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Effect of Different Booster on Growth Performance of *Dendrobium bigibbum*

Insyirah Aisyah Binti Che Ismail

F18A0040

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DECLARATION

I thus proclaim that the work encapsulated in here is the consequence of my own exploration aside from the cited as referred to in the references.

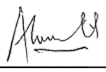
Signature

Student's Name: Insyirah Aisyah Binti Che Ismail

Matric No: F18A0040

Date: 26 February 2022

Verified by:



Supervisor Signature

Supervisor's Name: Puan Akmal Adilah Binti Idris

Stamp:

AKMAL ADILAH BINTI IDRIS
PENSYARAH
FAKULTI INDUSTRI ASAS TANI
UNIVERSITI MALAYSIA KELANTAN
09-9477539, EXT. 10858
akmaladilah@umk.edu.my

Date: 28/02/2022

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Kesan Penggalak Berbeza terhadap Prestasi Pertumbuhan *Dendrobium bigibbum*

ABSTRAK

Orkid dilihat sebagai tumbuhan berbunga dan dipangkas yang paling indah dan penting di seluruh dunia. *Dendrobium bigibbum* kerap ditanam sebagai tumbuhan hiasan. Orkid memerlukan nutrien yang mencukupi untuk memastikan ia tumbuh dengan baik. Oleh itu, kajian ini dijalankan untuk mengetahui kesan penggalak organik yang berbeza terhadap pertumbuhan *Dendrobium bigibbum*. Penggalak organik yang digunakan ialah Jus Tumbuhan Ditapai (FPJ), Jus Buah-buahan Ditapai (FFJ) dan air kosong digunakan sebagai kawalan. FPJ dan FFJ digunakan dalam kajian ini bagi mengatasi masalah apabila menggunakan baja organik. Ini kerana, baja organik lain mahal, sukar didapati dan lain-lain. Baja organik seperti FFJ dan FPJ adalah murah, mudah didapati dan mesra alam. Setiap penggalak organik ini mempunyai fungsi yang berbeza terhadap pertumbuhan *Dendrobium bigibbum*. Arang dan sabut kelapa digunakan sebagai media tanam untuk *dendrobium*. Parameter yang diukur ialah ketinggian orkid, panjang daun, lebar daun, diameter batang dan bilangan daun. Kemudian, data dianalisa untuk mengetahui penggalak organik terbaik untuk *Dendrobium bigibbum*. Daripada kajian 8 minggu ini, Jus Tumbuhan Yang Ditapai adalah penggalak organik terbaik untuk *dendrobium*. Diperhatikan, orkid yang diaplikasikan dengan FPJ mencatatkan ukuran tertinggi bagi ketinggian tumbuhan (28.5 cm), panjang daun (13.4 cm), lebar daun (3.75cm), diameter batang (3.77 cm), dan bilangan daun (4.1 cm). Daripada kajian ini FPJ disyorkan sebagai penggalak organik yang berkesan untuk *Dendrobium bigibbum*. Ia juga kos efektif, mesra alam, dan sangat mudah dibuat.

Kata kunci: Penggalak organik, *Dendrobium bigibbum*, Jus Tumbuhan Fermentasi, Jus Buah-Buahan fermentasi, pertumbuhan.

Effect of Different Booster on Growth Performance of *Dendrobium bigibbum*

ABSTRACT

Orchids are viewed as the most wonderful and important cut bloom and pruned plants wherever all over the world. *Dendrobium bigibbum* are regularly planted as an enlivening plant. Orchid need sufficient nutrients in order to make sure it growth nicely.Therefore, this study was carried out to find out the effect of different organic booster on the growth of *Dendrobium bigibbum*. The organic booster used were Fermented Plant Juices (FPJ), Fermented Fruit Juices (FFJ) and plain water were used as control. FPJ and FFJ were used in this study in order to overcome the problems when used organic fertilizer. It is because, other organic fertilizer were expensive, hard to find and etc. Organic fertilizer like FFJ and FPJ were cheap, easy to find and environmentally friendly. Plus, each of this organic booster has a different function on the growth of *Dendrobium bigibbum*. Charcoal and coconut husk chips were used as growing medium for *dendrobium*. The parameter measured were orchid height, leaf length, leaf width, stem diameter and number of leaf. Then, the data were analysed to find out the best organic booster for *Dendrobium bigibbum*. Data from this 8 week study, suggest that FPJ was the best organic booster for *dendrobium*. It is observed that, the orchid applied with FPJ recorded the highest measurement for plants height (28.5 cm), leaf length (13.4 cm), leaf width (3.75 cm), stem diameter (3.77 cm), and number of leafs (4.1 cm). FPJ is recommended as an effective organic booster for *Dendrobium bigibbum*. It also cost effective, environmentally friendly, and very easy to make.

Keywords: Organic booster, *Dendrobium bigibbum*, Fermented Plant Juices, Fermented Fruit Juices, growth.

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LIST OF ABBREVIATION AND SYMBOLS

FPJ	Fermented Plant Juices
FFJ	Fermented Fruit Juices
SPSS	Statistical Analyses for Social Sciences
ANOVA	Analysis of Variance
CRD	Complete Randomized Design
pH	Power of hydrogen
df	Degree of freedom
F	Frequency
Sig.	Significant
cm	Centimeter
l	Liter
ml	Milliliter
%	Percentage
=	Equal
>	Great
<	Less

CHAPTER 1

INTRODUCTION

1.1 Research Background

Orchids are normally assembled into two general classes that describe their development propensities. The common development propensity is sympodial. These orchids develop horizontally, conveying new shoots from the ancient rhizome. Leaves and blossom structure at the highest point of the new shoots. Numerous sympodial orchids have pseudobulbs, which are swollen shoots that store water and supplements to assist the plant with enduring times of delayed dry spell. Sympodial orchids includes *Cattleya, Cymbidium, Oncidium and Dendrobium* (Zhang, 2018).

Among the main parts of pot development of bloom crops is the choice of developing medium. The desirable medium must support air circulation with great water maintenance and great drainage. Furthermore, ideal developing medium should have the option to moor the roots and stems with the goal that the plant would not overturn as it becomes bigger, as well as preparing a solid climate for roots expansion.

Thus, the media must be inactive, permeable and impervious to natural disintegration. Meanwhile, it should be modest and effectively accessible. (Sanghamitra et al., 2019). In this experiment, the media used was a mixture of coconut husk chips and charcoals.

The development of *Dendrobium* orchids depends on by plant situation, moistness conditions and giving supplements through fertilization (Hariyanto et al., 2019). Sufficiency of supplements speeds up the development of orchids and the progression of blooming. Orchids are light feeders and require nitrogen from the start to 66% of their life cycle. During rest periods, they need not bother with any manures. During blossoming period and inflorescence advancement, plants are taken care of with less nitrogen, more phosphorus and potassium.

A grouping of 0.2 to 0.3% of 30:10:10 (N: P: K) at vegetative stage and 10:20:20 (N: P: K) at sprouting stage are applied for quality bloom creation. Fertilizer given to the planting medium is ordinarily as fluid spray with the goal that the supplement supply is taken up gradually. Orchids should be treated twice every month with fertilizer which contains N, P, K, Ca supplements and other micro elements. Fertilizer that are finished with micro elements, both counterfeit and organic fertilizer are generally accessible on the market. Liquid organic fertilizer can be applied by spray or sprinkled on the planting medium (Arthagama et al., 2021).

In this experiment, organic fertilizer likes Fermented Fruit Juice (FFJ) and Fermented Plant Juice (FPJ) were used as a booster for the *Dendrobium bigibbum* growth. Each organic fertilizer has it owns benefits that could be seen in a growth performance of *Dendrobium bigibbum*. Orchid plants require repotting on the off

chance that there is no space left in the pots for new developments and assuming the substrate has decayed or roots are spoiling. Timing is the main piece of good repotting. The best and ideal opportunity for repotting of an orchid is when new development and new roots are simply starting to frame, before those new roots reach even 1 cm long.

1.2 Problem Statement

Nowadays, the use of organic-based ingredients is widespread. This also includes organic fertilizer. Many farmers have started to use organic-based farming materials, as well as for orchid crops. Each of the organic fertilizer give a different benefits and different result to the orchids. But, common organic fertilizer that found were expensive, hard to find, and etc. Fermented plant juice (FPJ) is related to the enzymes in leaves that improve plant development and the advancement of photosynthesis. But, Fermented fruit juice (FFJ) works on the advancement of fruiting plants by providing them with potassium (K). The previous research that used silicon foliar application to enhance the growth of *Dendrobium bigibbum*. Thus, this project came out with innovation of Fermented Fruit Juices (FFJ) and Fermented Plant Juices (FPJ) that act as organic foliar spray and enhances the growth performance of *Dendrobium bigibbum* orchid. Plus, FFJ and FPJ are cheap, the ingredients are easy to find, which are readily available from postharvest waste as well as the kitchen waste, it is easy to apply and dilute and also environmentally friendly.

1.3 Hypothesis

H0: There is no significant effectiveness of using different organic booster on growth performance of *Dendrobium bigibbum*

H1: There is significant effectiveness of using different organic booster on growth performance of *Dendrobium bigibbum*

1.4 Significance of Study

Organic booster that was utilized in this investigation are natural, modest and easily discovered. Each of the selected booster has advantages, for instance, Fermented plant juice (FPJ) contain chlorophyll extract that could improve plant development and the advancement of photosynthesis. Hence, Fermented fruit juice (FFJ) works to promote orchid growth and advancement of orchid flowers as fruits used are rich in potassium and phosphorus. These nutrients can help orchid during flowering stage. This balance is important to keep a sound orchid.

1.5 Objective of the Study

1. To study the effect of different organic booster towards growth performance of *Dendrobium bigibbum* and to identify the best organic booster for *Dendrobium bigibbum.*

CHAPTER 2

LITERATURE REVIEW

2.1 History of Orchids

Orchids, member of family Orchidaceae, are significant floricultural plants. They are broadly distributed around the world and considered as biggest blossoming plant with 20,000 to 35,000 species (De, 2019). There are in fact numerous assortments of orchid like *Dendrobium, Epidendrodium, Phalaenopsis, Oncidium, Vanda, Cattleya* and so forth existed. Orchids are the most delightful blossoms in God's creation and have vanquished the cut blossom industry everywhere in the world during the most recent couple of years.

Orchid cut blossoms have arised as pioneer in the global market and have gigantically added to the economy of a few non-industrial nations. They are esteemed for cut blossom creation and as potted plant in business horticulture attributable to the wide scope of shadings, shapes, sizes and scent portrayed (Sanghamitra et al., 2019). Orchids are brilliant for garden and can be filled in beds, pots, containers, split hollows of bamboo pieces and so on. They are showcased around the world as cut blossoms for making corsages, decorative layouts and bouquets. They are likewise appropriate for inside beautification and stay fresh for a long time.

Dendrobiums are famous blooming pruned plants and cut blossoms all over the planet due to their floriferousness, wide range in bloom tone, size and shape, all year accessibility and extensive jar life. Hawaii, California, and Florida are major pruned *Dendrobium* developing areas in the United States. In the Netherlands, creation of pruned orchids is currently 40 to 50 million units with *Dendrobium* expanding in ubiquity. In Asia, Thailand is the world's biggest exporter of tropical cut orchids and second biggest provider to the EU, represented 22% of provisions to the EU (Thammasiri, 2016). *Dendrobiums* are famous for cut blossoms and for interiorscaping additionally important as pot plants or hanging bushels. The dried stems of *Dendrobium nobile* are utilized for making home grown medication. *Dendrobium* upgrades salivation and is utilized for the treatment of dry mouth, dry hacks and serious thirst. Blossoms could be utilized to fix eye infirmities. The tonic produced using *Dendrobium* supports stomach, lungs and kidneys. The plant is powerful in treating aspiratory tuberculosis, ineptitude and anorexia. The mash of pseudobulb is applied to bubbles and pimples, and the juice of the plant is utilized to diminish fever. *Dendrobium* blooms are the most well-known variety utilized in cooking.

In Thailand, these eatable blossoms are dunked in spread and pan fried while numerous European cooks decorate pastries and cakes with them. Like other blooming plants, orchids additionally need to achieve a specific phase of development and satisfy the enthusiastic interest to start blossoming. It might change from 3 years to 7 years relying on the kind of species and half breeds. Orchid pseudobulbs are occupied with the control of physiological cycles that are significant for development and endurance. The capacity to store water, minerals and starches in the pseudobulb has more prominent effect for endurance in the

harsh and supplement restricted epiphytic biotope. Pseudobulb photosynthesis reuses respiratory carbon that would contribute emphatically to entire plant carbon economy. There are critical varieties in the substance of starches in pseudobulbs and blossoms and chlorophyll content in leaves among various crossovers. (Chandra et al., 2014)

The cool developing *Dendrobium* orchid bunch flourishes well in temperatures range of 10 and 24°C. The moderate *Dendrobium* orchid lean towards a temperature scope of 14 to 26°C while the warm developing *Dendrobium* orchids favour 16 to 30°C. Low day temperature causes leaf yellowing, defoliation and decreases vegetative development, while higher temperatures defer bloom bud improvement. Low temperature and brief days could change the centralization of endogenous development controllers prompting the acceptance of blossoming in sympodial orchids (Blanchard, 2016).

Under enough light, orchid plants have short, stout stems with radiant green leaves, while a lot of light causes yellowing, hindering and withering of plants, and a lot of shade causes more obscure green, and velvety leaves. A wide range of *Dendrobium* orchids require warm splendid light. They should get 12-14 hours of light every day all year round. Pure air and great dissemination are fundamental for orchid creation (Chandra et al., 2014).

Most orchids are harmed by overwatering rather than under watering. Overwatering prompts root decay and numerous different illnesses. Most orchids lean toward water of pH 5.0-6.5 (Hicks, 2021). Watering with lower or higher pH or with significant degrees of disintegrated minerals can hamper supplement uptake. Continuous watering is fundamental under high daylight and high temperature conditions. Plants in little holders dry out more rapidly than in

enormous compartments. Plants in earthen pots require more watering than plants in plastic pots. A hanging plant, since it has better air circulation, needs more continuous watering than one in a pot. Watering ought to be polished either toward the beginning of the day or in the early evening. Preparing materials like coconut husk, tree plant and so on, having more dampness maintenance limit, need less water and less every now and again.

The single prevailing component that influences the development of orchids is moistness, which ought to be pretty much as high as 50-75%. It shifts species to species contingent on propensity for development, light, temperature and ecotypes. As dependable guideline, in high temperature, stickiness ought to be kept high. Arrangements of clouding units or even humidifiers will guarantee sufficient dampness. Standing water underneath the seats might be kept to further develop dampness (Chandra et al., 2014).

There are six primary strategies utilized for orchid propagation like division, back bulbs, aerial cuttings, keiki, micropropagation and seed culture. Other methods utilized in propagation are aerial shoots and tubers. Tissue culture, gives another resolution for generating an enormous amount of hereditarily comparative, phytosanitarily and physiologically great plantlets inside a restricted period. The tissue culture cycles, will produce a great endurance rate, related with an exclusive requirement of acclimatized sprouts, is attractive in commercial laboratories and organizations engaged towards orchid micropropagation. Tissue culture is additionally applied for acquiring new *Dendrobium* cultivars (Figure 1.1) (Naik, 2012). The in vitro climate being used in the creation of seedlings gathered from symbiotic or asymbiotic germination inside a clean climate following the suitable sanitization techniques. Tissue culture-raised plants

regularly require broad solidifying treatments to forestall high mortality after transfer to ex vitro conditions (Zeng et al., 2017).

Figure 2.1: Tissue culture cultivation method of *dendrobium* (Naik, 2012).

2.2 History of *Dendrobium bigibbum*

Dendrobium bigibbum, just as numerous different kinds of orchids, had lived on earth for a long time. Fossil records from New Zealand show that this orchid lived as far back in history as the early Miocene time frame, also known as Cenozoic era, which occurred from 65 million to 1.8 million years ago. The principal half breed *Dendrobium* orchid was created in Europe in 1864 (Arditti, 1984). Before the end of the nineteenth century, their ubiquity had developed and a detailed 66 cross breed species existed, as indicated by the book "*Dendrobium* and Its Relatives," (Baishnab and Datta, 2019).

Dendrobium bigibbum, regularly known as the Cooktown orchid or mauve butterfly orchid is an epiphytic or lithophytic orchid in the family Orchidaceae. It generally have lilac-purple blossoms. It be found in tropical North Queensland, Australia and New Guinea, Malaysia, Thailand and others. *Dendrobium bigibbum* is an epiphytic or lithophytic orchid with purplish pseudobulbs with size of 8–50 inch long and 0.6–0.8 inch wide (Bostock, 2009).

The blossoming stems are 8–20 inch long that consists of various colour such as lilac-purple colour, white or pinkish blossoms. The petals shape are most likely an egg-formed. Blooming happens from February to July.

Below is the taxonomy of the *Dendrobium bigibbum sp.* that could be used to describe types of orchids in more details.

Taxonomy of *Dendrobium bigibbum*:

Kingdom: Plantae

Subkingdom: Viridiplantae

Infrakingdom: Streptophyta

Superdivision: Embryophyta

Division: Tracheophyta

Subdivision: Spermatophytina

Class: Magnoliopsida

Superorder: Lilianae – monocotyledons

Order: Asparagales

Family: Orchidaceae

Genus: *Dendrobium*

Species: *D. bigibbum*

Taxonomy of *Dendrobium bigibbum* retrieved from ITIS website:

https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=500236#null

2.3 Growing Conditions and Management of *Dendrobium bigibbum*

Nets are cast above the plants in orchid nurseries to create a semi-shaded environment. This results in an environment with 50 to 70 percent sunlight, which is favourable for growth and flowering and protects leaves and flowers from sunburn. Along with water, sunlight is still the most important factor in ensuring a healthy plant and flowering.

Dendrobium bigibbum was most popular orchid in Malaysia because it could thrive in Malaysia daily temperature which could give more sunlight to the plants. *Dendrobium bigibbum* orchids requires a lot of warmth and dampness (Hou et al., 2017). *Dendrobium bigibbum* prefers drier conditions when development has completed for the season. This condition is shown by no creation of new leaves at the peak of the plant.

Watering is a little trickier than sunlight because it is affected by environmental factors and pot medium (Obsuwan et al., 2015). On a more serious note, improper watering can cause plant death. Keep in mind that too much watering causes root rot, which promotes fungal growth and other symptoms. That is why proper orchid pots are porous, allowing excess water to drain. Furthermore, *Dendrobium bigibbum* is typically grown in charcoal, which is an appropriate pot medium that does not retain excess water and allows roots to breathe.

Dendrobiums should be watered (mostly onto their roots) at times of the day when the sun is not too hot (around 8 a.m. and 6 p.m.). These are the times of day when orchids can absorb the most water for photosynthesizing, and there are

several hours of daylight following to help evaporate excess water (Aziz et al., 2009). Watering in the middle of the day or in the hot sun may shock the plants. The majority of the principles underlying orchid care are based on gradualism. Analogically, it is very unpleasant for the plants to be splashed with cool water after they have already been heated up in the hot sun.

2.4 Suitable Media for Orchids

The materials utilized for developing orchids are completely unique in relation to those utilized for different plants. An ideal medium ought to give firm anchorage, great air circulation, impede sickness and pathogenic variables which will be able to keep the plant liberated from spoiling, and give a touch of supplement, eco-accommodating and promptly accessible (Gupta, 2017). The best planting media should have a pH which is around 5.5 to 6.5 for ideal supplement accessibility and surface which licenses unhindered vaporous trade and water development for the appropriate root advancement. It is extremely helpful for expanding air circulation and waste inside the compartment due to its consistency and delicacy (Rajkumar et al., 2017). In this manner, right choice of media offers suitable conditions for the ideal outcomes. Preparing media just as dietary prerequisites are the main components influencing the establishing and development of plants.

2.5 Coconut Husk Chip

Husk chips are created from the husk of coconut. The benefits of coconut husk chips are, one of the most outstanding soil conditioners which bear relatively high water holding limit. Then, it also preferably to hold dampness in soil during summers. Act as normal 100 % natural best soil initiation, great air circulation, water absorbability. Moreover, it could help manure in giving its full proficiency in any soil and in any climate conditions. Furthermore, can assists liberated from weeds, insects and parasites (Amberger, 2010).

Coconut husk chips make it a better option than bark based developing medium. It is expanded the air full porosities and water holding limit. Coconut husk chips are great for orchid development. The cultivators are effectively utilizing coconut husk chips rather than bark, observing it provide huge benefits as far as quality, consistency, and even lower production costs. Coconut Husk Chips work extraordinary as growing medium of orchid. They will hold water and delivery it equitably (Amberger, 2010).

2.6 Charcoal

Charcoal is by a widely used as the main parts in a potting mix. Charcoal is the result of gradually burn out wood with a suitable temperature. The burning process happens at temperatures of 400°C – 500°C (750°F – 930°F) (Zakil et al., 2021). Charcoal has an extremely long time span of usability. That clarifies the high usefulness of charcoal as potting media.

However, charcoal being permeable, aggregates minerals salts that can make harm the root arrangement of the plant. To overcome this, a few specialists prescribe to cultivators that utilizing charcoal, to re-pot the plants consistently to stay away from root harm. Charcoal tends to absorb toxin from the digestion, for instance pine bark, bringing about multiplying the existence of some preparing other medium mixture. For instance, Sphagnum moss has typically a life expectancy of a half year, be that as it may, with 10% charcoal added, the life expectancy could increase (Zakil et al., 2021). Pine bark has a life expectancy of around a year and again with charcoal added, the life expectancy can increased to two years.

2.7 Benefits of coconut husk chips and Charcoals

Coconut husk chips are the customary cutting of the husk of the coconut in uniform sizes. Coconut husk chips are cleaved or cut into a size of 1 cm to 3 cm. It contains excellent peat with fibers to retain more water. It is utilized as mulching agent, as well as a substitute for wood barks (Compton and Zouche, 2006). The coconut husk chips shapes are appropriate for the plants which require more air filled porosity. It is ideal for plants like orchids. Coconut husk chips are liberated from weeds, forestalls creepy crawlies and parasites. Coconut husk chips also supports fertilizer in giving its full productivity in any dirt and in any climate condition.

Charcoal is a permeable dark strong fiber blocks, comprising of an indistinct type of carbon, made up of wood, bone, or other natural matter which is burnt without air (Mastrolonardo et al., 2019). Charcoal provides a superb growing condition for orchids since it absorb odour, curbs the development of microorganisms, and ingests the salt build-up. The physical characteristic of charcoal provides a firm stabilizer to bigger orchid root to stand erect, charcoal does not hold dampness, and can expand the pH of the orchid medium.

2.8 Organic Booster

Organic booster or called as organic fertilizer are normally accessible mineral sources that contain moderate measure of fundamental plant supplements. Organic fertilizer can be natural or processed, for example, compost, natural enzyme-digested proteins, and others. Organic fertilizers go about as slow release fertilizers, as it were, they give supplements in lower amount throughout a broad time period. Nitrogen (N), phosphorous (P), and potassium (K) are the three significant macronutrients significant for plant development. Synthetic fertilizer contain high amount of soluble nitrogen, which is effectively dissolvable in water. Though, greater part of organic fertilizer contain balanced amount of crude nitrogen and subsequently function as lethargic delivery fertilizer (Ahmad et al., 2016).

It is already known that organic fertilizer more advantages than chemical fertilizer in order to save the earth. Plus, organic fertilizer also could make sure soil ecosystems are well balanced. It is because, any organic fertilizer residues not give harm to the water and environment (Li et al., 2017). Moreover, it will aid to boosts plant growth performance naturally. So, chemical hazard and injuries of the plants will be reduces. Furthermore, decomposition process of it does not requires any chemical intervention.

2.9 Fermented Fruit Juices (FFJ)

Fermented Fruit Juice (FFJ) is a fruit extraction that works as organic booster or fertilizer to aid the plant growth. Raw brown sugar is a significant in creating FFJ, since it is could help for the extraction of phytochemicals which can be found in fruits and vegetables (Hubilla, 2020). The fermentation process typically takes about seven days, it might take about a month or longer. To make FFJ, it is suggested to utilize overripe organic products since it can reduce the maturation time frame and vital present microorganisms like molds. Creation of FFJ could utilize a solitary sort of fruit or the mix of at least two. Organic products with high citrus extract content like lemons and oranges are not suggested, because of their creation which is inverse to the important detailing that FFJ needs. Materials utilizing a mix of different fruits which are 1 kilogram every one of fruits chosen (all out 3 kg) and furthermore 3 kilograms brown sugar or molasses. The application is, blend 2 tablespoons of FFJ in with 1 litre of plain water. Spray it to plants 1 to 2 times each week.

2.10 Fermented Plant Juices (FPJ)

The entry of Philippine Republic Act 10068, also called the "Organic Agriculture Act of 2010" which advances natural farming innovation utilizing organic materials like fermented plant juices (FPJ) in horticultural creation. It is because, it is safe and eco-accommodating wellsprings of nutrients for plants. The utilization of fermented plant juices, can help the plant growth. It is a combination of chopped plant shoots or leaves and molasses that is fermented for a week and were diluted into water once applied to plants (Miller et al., 2013).

Fermented plant juices (FPJ) was suggested to use as plant booster because it comprises of the young shoots of overwhelmingly developing plants that are permitted to mature for around 7 days with the aid of brown sugar. The brown sugar coaxes the juices out of the plant material by means of assimilation and furthermore fills in as a food sources for the microorganisms doing the fermentation process.

The main necessity when choosing plants for making FPJ is to utilize the developing tips of plant species that are quick growers (Miller et al., 2013). Blossoms, and bloom buds can likewise be utilized. Hard or woody plant parts are not suggested to use because practically it does not contain plant juice. Plant parts ought to be gathered while the plants are in respiration mode (before dawn) and not in photosynthetic mode (during sunshine), because of the impacts these cycles have on plant chemistry. Abstain from gathering plant parts during or later precipitation and do not wash collected plant parts, to preserve their surface

microbial populaces, which will do the maturation cycle. Low levels of these microorganisms will bring about inappropriate maturation as well as low yields of plant juice.

2.11 Advantages of Organic Booster

2.11.1 Advantages of Fermented Fruit Juices

Fermented fruits juice, otherwise called FFJ, can be used as an organic fertilizer for plants and gardens. This organic fertilizer boost nutrients in the soil and subsequently in the plants filling in it, particularly potassium levels (Ahmad et al., 2016). This organic booster can be made at home from numerous fruits and definitely not as much as buying other liquid organic fertilizer. The fermentation process requires somewhere around seven days to finish, however may require a month or longer.

Fermented Fruit Juice (FFJ) is natural fertilizer which has been utilized in normal cultivating practice. FFJ can be applied as plant energizer in instigating blooming for *Dendrobium bigibbum* to decrease consumption of chemical fertilizer. Fermented Fruit Juice produced using a blend of easy to find fruit sources such as banana, papaya and pumpkin. These ready organic products contain phosphorous and potassium which are important during the blooming stage. Overripe sweet organic products are great for making organic Fermented

Fruit Juice because it will produced more fruit juices and contain more potassium (Tagotong, 2020).

2.11.2 Advantages of Fermented Plant Juices

Advantages of fermented plant juices (FPJ) for the plants are guaranteed safe and eco-accommodating supplements. The detailing and use of fermented plant juices, a combination which can further upgrade soil development. As a characteristic development enhancer. It is because, FPJ produced using effectively developing plant parts that contain natural growth hormones and mineralized that advances plant development (Miller et al., 2013).

There is no excess on the utilization of FPJ, thus it very well might be utilized generously. Fermented plant juices gives more nitrogen to plants and improves the capacity of plants to photosynthesize better. It likewise gives extra phosphorus and assists plants with retaining additional phosphorus from the soil. Subsequently, the utilization of FPJ could advance vegetative development and increment the volume and size of plants (Racoma et al., 2017).

CHAPTER 3

METHODOLOGY

3.1 List of Materials

In this experiment, there are several materials needed. The materials that involves are 45 samples of *Dendrobium bigibbum*, Fermented Fruit Juices (FFJ) and Fermented Plants Juices (FPJ), charcoals, coconut husk chips, pots, flower scissors, and fertilizers.

3.2 Methodology

3.2.1 Experimental design

Present research was conducted at the Tissue Culture Nursery, Universiti Malaysia Kelantan. Two different organic booster and 1 control were used as sources for growth including, Fermented Fruit Juices (FFJ) (treatment 1) and Fermented Plants Juices (FPJ) (treatment 2) and water as control.

In this experiment, 15 samples of *dendrobium* orchids were sprayed with FFJ, 15 samples were sprayed with FPJ and another 15 samples were sprayed with plain water. The organic booster were sprayed 5 sprays for each treatment once per week for 8 weeks.

45 pots which is the size is 6 inch used for growing plants. Growing media used for the orchids are charcoals and coconut husk chips with the ratio 1:1. Experiment was carried out in the nursery and data were collected once per weeks. The different physiological parameters including number of leaves per plant, plant height (cm), diameter of stems (cm) leaves lengths (cm) and width of leaves (cm).

Table 3.1: Treatment code for organic booster and control

Code	Treatment
T0	Control
T1	Fermented Fruit Juices (FFJ)
T2	Fermented Plant Juices (FPJ)

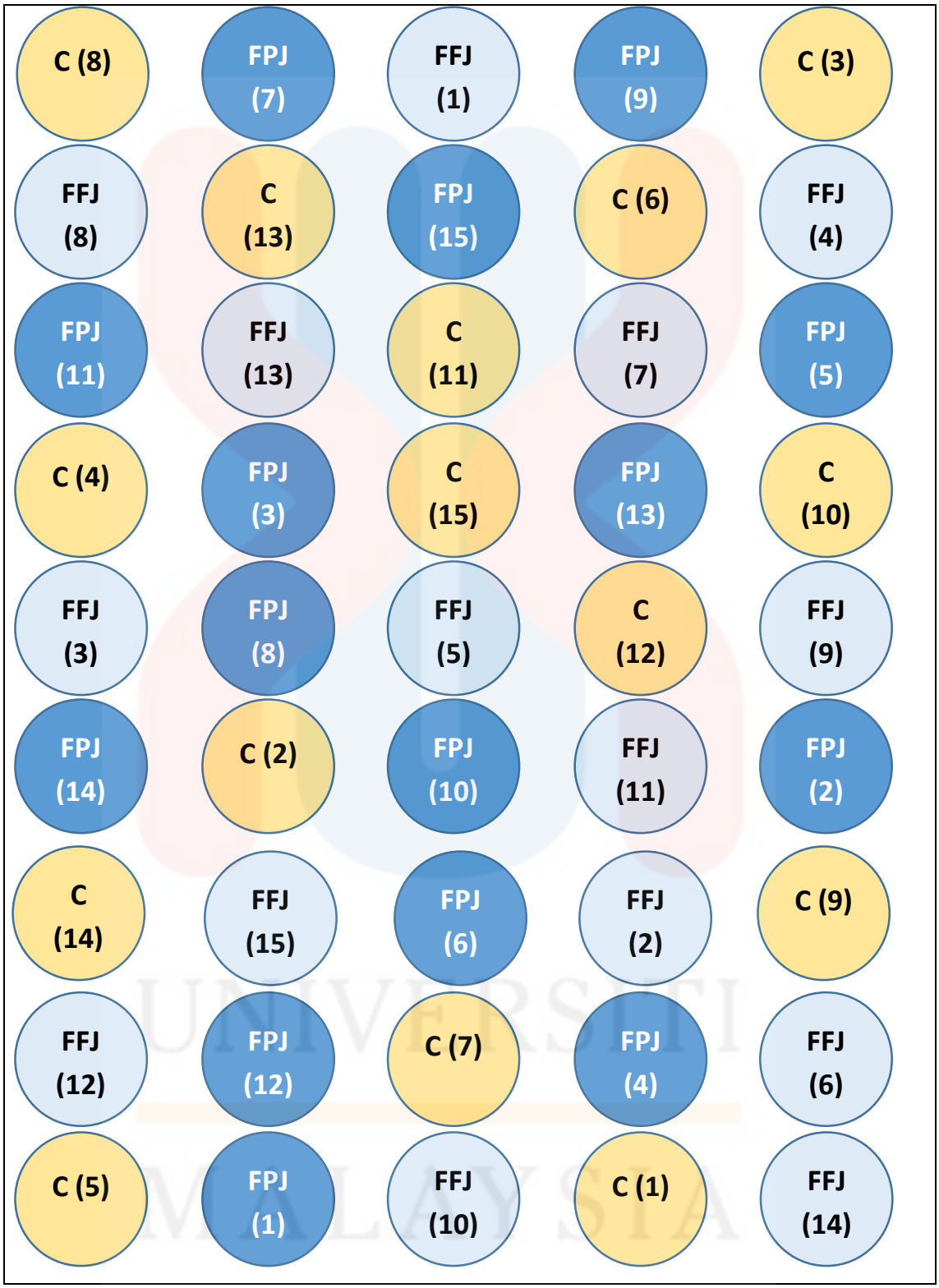

Figure 3.1: Layout of project design was complete randomized design (CRD).

3.2.2 Preparation of Fermented Plant Juices

A kilogram of green spinach, water spinach and mustard respectively were prepared. Soils were eliminated from plants however did not washed them with water since it might kill valuable microorganisms. The plants were chopped into an inch in size. All the chopped plants were mixed in a 20 L dark plastic container. 1 kilogram of molasses were added and the mixture were mixed again completely. After that, a nylon screen were placed on top of the compartment and hold down with significant burdens. The compartment were covered with permeable paper to permit air to flow then, at that point, tied it shut with elastic band or string. The mixed solution were labeled with the name and date of fermented started.

The mixture solution were saved in a dull or concealed space for 7 days. The mixture were opened and the fluid were extracted. The fluid were filtered and kept it in the jug, yet did not close the cover firmly. Released it to roughly one complete bit of the cap. The cap were totally closed following a week or when there are no more air pockets noticeable inside. The mixture prepared were ready to use after extraction.

3.2.3 Preparation of Fermented Fruit Juices

All the fruits needed like banana, papaya and pumpkin were prepared. Fruits that are liberated from bug nuisances and illnesses were utilized. Chopped the fruits into little pieces so the juice can be effortlessly produced. 1 kg of

pumpkin, 1 kg of banana and 1 kg of papaya were mixed in a huge plastic container, 1 kg unrefined sugar or molasses were added, and afterward mix well with hands.

Next, ensured that all chopped fruits are covered with molasses so the juice can be extricated without any problem. The plastic container were covered with paper or suitable material to permit some air to get inside the pot or bucket and for the gas that is being created during the fermentation process to get away. On the cover, the date of started the process were noted. The container that contains mixture solution were stored in a cool dry obscure spot for 7 days. Ensured that the capacity region was not invaded with cockroaches or mice, since they may affect by polluted the concoction.

In 7 days, plant juice were extricated and fermented. The fruits concentrate will change its tone from yellow orange to brown and will smell sweet and heavy drinker. Following 7 days, the blend were sieved and pressed hard to get the excess concentrates. After that, the fermented liquid were gathered and safeguard in dull shaded glass container. To cover the container, paper or suitable material were used to permit the gas to avoid during additional maturation, then, at that point, stored in a cool, obscure spot.

3.2.4 Preparation and planting

Bench area was cleaned first from other things and plants. The surface must cleaned and neat. After that, *Dendrobium bigibbum* were propagated by plant division. Huge orchid plants be can be divided so that a few new plants can

be developed. Prior to cutting the plant, cautiously inspect the root design to figure out where to make the cuts.

During division process growers need to utilize a clean, sharp scissors, or even by delicately pulling the plant separated. Usually, the plant will have a characteristic territory where it parts effectively, and it is a smart thought to follow that division however much as could be expected.

Total of 45 samples of *Dendrobium bigibbum* were in a ready condition to be planted. The next step is to plant the orchid in the plastic pots with growing media.

3.2.5 Preparing and applying FPJ and FFJ

FPJ were diluted with water usually, at a ratio of 20 ml for every 500 ml of water. FPJ were applied once each week in the early morning, best if before dawn since, it were the best an ideal opportunity to apply before plant do a photosynthesis interaction. The booster can be watered onto plants, or it tends to be applied as a foliar spray. The booster were applied once in a week.

Then, the steps above were repeated to prepare and apply FFJ booster.

3.2.6 Managements of *Dendrobium bigibbum*

Dendrobium orchids were watered twice per week. The purpose is to make sure that the growing media moist. Then, the orchids were sprayed with organic booster once per week. 20 ml harvested FFJ and FPJ were diluted in 500 ml of water. Once ready, the organic boosters were sprayed to the *Dendrobium bigibbum* accordings to treatment which has been set. Moreover, the orchids were fertilized once per two weeks using suitable common fertilizer like Alpha-Omega fertilizer.

3.2.7 Data analyses

Data that were collected once in a week for the 8 weeks. Then the data were analyzed to measure the growth performances of *Dendrobium bigibbum*. The data were analyze using statistical package for social science (SPSS). The entire data will include two groups of different growing media were analyzed using one- way ANOVA and Tukey's test to find the differences between each treatment. The analysis carried out with 95% confidence level (p=0.05). The experimental design used in this study was Completely Randomized Design (CRD) without any blocking.

CHAPTER 4

RESULTS AND DISCUSSION

The organic booster utilized in the current research showed diverse response. Result of the study were supported the theory that there was an impact on *Dendrobium bigibbum* growth performances by various types of organic booster. From the observation below, comparison had been made in order to differentiate the effectiveness of different organic booster.

Treatment	Week 1	Week 8
FPJ (T2)		
FFJ (T1)		

Control (T0)		

Figure 4.1: Comparison growth of *Dendrobium bigibbum* between week 1 and week 8 for the three treatments applied.

From the figure 4.1, can be observed that orchid applied with Fermented Plant Juices had the highest increment and differences compared to the others treatments.

4.1 Plant height

Table 4.1: The plant height within 8 weeks.

Code	Treatment	Mean±SE (cm)
T0	Water (Control)	26.196±0.212[a]
T1	Fermented Fruit Juices (FFJ)	27.240±0.291[b]
T2	Fermented Plant Juices (FPJ)	28.502±0.252[c]

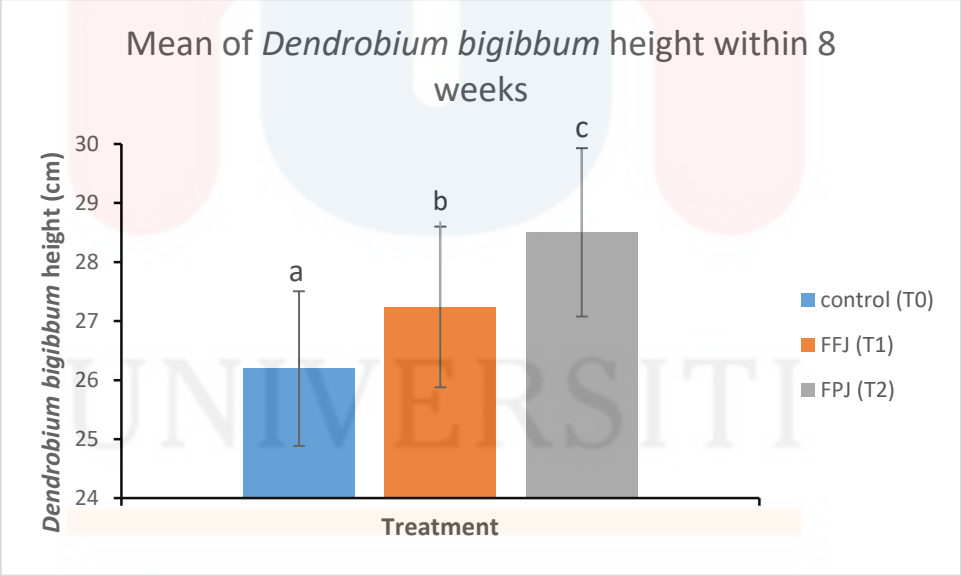

Figure 4.2: Mean of *Dendrobium bigibbum* height within 8 weeks.

Figure 4.3: Comparison of orchid height between three treatments.

In the current research, just vigorous *Dendrobium bigibbum* plantlets were chosen to perform analyses of effectiveness of different organic booster. The aftereffects of the treatment showed that there was a huge contrast in the plants height among various organic booster as displayed in Figure 4.3. Based on Table 4.1, between different organic booster utilized in this research, the most high performance of plant height was in T2 (28.5 cm) following 8 weeks of study. The outcomes displayed show that T2 treatment were outperform than control (T0). For the second higher mean is T1 (27.2 cm) and lastly is for the control (26.2 cm).

When compared to FFJ, fermented plant juices produces significantly taller *dendrobium*. This finding supported Tagotong's (2020) findings that applying fermented plant juice (FPJ) to vegetable crops promotes good plant growth and vitality. He also stated that combining 1 tbsp per litre of water will have a very favourable effect on plant growth. Organic fertilizers, such as

fermented plant juice, is a good source of plant nutrients for improving plant physical properties.

The statistical analysis displayed there was a significant impact on treatments on plant height at the $p<0.05$ level for the 2 different treatments and 1 control ($F (2, 402) = 20.765$, $p = <0.000$). Post hoc comparison utilizing the Tukey's test showed that the mean score for *Dendrobium bigibbum* applied with treatment T2 ($M = 28.502$, $SE = 0.252$). Mean score for treatment 1 is ($M = 27.240$, $SE = 0.291$). Then, for the control is ($M = 26.196$, $SE = 0.212$). All the mean level for the plant height were significant at the 0.05 level.

4.2 Leaf length

Table 4.2: The leaf length within 8 weeks.

Code	Treatment	Mean±SE (cm)
T0	Water (Control)	11.626 ± 0.170^{a}
T1	Fermented Fruit Juices (FFJ)	12.699 ± 0.128^{b}
T2	Fermented Plant Juices (FPJ)	13.396 ± 0.175^{c}

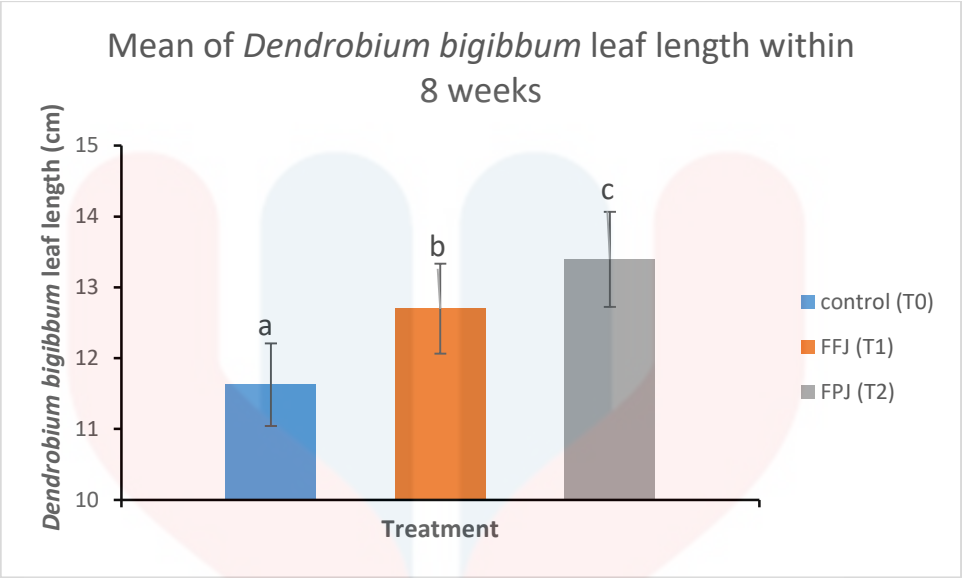

Figure 4.4: Mean of *Dendrobium bigibbum* leaf length within 8 weeks.

Until about 8 weeks of management of *Dendrobium bigibbum* in nursery, there was effective development of leaf length in the review. The outcomes in Figure 4.4 showed the leaf length between treatments. The best outcome goes to T2 treatments for leaf length development than other treatments. The T2 treatment recorded highest leaf length at 13.4 cm. Followed by T1 treatment with 12.7 cm. The T0 treatment recorded lowest reading of leaf length at 11.6 cm.

Better execution of plant stature may presumably on the grounds that new shoot plant has higher auxin content, accordingly it very well may be valuable to trigger age and separation of new shoot cell. The FPJ assisted crops with acquiring their required N to increment in volume, along these lines appropriate to be utilized during vegetative development.

Better leaf length performance is likely due to the higher auxin content of the shoot plant, which may be useful in triggering the generation and differentiation of shoot cells. The plant materials used in FPJ also assist plants in obtaining the

necessary N, making it suitable for use during vegetative growth. Plant growth hormones, known as auxins, are abundant in fermented plant juices. Auxins are powerful growth hormones that plants produce naturally. It is found in the tips of shoots and roots and promotes cell division, stem and root growth. Auxins can also have a significant impact on plant orientation by directing cell division to one side of the plant in response to sunlight and gravity. Auxins have a positive effect on gibberlins, which promote cell elongation. This lengthens the plant. Gibberlins, and thus auxins, essentially increase the distance between nodes, spacing the branch points further apart (Balzan et al., 2014).

Essentially, the measurable investigation displayed there was a significance different of leaf length at the $p<0.05$ level for the 3 treatments ($F(2, 402) = 31.533$, $p = <0.000$) (Table 4.2). Post hoc examinations utilizing the Tukey test demonstrated that the mean score for *Dendrobium bigibbum* applied with treatment T2 ($M = 13.396$, $SE = 0.175$) showed higher value compared to T1 ($M = 12.699$, $SE = 0.128$) and *Dendrobium bigibbum* applied with control treatment just ($M = 11.626$, $SE = 0.170$).

4.3 Leaf width

Table 4.3: The leaf width within 8 weeks

Code	Treatment	Mean±SE (cm)
T0	Plain water (Control)	3.285±0.050[a]
T1	Fermented Fruit Juices (FFJ)	3.422±0.058[a]
T2	Fermented Plant Juices (FPJ)	3.753±0.059[b]

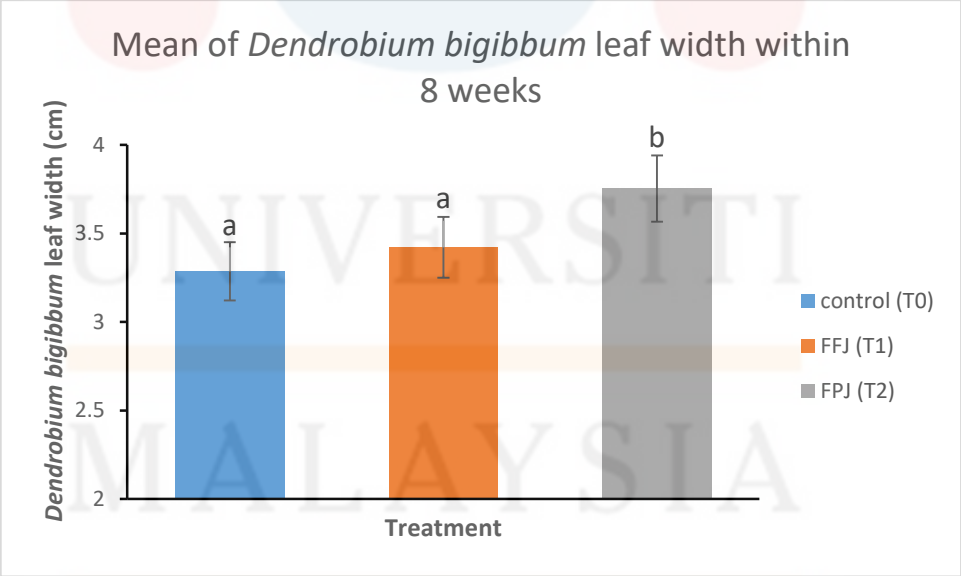

Figure 4.5: Mean of *Dendrobium bigibbum* leaf width within 8 weeks

Leaf width of the orchid were measured each weeks to make comparison among these treatments. Result for the leaf width were displayed in figure 4.5.

The orchids that were applied with Fermented Plant Juices (FPJ) showed widest leaf which are 3.75 cm. Then, at that point, trailed by plant treated with treatment 1 (3.4 cm). For the leaf width that unapplied the organic booster showed the bottom increased in leaf width (3.3 cm).

According to Table 4.3, only orchid applied with FPJ had a significant effect. Meanwhile, the T1 and control did not showed any significant results. FPJ applied in the early morning had an effect on leaf width increment. Treatment of the plants were done in the morning since *dendrobium* is Crassulacean Acid Metabolism (CAM) plant. The stomata open at night and close during the day. CAM employs a mechanism to bind carbon dioxide at night when stomata open, while also allowing water and nutrients to enter through the stomata. As a result, CAM plants can photosynthesize without losing a lot of water through stomata transpiration (Cushman, 2017). The increase in leaf width may have occurred as a result of orchid plants absorbing nutrients from the growing medium and distributing them through the leaves.

Nutrients were delivered to the leaves by spraying fertilizers directly into the leaves, allowing the leaves to grow and develop. This was due to the fact that the nutrient capacity applied to the plants was quite sufficient, allowing the photosynthesis process to run smoothly (Hariyanto, 2019). This had an effect on the leaf width.

For the leaf width, the statistical analysis displayed there was a significant pattern of leaf width at the $p<0.05$ level for the 3 treatments ($F (2, 402) = 18.638$, $p = <0.000$). Post hoc correlations utilizing the Tukey's test demonstrated that the mean score for *Dendrobium bigibbum* applied with treatment T2 (M = 3.753, SE

= 0.059) was significantly different than T1 (M = 3.422, SE = 0.058), and T0 (M = 3.285, SE = 0.050).

4.4 Stem diameter

Table 4.4: The stem diameter within 8 weeks

Code	Treatment	Mean±SE (cm)
T0	Plain water (Control)	3.341 ± 0.039^{a}
T1	Fermented Fruit Juices (FFJ)	3.573 ± 0.041^{b}
T2	Fermented Plant Juices (FPJ)	3.773 ± 0.053^{c}

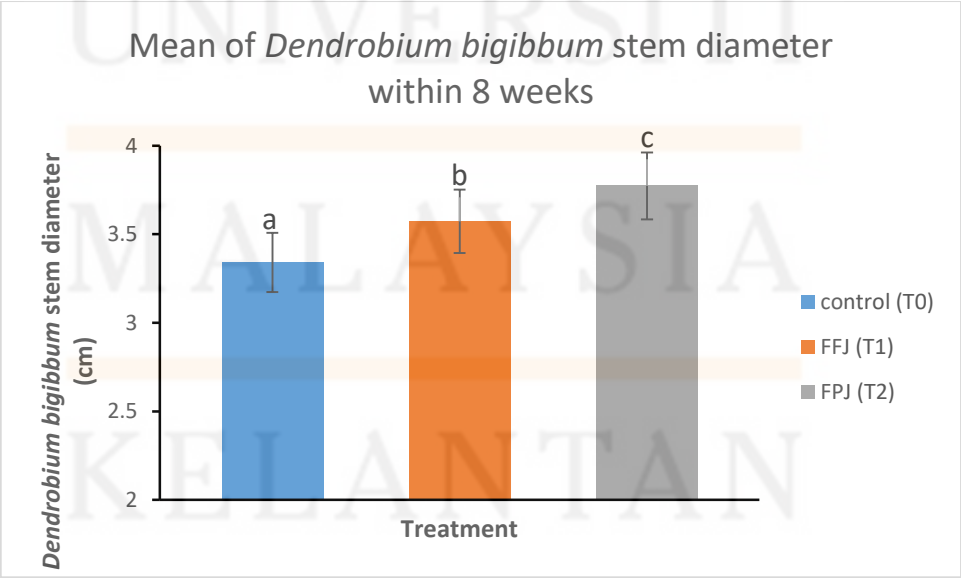

Figure 4.6: Mean of *Dendrobium bigibbum* stem diameter within 8 weeks

The outcomes showed that Fermented Plant Juice (FPJ) significantly affects stem diameter. The aftereffect of the greatest stem diameter (3.77 cm) observed in T2 (Fermented Plant Juices) treated plants, followed by 3.6 cm in T1 (FFJ). Whereas, the smallest in stem diameter, 3.3 cm obtained in control (water) plants. The size of orchid stem diameter vital to ensure it can give backing to plants. Orchid stem likewise go about as capacity places of food and water to support the orchid plant during dry conditions.

FPJ derived from actively growing plant parts and fast growing plants may contain natural growth hormones as well as mineralized nitrogen, which promotes orchid growth. Fermented plant juice provides more nitrogen to plants and improves orchid photosynthetic ability. It also provides additional phosphorus and aids in the absorption of phosphorus from organic booster (Zalan et al., 2012). As a result, the use of FPJ promoted vegetative growth and increased stem diameter size. The used plant materials like water spinach, green spinach, and mustard in FPJ has impacted the orchid growth. The potential of these plant leaves and saps provided viable sources of nutrients and organic matter for improved orchid plant growth and development.

Likewise, the statistical analysis displayed there was a significant design of stem diameter at the $p<0.05$ level for the 3 treatments ($F (2, 402) = 23.150$, $p = <0.000$). Post hoc comparison utilizing the Tukey's test showed that the mean score for stem diameter of *Dendrobium bigibbum* applied with treatment T2 ($M = 3.773$, $SE = 0.053$) was significantly different than T1 ($M = 3.573$, $SE = 0.041$), and *Dendrobium bigibbum* applied with control treatment just ($M = 3.341$, $SE = 0.039$).

4.5 Leaf number

Table 4.5: The plant leaf number within 8 weeks

Code	Treatment	Mean±SE (cm)
T0	Plain water (Control)	3.884±0.086[a]
T1	Fermented Fruit Juices (FFJ)	4.037±0.059[a]
T2	Fermented Plant Juices (FPJ)	4.104±0.082[a]

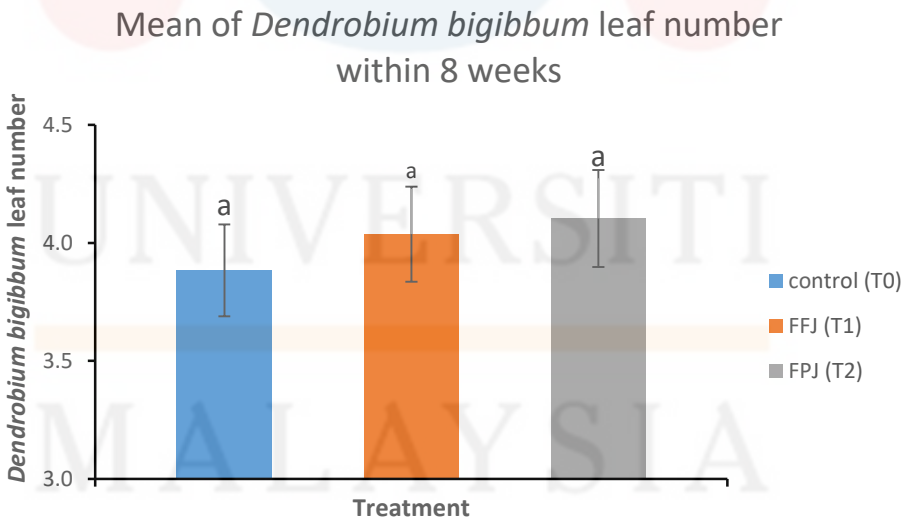

Figure 4.7: Mean of *Dendrobium bigibbum* leaf number within 8 weeks

The outcome in Figure 4.7 showed the leaf count of *Dendrobium bigibbum* varied across treatments. Among every one of the treatments utilized in this study, the highest leaf count was observed in the T2 treatment (Figure 4.7) which is 4.1 cm. Then, it followed by T1, and T0 with leaf count stood at 3.9 cm to 4.0 cm. T0 showed low development in of leaf count. The development of leaves was critical in plant growth because it ensured the photosynthesis and gas exchange processes occur at optimum level.

Because fermented plant juices are high in micro and macro nutrients, the number of leaves counted for treatment 2 is higher than for the others. The primary elements provided by FPJ are nitrogen and some micro elements such as calcium, molybdenum, manganese, and others. The juices are also high in microorganisms, which give plants strength. Young leaves are the plant parts used for this fermentation because they store a high percentage of nutrients from the soil and the atmosphere (Singh et al., 2017). Furthermore, plants used for FPJ are fast growing. This will provide more benefits for orchid growth performance than the other method that did not use FPJ.

There is no significant difference in the number of orchid leaves between the three orchid treatments used in this study. It could be because there isn't a significant increase in the number of leaves per week. It is because it is well known that it takes time for an orchid to form a new leaf. FPJ only showed a good increase in leaf length and leaf width for the related leaf parameters.

The statistical analysis displayed there was no significant pattern of leaf count at the $p<0.05$ level for the 3 treatments ($F (2, 402) = 2.178$, $p = > 0.0115$). Post hoc comparisons utilizing the Tukey's test showed that the highest mean score for *Dendrobium bigibbum* applied with treatment T2 is (M = 4.104, SE =

0.082). Then, followed by the T1 (M = 4.037, SE = 0.059) and *Dendrobium bigibbum* applied with control treatment is (M = 3.884, SE = 0.086).

CHAPTER 5

CONCLUSION AND FUTURE RECOMMENDATIONS

From the obtained results, organic booster effectively used to enhance the growth performances of *Dendrobium bigibbum.* Orchid were sprayed by the different organic booster in order to observe the growth performances of *Dendrobium bigibbum.* The objective of conducted study was achieved by the observed the effects when used different organic booster and FPJ was identified as the best organic booster for *Dendrobium bigibbum.* FPJ organic booster showed the highest measurement for plants height (28.5 cm), leaf length (13.4 cm), leaf width (3.75 cm), stem diameter (3.7 cm), and number of leafs (4.1 cm).

Based on the results of this experiment, it is suggested that we use local plant resources such as green spinach, water spinach, and mustard to make fermented plant juices (FPJ). Because organic fertilizer contains a high concentration of N, P, and K nutrients, it is sufficient to meet the N, P, and K nutrient needs of orchid plant growth. FPJ derived from plant materials has the potential to be used as a complementary fertilization technology in the development of organic agriculture. The use of FPJ is a low-cost and effective technology in organic farming. As a result, locally based FPJ containing mustard, water spinach, and green spinach extracts have the potential to support growth performance of *Dendrobium bigibbum*.

Further research is still needed to determine the appropriate concentration and doses of FPJ and FFJ so that we can identify which concentration are suitable as organic booster for orchid. Further study can be conducted by changing the growing media as treatment too.

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APPENDICES

Table A1: ANOVA growth performances of Dendrobium biggibum.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
HEIGHT	Between Groups	360.215	2	180.108	20.765	.000
	Within Groups	3486.811	402	8.674		
	Total	3847.026	404			
LEAF_LENGTH	Between Groups	214.556	2	107.278	31.533	.000
	Within Groups	1367.636	402	3.402		
	Total	1582.192	404			
LEAF_WIDTH	Between Groups	15.654	2	7.827	18.638	.000
	Within Groups	168.814	402	.420		
	Total	184.468	404			
STEM_DIAMETER	Between Groups	12.609	2	6.305	23.150	.000
	Within Groups	109.480	402	.272		
	Total	122.090	404			
LEAF_NO	Between Groups	3.436	2	1.718	2.178	.115
	Within Groups	317.027	402	.789		
	Total	320.463	404			

Table A2: Tukey's test of height.

HEIGHT

Tukey HSD[a]

		Subset for alpha = 0.05		
SAMPLE	N	1	2	3
CONTROL	135	26.1956		
FFJ	135		27.2400	
FPJ	135			28.5022
Sig.		1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 135.000.

Table A3: Tukey's test of leaf length

LEAF_LENGTH

Tukey HSD[a]

SAMPLE	N	Subset for alpha = 0.05		
		1	2	3
CONTROL	135	11.6259		
FFJ	135		12.6985	
FPJ	135			13.3956
Sig.		1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 135.000.

Table A4: Tukey's test of leaf width.

LEAF_WIDTH

Tukey HSD[a]

SAMPLE	N	Subset for alpha = 0.05	
		1	2
CONTROL	135	3.2852	
FFJ	135	3.4215	
FPJ	135		3.7533
Sig.		.196	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 135.000.

Table A5: Tukey's test of stem diameter.

STEM_DIAMETER

Tukey HSD[a]

SAMPLE	N	Subset for alpha = 0.05		
		1	2	3
CONTROL	135	3.3415		
FFJ	135		3.5726	
FPJ	135			3.7733
Sig.		1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 135.000.

Table A6: Tukey's test of leaf number

LEAF_NO

Tukey HSD[a]

SAMPLE	N	Subset for alpha = 0.05
		1
CONTROL	135	3.88
FFJ	135	4.04
FPJ	135	4.10
Sig.		.105

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 135.000.

Table A7: Multiple Comparison for the Tukey's test of Dendrobium biggibum growth.

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) SAMPLE	(J) SAMPLE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
HEIGHT	CONTROL	FFJ	-1.04444*	.35847	.011	-1.8877	-.2012
		FPJ	-2.30667*	.35847	.000	-3.1499	-1.4634
	FFJ	CONTROL	1.04444*	.35847	.011	.2012	1.8877
		FPJ	-1.26222*	.35847	.001	-2.1055	-.4190
	FPJ	CONTROL	2.30667*	.35847	.000	1.4634	3.1499
		FFJ	1.26222*	.35847	.001	.4190	2.1055
LEAF_LENGTH	CONTROL	FFJ	-1.07259*	.22450	.000	-1.6007	-.5445
		FPJ	-1.76963*	.22450	.000	-2.2978	-1.2415
	FFJ	CONTROL	1.07259*	.22450	.000	.5445	1.6007
		FPJ	-.69704*	.22450	.006	-1.2252	-.1689
	FPJ	CONTROL	1.76963*	.22450	.000	1.2415	2.2978
		FFJ	.69704*	.22450	.006	.1689	1.2252
LEAF_WIDTH	CONTROL	FFJ	-.13630	.07888	.196	-.3218	.0493
		FPJ	-.46815*	.07888	.000	-.6537	-.2826
	FFJ	CONTROL	.13630	.07888	.196	-.0493	.3218
		FPJ	-.33185*	.07888	.000	-.5174	-.1463
	FPJ	CONTROL	.46815*	.07888	.000	.2826	.6537
		FFJ	.33185*	.07888	.000	.1463	.5174
STEM_DIAMETER	CONTROL	FFJ	-.23111*	.06352	.001	-.3805	-.0817
		FPJ	-.43185*	.06352	.000	-.5813	-.2824
	FFJ	CONTROL	.23111*	.06352	.001	.0817	.3805
		FPJ	-.20074*	.06352	.005	-.3502	-.0513
	FPJ	CONTROL	.43185*	.06352	.000	.2824	.5813
		FFJ	.20074*	.06352	.005	.0513	.3502
LEAF_NO	CONTROL	FFJ	-.153	.108	.332	-.41	.10
		FPJ	-.220	.108	.105	-.47	.03
	FFJ	CONTROL	.153	.108	.332	-.10	.41
		FPJ	-.067	.108	.811	-.32	.19
	FPJ	CONTROL	.220	.108	.105	-.03	.47
		FFJ	.067	.108	.811	-.19	.32

*. The mean difference is significant at the 0.05 level.

Figure A1: Effects of Fermented Fruit Juices (FFJ) in enhance flowering of *Dendrobium bigibbum.*

Effect of Different Booster on Growth Performance of Dendrobium bigibbum

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