaysia that being consumed and exported. In this research, peels skin from pineapple was chosen to compare between Soil Amendment

pineapple peels Powder and Commercial Organic fertilizer on Growth Performance of *Abelmoschus esculentus* (Okra) Seedling which one is the most effective and gave a positive feedback.

1.2 Problem Statement

Demands of consumer to okra production is increase due to the rapid growth in world populations. However, the performance of fresh fruits and vegetables (FFV) are not improved much though many incentives programmes have implemented by the Malaysian government through Third national Agricultural Policy (NAP3). Due to lack of vegetables production, it also causes other sides problems such as low quality and inconsistent supply (Nawi, 2009).

Mostly nutrients needed by plants contain in an inorganic fertilizer. In order to produce high yield of okra, the requirements of nutrients status should meet the crop's need and it also to maintaining the fertility of soil. Hence, the excessive usage of inorganic fertilizer can gave depression effect on yield (Dauda, S.N., Ajayi & Ndor, 2008). This can causes decrease in fruits number, delays and reduces fruit setting which is delay the ripening period and also lead to slow vegetative growth.

Therefore, this research study is to decrease the yield period and increase the rate of germination seed by using pineapple peels as soil amendment and also a commercial organic fertilizer. This is to find out which treatment gave a positive feedback and showing the most effective growth performance of the seedlings.

1.3 Hypothesis Statement

1.3.1 H_0

The fruit peels powder of pineapple does not affects the growth performance of *Abelmoschus esculentus* (Okra) seedlings.

1.3.2 H_a

The fruit peels powder of pineapple do have affects the growth performance of *Abelmoschus esculentus* (Okra) seedlings.

1.4 Objectives

The objectives of this research study are as following:

1. To measure the growth performance of *Abelmoschus esculentus* (Okra) seedlings *based* on several parameters upon exposure to soil amendement of pineapple peels powder and commercial organic fertilizer.
2. To compare the impact of soil amendment Pineapple peels Powder and Commercial Organic fertilizer on the physical growth of *Abelmoschus esculentus* (Okra) seedlings

1.5 Scope of Study

This study is to compare the growth performance of *Abelmoschus esculentus* (Okra) seedlings by using soil amendment pineapple peels powder and commercial organic fertilizer. The fruits peel that have been chosen is pineapple peels which one of Tropical fruits in Malaysia. The analysis of this study will include the germination rate (%), height of plant (cm), number of leaves, number of branch and survivability percentage (%). The experimental study will be conducted at UK Farm, Kluang, Johor.

1.6 Significance of Study

The importance of conducting this study is to decrease the duration of yielding okra which is to become shorter than usual period. The okra production can be produce compatible with the demand from customers. Next is to reduce the uses of dangerous chemical treatment on the okra plant which also can reduce the effect on human and environment. The growth of okra will be speed up by applying the pineapple peel powder as soil amendment. Due to unpredictable climate in Malaysia, through the research of an organic fertilizer, it would help in increasing the growth rate and reduce the chances of chemical fertilizer residue in agricultural activities that could harm human, animal and environment.

CHAPTER 2

LITERATURE REVIEW

2.1 Classification of *Abelmoschus esculentus* (Okra) and it's Cultivation

Figure 2.1: *Abelmoschus esculentus* (Okra)

The scientific name *of* okra *is Abelmoschus esculentus. Abelmoschus esculentus* is commonly known as ladies finger which belongs to Malvaceae family. Okra being assumed to be originated from India and it is a warm-season crop which commercialized traditionally in West Africa, Southeast Asia, Southern United States, Brazil, northem Australia and Turkey (Noorizzatie, 2015). Okra is known by many local names according to part of the world such as in England it is called as lady's finger, in United States of America called as gumbo, and bhindi in India.

The term okra started to be used at end of 18th century. Okra is suitable to be planted as a garden crop or as a commercial crops on farms (Gemede, Ratta, Haki, Beyene, & Woldegiorgis, 2015). Due to its various uses and multipurpose, all part of the okra plant can be used such as fresh leaves, buds, flowers, pods, stems and seeds.

The immature okra can be consumed as vegetables that can be used in salads, soups and stew. Okra either can be ate as fresh or dried, or also can be cooked as fried or boiled.

The top country which produce okra with 0.35 million ha land which involve 70% total world production of okra (Ige & Eludire, 2014). Malaysia is at rank of 14th among all the country that producing okra as commercial domestic production. Okra are being planted commercially in Malaysia by many companies that involved in agriculture. Malaysia assumed to produce 20,000 tons of okra per year and the value start to increase from year to year, since 1990. Most state that planted okra in Malaysia is Johor then followed by Kedah, Sarawak and Kelantan (Ige & Eludire, 2014).

Figure 2.2: Structure of *Abelmoschus esculentus* (okra) plant.

Table 2.1.: Taxonomy of *Abelmoschus esculentus* (Okra).

Name	Okra
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Malvales
Family	Malvaceae
Genus	*Abelmoschus*
Species	*esculentus*

(Sources: MoEF, 2011)

Okra is one of the most popular and consumed species of Malvaceae family. Previously, okra is under Hibiscus genus then later it being designated under *Abelmoschus*, which is different from the genus of Hibiscus (Gemede et al., 2015). The genus is differentiate based on several characteristics such as calyx, and spathulate.

Okra is mainly planting by using seeds and the period of planting is 90 to 100 days. Okra is an annual plant with robust stem, erect, variable in branching and various range of height from 0.5 t0 4.0 metres. The leaves are alternate and usually palmately with five lobed, whereas the flower is axillary and solitary. The growth of okra is classed as intermediate growth. The flowering of okra is continuously yet dependable on biotic and abiotic stress. It's usually bears its first flower in one to two month after sowing. The fruit grows quickly after flowering (MoEF, 2011). Its fruits are a green capsule containing numerous white seeds when immature and its can be classified based on the shape, angular or circular (Noorizzatie, 2015). Okra plants can continuous to flower and to fruit for a long time depends on the variety, season and soil moisture and fertility. Harvesting regularly can stimulates continuous fruiting and it is necessary to harvest

every day in climate where growth is especially vigorous (MoEF, 2011: Ige & Eludire, 2014).

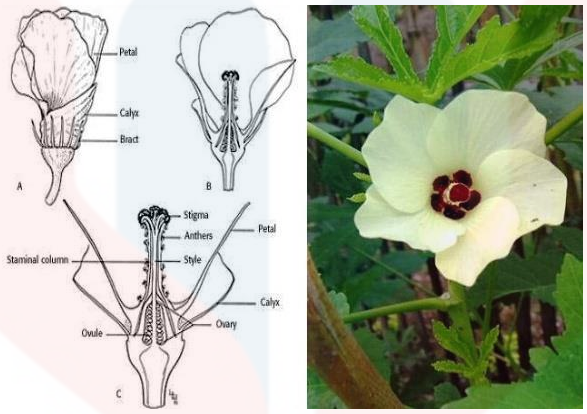

Figure 2.3: Flowers of *Abelmoschus esculentus* (Okra).

Okra's flower have 4-8 cm in diameter with five yellow to white petals. It's often with red or purple spot each petal at their base and the flower withers within one day. The structure of flower is combines hermaphroditism and self-compatibility. Flower bud appears above sixth to eighth leaf depending on the cultivar in the axil of each leaf. At that time, crown of the stem will bear three to four undeveloped flower yet later on during profuse flowering period of the plant, there may be as many as 10 undeveloped flowers on a single crown. Time of development of flower may be two, three or more days for each flower but on a single stem there will be not more than one flower appeared. A flower bud takes about 22-26 days from initiation to bloom fully. The style is surrounded by a staminal column which can have more than 100 anthers. Okra has perfect flower which have male and female reproductive parts in the same flower. Okra flower also self-pollinating (MoEF, 2011).

While growing Okra, the most important factor of cultivation are the climate and soil requirement. Okra needs a long, warm and humid growing period. In hot humid areas, it can be successfully grown and it is very sensitive to extreme low temperature and frost. 24°C and 28°C is the preferred temperature for a normal growth and development. The first flower bud may appear differently on axil due to the temperature. At high temperature the plants grow faster yet higher temperature also delaying the fruiting. But at higher temperatures beyond 40°–42°C, flowers may desiccate and drop which causing losses of yields. Beyond this range the germination will be delayed and weak seeds may not even germinate. With well-developed tap root system, a well-drained, rich soils and relatively light the okra also can be grown on sandy to clay soils. All soils need to be pulverized, moistened and enriched with organic matter before sowing (MoEF, 2011).

2.1.1 Chemical Composition and Health Benefit of *Abelmoschus esculentus* (Okra)

Table 2.2: Chemical composition of *Abelmoschus esculentus* (Okra) per 100 grams

Calories	35.0	Calcium (mg)	66.0
Moisture (g)	89.6	Iron (mg)	0.35
Carbohydrates (g)	6.4	Potassium (mg)	103.0
Protein (g)	1.9	Magnesium (mg)	53.0
Fat (g)	0.2	Copper (mg)	0.19
Fiber (g)	1.2	Riboflavin (mg)	0.01
Minerals (g)	0.7	Thiamine (mg)	0.07
Phosphorus (mg)	56.0	Nictonic acid (mg)	0.06
Sodium (mg)	6.9	Vitamin C (mg)	13.10
Sulphur (mg)	30.0	Oxalic acid (mg)	8.0

(Sources: *Gopalan et al., 2007*)

Okra (*Abelmoschus esculentus* L.) is an annual vegetable crop which planting in tropical and subtropical areas. It is assumed as a precious vegetable crop due to its

high level of vitamins, minerals, carbohydrates and also fats (Habib, Kausar, & Saud, 2016).

According to Gemede et al., (2015) the composition of okra for each 100 gram of edible portion is 81% of the product as purchased and ends trimmed. It's consist of 89.6 g water, 35 kcal as total of energy value. The approximate nutritional content per each 100 g of edible portion of Okra are protein 1.9 g, fats in total 0.2 g, carbohydrates 6.4 g, fiber 1.2 g, Potassium 103 mg, Calcium 66 mg, Phosphorus 56 mg, Iron 0.35 mg, Sodium 6.9 mg, Sulphur 30 mg Magnesium 53 mg, and Copper 0.19 mg. Okra contains several vitamins which are Vitamin C 13.10 mg, Thiamine 0.07 mg, Oxalic acid 8 mg, Nictonic acid 0.06 mg, and Riboflavin 0.01 mg.

Okra have numerous of benefits, because of that it being call as "a perfect villager's vegetable" (Gemede et al, 2015). It being called as "a perfect villager's vegetable" due to its robust nature, dietary fiber and distinct seed protein balance of both lysine and tryptophan amino acid. Protein of Okra is different from proteins of cereals and pulses.

Okra mucilage can be used as food, non-food products and medicinal applications. Example, the mucilage can be used as a plasma replacement or blood volume expander. The mucilage of okra binds cholesterol and bile acid carrying toxins dumped into it by the liver. While, an immature pods can use in making pickle. The whole part of Okra plant is edible and can be used to serve several foods. Okra seeds also can be a source of oil and protein. A small scale of oil production has been used okra seed. Okra seeds also can be used as non-caffeinated substitute for coffee or it can be roasted and ground to form a caffeine-free substitute for coffee (Gemede et al, 2015).

According to Gemede et al., (2015) in recent years, the attention of human health on role of diet is keeps rising. A few of Okra's health benefits are helps to stabilize blood sugar. Blood sugar level can be stabilize by regulating the rate which is the sugar is absorbed from intestinal tract. As fiber get along with other nutrition, it is useful for minimizing blood sugar level within body, assisting along with diabetes. Next, it can treats digestive issues. Frequently consumed of Okra might help avoid kidney disease. Several digestive issues like gastritis and gastric ulcers can be treated by consumed more Okra. By eating more okra, it can keep stomach clean and it is usually support colon health. Thus, it can promote healthy skin and blood. In 100 gram of Okra contains approximately 27% of vitamin C and 50% of vitamin K.

Vitamin C is the essential antioxidant that helps in growth and repair of bodily tissues. By consumed more okra can rejuvenate the skin and hair, and also protect us from degenerative diseases associated with long-term free radical damage. On the other hand, Vitamin K plays an important role in blood clot formation. If you are suffering from regular nosebleeds, bleeding gums, heavy menstrual bleeding, or easy bruising, your blood might be too thin. By adding more vitamin K-rich foods like okra into your diet can improve your blood's ability to coagulate.

Besides, it also promote a healthy of the pregnancy. New cells can be created and maintained by consuming Vitamin B. The vitamin helps in preventing birth defects such as spina bifida and allowed complete development of the baby. Vitamin C is required additionally for baby development. Okra is full of both foliate and vitamin C. While pregnancy, the high quantity of foliate in okra is very helpful for the fetus. Foliate is an important nutrient for development of fetus's brain and growth. The high quantity of folic acids in okra plays a major role in the formation of neural tube of the fetus through the fourth to the 12th week of pregnancy. Hence, it also improve heart health. The chances of cardiovascular disease can be decrease as soluble fiber within okra

helps by reducing the serum cholesterol. Consuming okra is an efficient method to manage the body's cholesterol level. Okra also additionally loaded with pectin which help in reducing high blood cholesterol simply by modifying the creation of bile within the intestines. Okra also used to improve good eyesight. The okra pods contains Vitamin A and also beta carotene that are both important nourishment for sustaining an excellent eye-sight along with healthy skin. Additionally, these types of important nourishment also assist inhibits eye associated illnesses along with problems on the skin. Okra is better being consumed along with other healthy veggies. Consuming okra has truly numerous advantages, simply bear in mind to eat natural veggies as opposed to processed veggies.

Lastly, Okra also used to control cholesterol level of body. High cholesterol level can caused numerous significant illness. Body's cholesterol level is nearly difficult to be managed because it's hard to avoid foods loaded with cholesterol content. By consuming Okra, cholesterol level in human's body can be managed powerfully. It also can helps in diet as it is helps in slimming down and also reduces cholesterol. Diet advisors also recommended to consume okra within the qualities for a good diet plans.

2.2 Classification of *Ananas comosus L.* (pineapple)

Figure 2.4: *Ananas Comosus L*. (pineapple)

An Italian explorer, Christopher Columbus who is also a navigator is who is discover pineapple. According to Joy et al., (2015) Christopher Columbus describe pineapple as “Fruits like artichoke, four times as tall, fruit in the shape of a pine cone, twice as big, fruit is excellent and can be cut with a knife like a turnip and it seems to be wholesome.” . *Ananas Comosus L.* which is commonly known as pineapple can be considered as a global fruit as it counted as world contribution to global well-being, along other major crops such as maize, potato, cassava, beans and tomato (G. Coppens d’Eeckenbrugge et al., 2011). Pineapple can be found in almost tropical and subtropical areas of the world. Brazil, Costa Rica, Philipines, Indonesia and Thailand are the countaries as top pineapple producer around the world in 2013 (joy et al., 2015). Ananas genus is a part of monocotyledoneae group which is under Farinose order and Bromeliaceae family (Loibon-cabot, 1992) which is a perennial crop (G. Coppens d’Eeckenbrugge et al., 2011).

2.2.1 Chemical Composition and Health Benefit of *Ananas comosus L.* (pineapple)

Table 2.3: Chemical composition of *Ananas Comosus L*. (pineapple)

Energy (Kcal/100g)	50	Sugar (g)	9.85
		Calcium (mg)	15
Moisture (g)	86.0	Iron (mg)	0.29
Carbohydrates (g)	15.12	Potassium (mg)	109
Protein (g)	0.54	Magnesium (mg)	12
Fat (g)	0.12	Zinc (mg)	0.12
Fiber (g)	1.4	Riboflavin (mg)	0.032
niacin (mg)	0.5	Thiamine (mg)	0.079
Phosphorus (mg)	8	Pantothenic acid (mg)	0.225
Sodium (mg)	1	Vitamin C (mg)	47.8
choline (mg)	5.5	Folate (μg)	1.5

(Source: USDA, 2016)

In each 100 grams of pineapple fresh fruits contents various chemicals composition which consist of vitamins, Minerals, water, fat and proteins. Sugar content per each 100 grams of fresh pineapple is 9.85 g and it's contains 15.12 g carbohydrates. The approximate nutritional content per each 100 g of papaya are edible portion is water 86.0 g, protein 0.54 g, fats in total 0.12 g, dietary fiber 1.4 g, potassium 109 mg, calcium 15 mg, phosphorus 8 mg, iron 0.29 mg, sodium 1 mg, magnesium 12 mg, and zinc 0.12 mg. Watermelon contains several vitamins which are vitamin C 47.8 mg, vitamin B6 0.112 mg, thiamine 0.079 mg, niacin 0.5 mg, choline 5.5 mg, pantothenic acid (B5) 0.225 mg, folate (B9) 1.5 μg and riboflavin (B2) 0.032 mg. The energy value is 50 Kcal/100 g.

2.3 Fertilizer

Sufficient and balanced quantities of nutrients is a must to ensure optimum plant growth. Soil have natural reserves of nutrients for plant, but those nutrients are largely in forms of unavailable to plants, and only a minor portion is released every year through biological activity or chemical processes. However, the release process is too slow compared to the usage of nutrients uptakes by agricultural production in order to fulfill the crop requirement. Therefore, fertilizers are designed to act as supplier to supply the nutrients that already present in the soil (Chen, 2006). Fertilizers are any organic or inorganic material of natural or synthetic origin that is added to the soil as a supplement to the plants. For growth of plants, one or more plant nutrients is necessary (Mercy et al., 2014). Fertilizer can be divided into 2 types, which are organic fertilizer and inorganic fertilizer.

Animal manure, compost and household wastes are usually used to produce organic fertilizers. The use of organic fertilizer as substitutes for chemical fertilizer will encourage the use of organic waste materials (Zhai et al., 2009). Organic fertilizers also provide nutrients that needed by plants in a safe way. Organic fertilizers not only provide nutrients but also improve the quality of soil by improving the structure, chemistry and biological activity level of the soil (Omidire et al., 2015). Organic fertilizer gradually release nutrients, thus they also promote soil organic matter content (Sarkar et al., 2003). The improvements to soil organic matter are favored when decomposition is slow. However, temperature and soil moisture are greatly giving effect to decomposition of organic material. This prove that nutrients may be released when not needed by the plant. Organic fertilizer only have a limited amount of nutrients because the availability amount of organic material is very limited in many regions, and by applying only organic fertilizer will be very difficult to meet crop nutrients demand

(Morris et al., 2007). While, Chemical fertilizer or mineral also being refer as inorganic fertilizers. Nutrients in mineral fertilizers are relatively high, and the nutrients are faster released because in mineral fertilizer, decomposition is not needed. In mineral fertilizer, the level and timing of nutrients uptake by crops can be well predicted (Omidire et al., 2015. However, it can cause a high cost and give negative effect on environment if managed poorly (Morris et al., 2007). Several negative effect that causes of mineral fertilizers is the destruction of soil texture and structure, which leads to soil degradation. Besides, effect of the nutrients leach off can result in acidity which will influence the crop yield production (Ojeniyi, 2000).

2.3.1 Advantages and Disadvantages of Using Organic Fertilizers and Chemical Fertilizers

The use of fertilizers has its own advantages and disadvantages in terms of nutrient supply, crop growth and environment (Chen, 2006). The advantaged of using organic fertilizer for plant growth are the nutrient supply is more balanced which helps to keep the plant healthy. Organic fertilizer also enhance the biological activity of soil, which improves the mobilization of nutrient from organic to chemical sources and also decompose of toxic substances. Next, it also enhance the colonization of mycorrhizae that will improve the supply of P. Hence, promote root growth due to better soil structure. Increased the organic matter content in the soil, therefore it also improving the exchange capacity of nutrients, increase soil water retention, improve soil aggregates and buffering the soil against acidity, alkalinity, salinity, pesticides and toxic heavy metals. A residual of organic N and P in the soil as the nutrients are released slowly, it cause decrease of N leaching loss and P fixation as they also can supply micronutrients. Organic fertilizers also can supply food and encourage the growth of micro-organism and earthworms which are beneficial for plant growth. Lastly, organic

fertilizer also capable to help suppress certain plant diseases such as soil-borne diseases and parasites (Chen, 2006).

The consequences of using organic fertilizers are they are have lower nutrient content, so it will needed in large volume to provide enough nutrients for crop growth. Due to slow rate of nutrients release, some nutrient deficiency may occur and it will need a long time to meet the crop requirement. Major plant nutrients may not exist in organic fertilizer in enough quantity to maintain maximum crop growth. The cost of organic fertilizer is high compared to chemical fertilizer as the nutrient composition of compost is highly variable. Lastly, heavy application to agricultural soil may affect in salt, nutrient or heavy metal accumulation which also can affect plant growth, soil organism, water quality, animal and human health (Chen, 2006).

The advantaged of using chemical fertilizer for plant growth are the nutrients are soluble which is immediately available for plants uptake. Usually, the effect is directly and fast. Next, chemical fertilizer has a lower price compared to organic fertilizer and this is one of the reason chemical fertilizer is more acceptable and often applied by farmers. The nutrient content in chemical fertilizer is quite high and it is only needed in small quantity to fulfill the requirement for crop growth (Chen, 2006).

The disadvantages of using chemical fertilizers can give a negative effects due to overapplication. Leaching, water resources polluted, micro-organism and friendly insects are killed, crop susceptible to disease attack, acidification or alkalization of the soil or reduce in soil fertility. This negative effects will causing irreparable damage to the whole system. Excessive of n supply will cause the softening of plant tissue which make plant more sensitive to disease and pests. High N fertilization can inhibit

symbiotic N fixation by rhizobia and it also reduce the colonization of plant roots with mycorrihizae. Chemical fertilizer increase the decomposition of soil organic matter which result in degradation of soil structure. Lastly, nutrients are easily lost from soils through leaching, fixation or gas emission and can cause to decrease in fertilizer efficiency (Chen, 2006).

2.3.3 Essential nutrients in Fertilizer

Plants require 16 essential elements for their growth and development. Carbon, hydrogen and Oxygen are obtain from the atmosphere and soil water. The rest of 13 essential elements are Nitrogen, Phosphorus, Potassium, Copper, Magnesium, Sulfur, Iron, Zinc, Manganese, Copper, Boron, Molybdenum and Chlorine. The 13 essential elements are obtained either from soil minerals and soil organic or by organic or inorganic fertilizer. Primary nutrients are N, P and K. Amount of primary nutrients needed by plants are in large volume and sufficient. Insufficient or commonly called as deficiency of nutrients can affect the growth of plants. For each nutrients it have different functions and symptoms of deficiency (Uchida, 2000).

N is for Nitrogen. It available to plants as nitrate (NO_3^-) and ammonium (NH_4^+) ions. The nutrients functions of N are it is biologically combined with C, H, O and S to create amino acids, which are can form proteins. Amino acids are used in forming protoplasm. Protoplasm is the site for cell division and for plant growth and development. As all plant enzymes is made of proteins, N is needed for all of the enzymatic reactions in a plant. N is a major part of chlorophyll which helps in photosynthesis. N also improves the quantity and quality of dry matter in leafy vegetables and protein in grain crops. Deficiency symptoms of N are such stunted growth. It is happen because of decrease in number of cell division. Chlorosis appear on first of older leaves which starting at the tips. Chlorosis could resulting death and/or

dropping older leaves depends on the severity of deficiency. It also can causes of lowering proteins content in the seed and vegetative parts of the crops. In severe cases, it also reduce flowering. Lastly, N deficiency also causes early maturity in some crops, which results in yield reduction and quality (Uchida, 2000).

P is for phosphorus. It available in forms of orthophosphate ions (HPO_4^{2-}). In photosynthesis and respiration, P plays as important role in energy storage and transfer as ADP and ATP (adenosine di- and triphosphate) and DPN and TPN (di- and triphosphopyridine nucleotide). P is part of the RNA and DNA structures, which are the major components of genetic information. In a mature plant, seeds have the highest concentration of P. P is required in large quantities for young cells, such as shoots and root tips, where metabolism is high and cell division is rapid. P promote in root development, flower initiation, seed and fruit development. In some plant, P can reduce the disease incidence and able to improve the quality of certain crops. Deficiency symptoms of P such as slow, weak and stunted growth because P is needed in large quantities during early stages of cell division. P is relatively mobile in plants and can be transferred to sites of new growth, causing symptoms of dark to blue-green coloration to appear on older leaves of some plants. Under severe deficiency, purpling of leaves and stems may appear. Lack of P can cause delayed maturity and poor seed and fruit development (Uchida, 2000).

K is for Potassium. It is available as ion (K^+). Unlike N and P, K does not form any vital organic compounds in the plant. However, the presence of K is vital for plant growth because K is known to be an enzyme activator that promotes metabolism. K helps in regulating the plant's use of water by controlling the opening and closing of leaf stomates, where water is released to cool the plant. In photosynthesis, K play a role of maintaining the balance of electrical charges at the site of ATP production. K promotes the translocation of photosythates (sugars) for plant growth or storage in

fruits or roots. Through its role assisting ATP production, K is involved in protein synthesis. K has been shown to improve disease resistance in plants, improve the size of grains and seeds, and improve the quality of fruits and vegetables. Symptoms of deficiency of K which is common is chlorosis. The chlorosis along the edges of leaves. It occur in older leaves because K is very mobile in the plant. Because K is needed in photosynthesis and the synthesis of proteins, plants lacking K will have slow and stunted growth. In some crops, stems are weak and lodging is common if K is deficient. The size of seeds and fruits and the quantity of their production is reduced (Uchida, 2000).

CHAPTER 3

MATERIALS AND METHODS

3.1 Methodology

3.1.1 Selection of Okra Seed

Okra seeds were bought from Agriculture based industry shop at Gua Musang, Kelantan. The seed came from the same brand to ensure the seed is genetically identical with similar genetic information. Total of 120 seed were chosen.

Figure 3.1: Seed that used for the study

3.1.2 Preparation of Pineapple Peels Powder

Fruits peel was chosen is pineapple. The fruits peels were dried under sunlight for 20 days for 10 hours every day. Then, it were grinded in a mixer to produce as soil amendment in powder form. For the control, one package of commercial organic fertilizer (Trio) were bought.

(a)

Figure 3.2 (a): Drying Process of Pineapple Peels

(b)

Figure 3.2 (b): Commercial Organic Fertilizer Selected (Trio)

3.1.3 Preparation of Planting Medium

Figure 3.3: Fruits peels that have being grinded

There should be about nine kilograms of planting medium that consist of top soil, sand and organic fertilizer that were processed from fruit peels. The planting medium were mixed with 2:1:1 ratio. 60 poly bags were needed in the study and the size was 4 inch length 3 inch wide. The planting medium then fill up the poly bags with equal amount of mix soil and 50grams of fruit peels organic fertilizer which makes total of 200 grams of planting medium in each polybags. After being mix with soil amendment, the planting medium were left out for 15 days

Figure 3.4: The polybags used in the experiment (4 Inch × 6 Inch)

3.1.4 Preparation of planting site

An experimental model were set up and divided into 2 section area which were labelled as C and T1. The C area was set as control while T1 area was set as treatments which was pineapple fruit peel. The poly bags of experimental were arranged side by side with a labelled tag and a space between each section areas. The purpose of putting a tag label and a space was to prevent any disturbance that could affect other plants growth performance. The experimental area were placed at area which have a good conditions that enhance the plant growth performance

3.1.5 Experimental Set Up

The experiment were conducted for 42 days at UK Farm Resort, Kluang, Johor Baharu. The first day were counted when seed is sowing. The experiments was design in Completely Randomized Design (CRD) with 2 set of treatments with 15 replication for each treatments. In each of poly bags, 2 okra seed were sow in a hole with deep hole about 2 centimeter, then the seeds were water two times a day which is in the morning and in the evening.

3.1.6 Monitoring and Observation

The observation and data measurement of the okra plant is observe every day for 42 days. The observation and measurement is done based on several parameters which are germination rate (%), height of plant (cm), number of leaves, number of yields, number of branch and survivability percentage (%).

3.2 Parameter Observed

The Germination rate of Okra seeds of the plants were sown in poly bags that contain mixture of planting medium and soil amendment of pineapple peels powder. Each of the poly bags contain two seed. The germination of seed were observed and recorded every week.

Next, for height of okra plant were measured in cm randomly by using a ruler from the day of seed germinated until the day 42 to make sure that the differences can be determined. The measurement was measured from the internode stem to the tip of meristem.

Figure 3.5: Measuring the height of Okra plant.

The number of leaves emerged from the okra plant were recorded until the 42th days in both treatments. While for observation of branch, the number of branches were recorded when the start of emerged of branch from the okra plant.

Furthermore, the survivability percentage (%) of okra plant was observed from the first day of the experiment until the last day of experiment. The Percentage of survivability can be calculated by using the equation below:

$$\text{Survivability percentage (\%)} = \frac{N_f}{N_i} \times 100\%$$

Where,

N_f = number of seed at the end of the experiment

N_i = number of seed at the beginning of the experiment

3.2.1 Data Analysis

The statistical data of okra plant will be analyze using Independent Sample of T-Test. The test will be conducted using Levene's Test for equality of variances. If significance (p) > 0.05, the assumption of equal variances holds. If p (2-tailed) > 0.05, the population means are equal.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Germination Rate of Okra Seeds

Table 4.1 **shows** the germination rate of okra seeds which is alive and dead for each treatment. It shows that, the seeds in Treatment 1 are 15 alive compared to in Control it only 14 alive.

Table 4.1: Germination rate of the okra seed.

	Alive	Dead
Control	14	1
Treatment 1	15	0

Table 4.2: Germination rate of the okra seed against time (weekly).

Week	**Week 1**	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**
Treatment						
Control	14	-	-	-	-	-
Treatment 1	12	2	1	-	-	-

Control = Commercial Organic fertilizer (Trio), Treatment 1= Pineapple peels

Table 4.2 shows the germination of seeds from week 1 to week 6. From the table, seeds in both treatment start to germinate in week 1 and fully germinate until week 3. Control only able to germinate 14 of seeds out of 15 replications while Treatment 1 are able to germinate all of 15 replication of seeds in three weeks.

The germination rate between each treatments are different because each of treatments contains different amount of nutrients. For control, an organic fertilizer was used with N8:P8:K8 MGO3. The fertilizer used is suitable for all types of plants including okra. Trio organic humus fertilizer were made up from decomposed plants and coffee residues. It contains good trace elements which is provides essential nutrients to plants that help in seed germination. While in Treatment 1, the germination rate of seed a bit slower as it lack of N, P, K.

4.2 Height of Okra Plant

The height of okra plants for 42 days in Control and Treatment 1 are shown in Table 4.3. The Result from table show that plant that grown in Control have the highest mean which is 2.2132 cm. Then followed by Treatment 1 with 1.6216 cm.

Table 4.3: Height of okra plant (cm).

Treatment, n= 630	**Height of Plant (Mean ± SD)**
Control	2.2132 ± 5.49807
Treatment 1	1.6216 ± 3.77494

Control = Commercial Organic fertilizer (Trio), Treatment 1= Pineapple peels

Based on Levene's test, the height of okra plants are significantly different ($p > 0.05$) which is the assumptions of equal variances holds. Plants in Control have the highest height because it have sufficient nutrients that helps in plant growth. Plants in control being supplied with organic fertilizer one week after sowing of the seeds. Compared to plants in Treatment 1, that only depends on the fertilizer that have being mixed with planting medium at early experimental set up. Overall, plants in Control have higher effect on the height of plants.

4.3 Number of Branches

Table 4.4 shows the number of branches of okra plants for 42 days. Treatment 1 shows the lowest number of leaves which is 1.1800 compared to Control Treatment which is 1.2500.

Table 4.4: Number of okra plant branches.

Treatment, n=630	Number of Branches (Mean ± SD)
Control	1.2500 ± 2.2910
Treatment 1	1.1800 ± 1.6850

Control = Commercial Organic fertilizer (Trio), Treatment 1= Pineapple peels

The results of the number of branches based on Levene's test shows that soil amendments are significantly different ($p > 0.05$) which is the assumptions of equal variances holds. The numbers of branches depends on the intake of P by plants. According to Uchida (2000), P promote in root development, flower initiation, seed and fruit development. Those development including the shoots and root tips development. From the results, it can be assumed that Control have more amount of P compared to Treatment 1. Overall, the results showed that Control treatment was highly significant when compared to Treatment 1.

4.4 Number of Leaves

Table 4.5 shows the number of okra plant leaves for 42 days. Control treatment shows the highest mean of leaves which is 2.7400 compared to Treatment 1 which is 2.4300.

Table 4.5: Number of okra plant leaves.

Treatment, n=630	Number of Leaves (Mean ± SD)
Control	2.7400 ± 2.4880[c]
Treatment 1	2.4300 ± 1.6310[b]

Control = Commercial Organic fertilizer (Trio), Treatment 1= Pineapple peels

The results of the number of leaves based on Levene's test shows that soil amendments are significantly different ($p > 0.05$) which is the assumptions of equal variances holds. The number of leaves that not received any N uptakes for the plant growth will have a lower number of leaves. This situation applied to Treatment 1 as the pineapple peels does not contains many N nutrients based on the number of leaves emerged in the experiment. According to Uchida (2000), N helps in photosynthesis which it also helps in plant growth and give the plants green colour. Overall, the results showed that the Control treatment that being applied with commercial organic fertilizer was highly significantly when compared to the Treatment with pineapple peels.

4.5 Survivability Percentage (%)

Table 4.6 and Figure 4.1 shows the survivability percentage of the okra plant after sowing process. The figure obviously shows that the highest survival is in Treatment 1 with 66.67% and followed by Control 33.33 %.

Table 4.6: Survivability percentage of okra plant.

Treatment	Survivability Percentage (%)
Control	33.33
Treatment 1	66.67

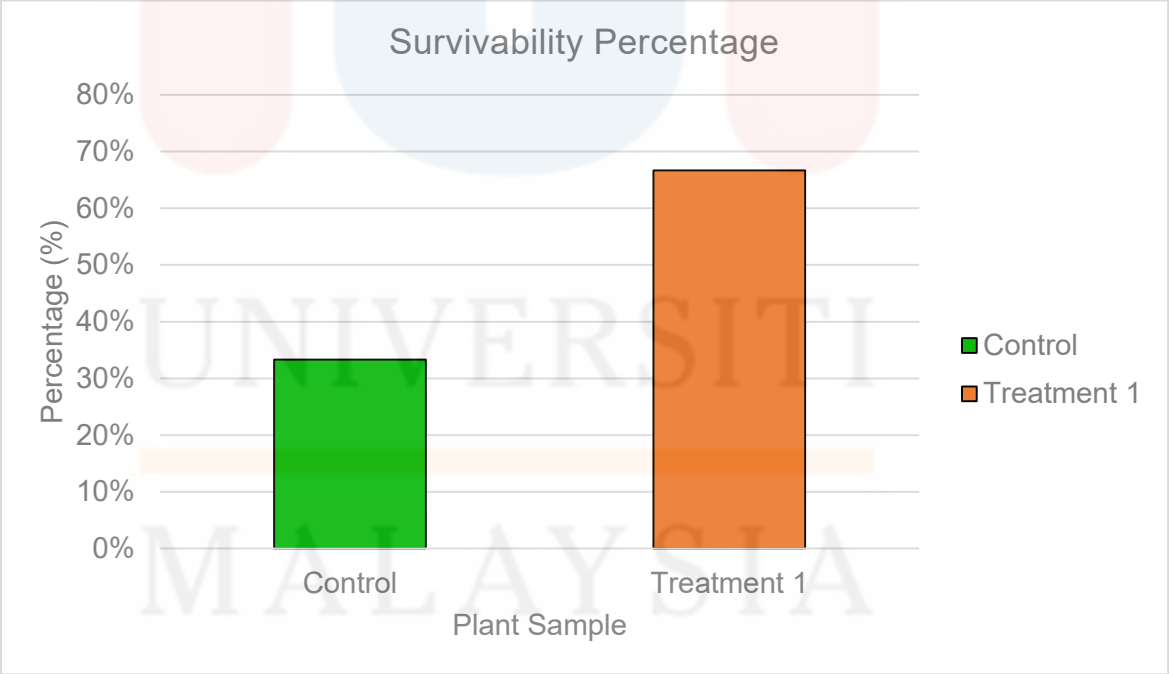

Figure 4.1: Percentage of survivability rate of okra plant.

Based on the Table 4.6 and Figure 4.1,, the overall seeds that germinate are 29 seeds from 60 seeds in the beginning. Survivability of the seeds is depends on the quality of the seeds. This means that the seeds that being sown in the poly bags for each treatments have different level of survivability as they are from the same brand so they considered sharing the same genetic information. However, at the end of experiment, the numbers of survivability in control treatment were reduced as the plant might be stressed over extreme temperature and unable to survive. While compared to plants in Treatment 1, they were able to survive over extreme temperature as the fruit peels also play a role as good water absorber. The fruit peel in the treatment 1 was able to maintain the moisture content in the soil and this is the factor of survivability of treatment 1.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Overall, this study has achieved the objectives in determined the growth performance of *Abelmoschus esculentus* (Okra) seedlings based on several parameters upon exposure to soil amendement of pineapple peels powder and commercial organic fertilizer. This study also able to compare the impact of soil amendment Pineapple peels Powder and Commercial Organic fertilizer on the physical growth of *Abelmoschus esculentus* (Okra) seedlings such as the height and number of leaves. Fertilizer does influenced the height of plants, number of leaves and the number of branches. However, there are some factors that may also influencing the growth performance of okra seedlings and plants. Plant growth and yield production can be affected by different parameters (Miransari, 2010) which abiotic (Amany, Sameera & Abdulmoneam, 2016) or biotic stress including soil, plant and climate properties. Therefore, it can be concluded that fertilizer does help to promote the growth performance of okra seedlings and plants. It is also found that pineapple peels are good water absorber.

5.2 Recommendation

Recommendation for this study is firstly about the method of preparing the fruit peels. Apart from apply drying method under sunlight for 20 days. It can be change into drying the fruit peels by using oven with 45℃ for 48 hours. By applying the method, it can save time for drying the fruit peels. Second recommendation for this study is, a further study can be made by using the same fruit peels but with different type of form. If in this study, the fruit peels is in powder form, for the further study the peels can be changed into an extraction form which can be used as liquid fertilizer. Other than that, the amount of fruit peels should be double or apply it as the same schedule of commercial fertilizer.

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APPENDIX A

Figure A.1: Fruit peels before drying (Pineapple)

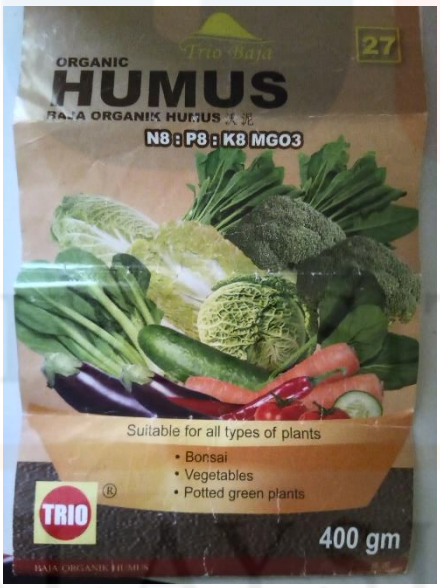

Figure A.2: Commercial organic fertilizer (TRIO)

APPENDIX B

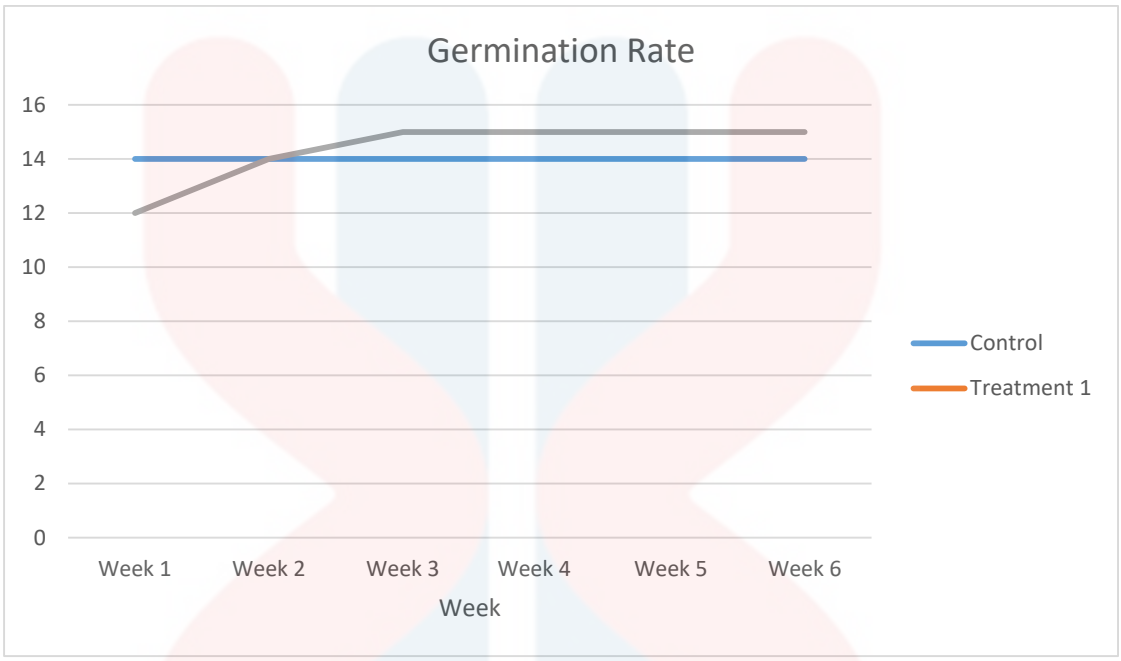

Figure B.1: Germination rate of okra seed by weeks

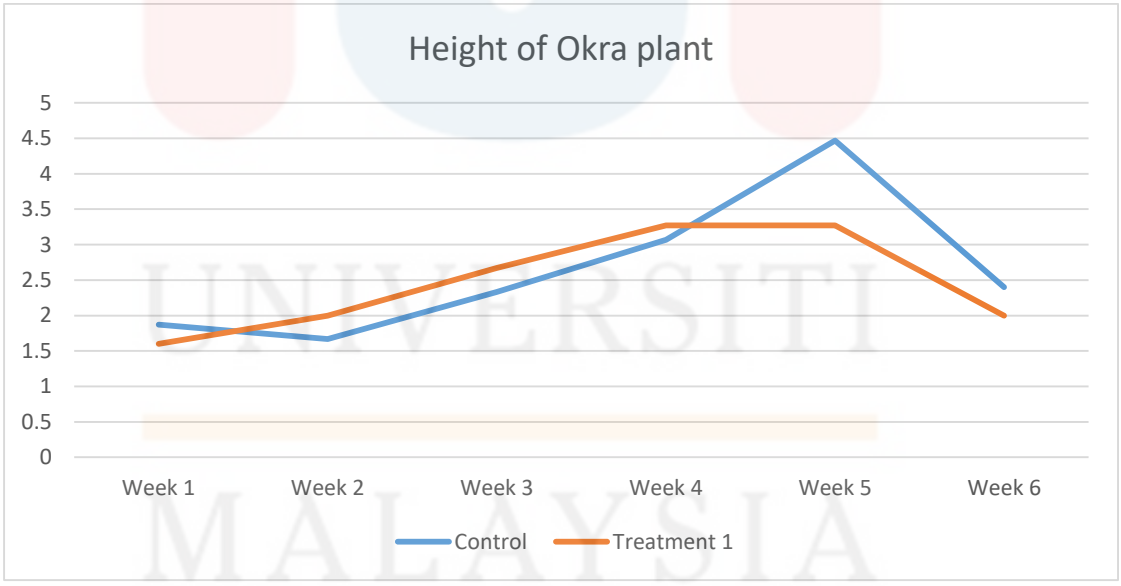

Figure B.2: Height of okra plant by week

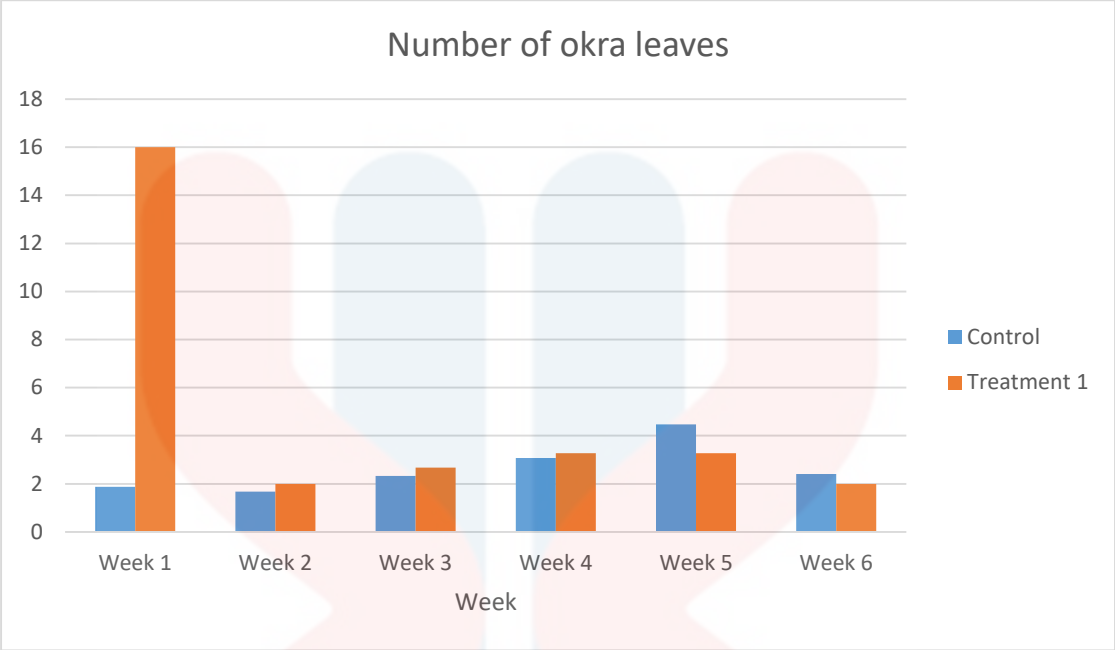

Figure B.3: Number of okra leaves by weeks

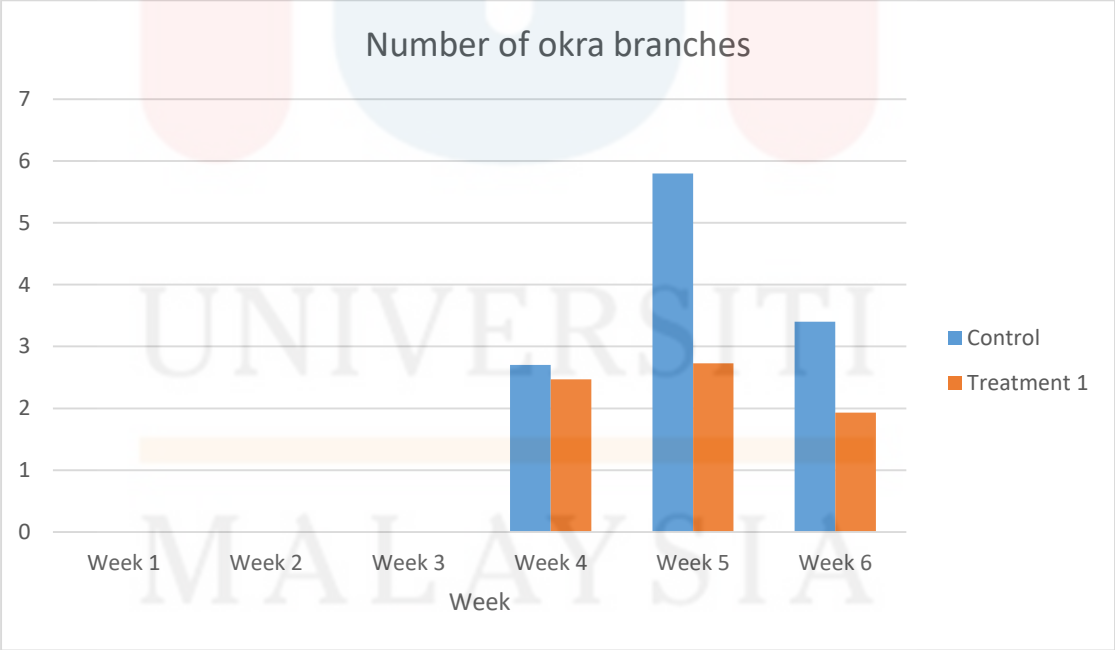

Figure B.4: Number of okra branches by weeks

APPENDIX C

Table C.1: Group Statistics of T-Test

	TREATMENT	N	Mean	Std. Deviation	Std. Error Mean
HeightOfPlant	CONTROL	630	2.2132	5.49807	.21905
	TREATMENT 1	630	1.6216	3.77494	.15040
NumberOfLeaves	CONTROL	629	2.74	2.468	.098
	TREATMENT 1	629	2.43	1.531	.061
NumberOfBranch	CONTROL	630	1.25	2.291	.091
	TREATMENT 1	630	1.18	1.685	.067

Table C.2: Levene's Test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
HeightOfPlant	Equal variances assumed	31.288	.000	2.226	1258	.026	.59159	.26571	.07030	1.11287
	Equal variances not assumed			2.226	1114.208	.026	.59159	.26571	.07024	1.11293
NumberOfLeaves	Equal variances assumed	219.118	.000	2.746	1256	.006	.318	.116	.091	.545
	Equal variances not assumed			2.746	1049.063	.006	.318	.116	.091	.545
NumberOfBranch	Equal variances assumed	34.319	.000	.616	1258	.538	.070	.113	-.152	.292
	Equal variances not assumed			.616	1155.583	.538	.070	.113	-.152	.292