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Effect of Different Booster on Growth Performance of *Mokara* Orchid

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DECLARATION

I hereby declare that the work embodied in this report is the result of the original research except the excerpts and summaries that I have made clear of the sources.

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Kesan Penggalak Berbeza terhadap Prestasi Pertumbuhan Orkid *Mokara*

ABSTRAK

Orkid terutamanya *Mokara* memerlukan nutrien yang baik untuk memastikan pertumbuhan yang sihat. Memahami keadaan in-situ di mana orkid ditanam secara semula jadi kritikal untuk menyediakan keadaan yang sesuai untuk orkid pasu untuk berkembang maju. Tanpa yang optimum dan mengimbangi keadaan pertumbuhan serta penggalak, orkid akan layu dan mati. Penggunaan penggalak yang betul menawarkan keadaan pertumbuhan yang stabil dan konsisten untuk orkid, menghasilkan hasil yang lebih tinggi dan pertumbuhan yang lebih produktif. Kajian ini bertujuan untuk mengenal pasti penggalak yang sesuai yang mempengaruhi prestasi pertumbuhan *Mokara* Fuchsia Diamond dan untuk memerhati rawatan yang lebih berkesan. Kajian ini terdiri daripada satu kawalan iaitu menggunakan air dan dua rawatan iaitu: (i) menggunakan Jus Buah-buahan Fermentasi (FFJ) dan (ii) Jus Tumbuhan Fermentasi (FPJ). Parameter kajian ini ialah ketinggian pokok *Mokara* Fuchsia Diamond, panjang daun (18.34cm), lebar daun (9.8cm), diameter batang (3.27cm) dan bilangan daun (13.50). Kajian ini telah menemukan penggalak terbaik untuk meningkatkan prestasi pertumbuhan *Mokara* Fuchsia Diamond. Hasil kajian menunjukkan bahawa *Mokara* Fuchsia Diamond yang dibaja dengan Jus Tumbuhan Fermentasi (FPJ) mempunyai peningkatan yang paling ketara dalam ketinggian tumbuhan, panjang daun, lebar daun, diameter batang dan bilangan daun berbanding dengan yang dirawat dengan Jus Buah- buahan Fermentasi (FFJ) dan air.

Keywords: *Mokara* Fuchsia Diamond, Buah- Buahan Fermentasi (FFJ), Tumbuhan Fermentasi (FFJ).

Effect of Different Booster on Growth Performance of *Mokara* Orchid

ABSTRACT

Orchids especially *Mokara* needs good nutrients to ensure their healthy growth. Understanding the in-situ conditions under which orchids are naturally grown are critical to provide the suitable conditions for potted orchids to thrive. Without the optimal and balance growth conditions as well as booster, the orchids will wither and died. The right growing booster offers stable and consistent growing conditions for the orchids, resulting in higher yields and more productive growth. This research aims to identify the suitable booster that affects the growth performance of *Mokara* Fuchsia Diamond and to observe which treatment is more effective. This study consists of one control which is using water and two treatments (i) using Fermented FruitJuice (FFJ) and (ii) Fermented Plant Juice (FPJ). The data recorded based on the growth parameter which includes the height of the *Mokara* Fuchsia Diamond, the leaf length, leaf width, stem diameter and number of leaves. The study has found a significant booster for *Mokara* Fuchsia Diamond. The result showed that *Mokara* Fuchsia Diamond fertilized with Fermented Plant Juice (FPJ) have increased plant height (18.34cm), leaf length (9.8cm), leaf width (1.87cm), stem diameter (3.27cm) and number of leaves (13.50) compared to those treated with Fermented Fruit Juice (FFJ) and water as control.

Keywords: *Mokara* Fuchsia Diamond, Fermented Fruit Juice (FFJ), Fermented Plant Juice (FPJ

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LIST OF ABBREVIATION

SPSS	- Statistical Package for Social Sciences
ANOVA	- Analysis of Variance
CRD	- Complete Randomized Design
FPJ	- Fermented Plant Juice
FFJ	- Fermented Fruit Juice
df	- Degree of freedom
F	- Frequency
Sig.	- Significant
cm	- Centimeter
%	- Percentage
=	- Equal
<	- Less
>	- Great

CHAPTER 1

INTRODUCTION

1.1 Research Background

Made up of 20,000 to 30,000 plants species, Orchidaceae is the largest plant genus. Orchids are regarded as the most appealing clusters of ornamental plants due to their morphological characteristics, especially the scale, form, colour, and beauty of their flowers. In recent years, the orchid cultivation industry has grown rapidly and has made considerable contributions into the agriculture sector. Orchids have become a popular business product that is sold all over the world. *Mokara (Mokara* spp), also known as "Smile Orchid," is a species of orchid that was first found and cultivated in Singapore (Dalayap, 2011).

Orchids have two main growth habits with sympodial and monopodial (Bhattacharjee, 2015). The system used to propagate mature orchid is determined by their growth

patterns. This has to do with the axillary buds' position and capacity to regenerate. Any rising branch in a plant has an apical shoot meristem. The composition of the entire plant's primary tissues is regulated by the apical meristem. Different orchids may inhabit different habitats and are categorized as aquatic, epiphytic, or lithophytic in terms of ecology. Most epiphytic and lithophytic orchids have succulent leaves and crassulacean acid metabolism (CAM), which may help them respond to water stress, while most terrestrial orchids have thin leaves and C3 metabolism, which is less tolerant of water stress (Xing et al., 2015).

The *Mokara* Orchid is a type of epiphyte. Any plant that grows on another plant or object only for the purpose of physical support is known as an epiphyte, sometimes known as an air plant. Epiphytes don't have an association to the ground or the other evident nutrient source, and that they don't seem to be parasitic on the plants they support. The bulk of epiphytes are found in damp tropical environments, wherever their capability to grow on top of ground level permits them to achieve access to daylight in densely shadowy woods and to reap nutrients from leaf and other organic detritus that accumulates high within the tree cover. Epiphytes get their water from rain and water vapour in the air; most of them absorb it through their roots, but others have specialised leaves that can also absorb moisture. While some elements are taken directly from rain, the majority of nutrients are acquired via the detritus that accumulates on the supporting plants. Many epiphytes rely on wind for seed dissemination due to their restricted habitat needs, and their seeds are feathery or dusty (Petruzzello & Melissa, 2020).

Compared to their wild relatives, potted orchids require fertilizer to thrive in their surroundings. Suitable fertilizers for orchids growth must include elements such as

nitrogen, phosphorus, potassium, calcium, sulfur, and others that are essential for plant growth. Unlike some types of orchids, *Mokara* orchids require more water than most other orchids. Water them in the morning; make sure the liquid is at room temperature. Water should overflow from the potting soil for a few minutes. The plant needs to be watered several times a week. However, it is important not to let it sit in water because soaking can damage the roots. There are several types of plant parts that can be used for propagation of *Mokara*. Keiki is one of them and it is going to be used as the planting material in this study. Keiki is a small plant complete with roots that emerges from one of the nodes on the stem rather than a branch. They are caused by a build-up of growth hormones at a certain stage (De et al., 2015)

1.2 Problem Statement

Understanding the *in-situ* conditions under which orchids are naturally grown are critical to provide the suitable conditions for potted orchids to thrive. Without the optimal and balance growth conditions as well as booster, the orchids will wither and died. The right growing booster offers stable and consistent growing conditions for the orchids, resulting in higher yields and more productive growth. Since plant species need varying amounts of water and nutrients, different types of growth booster are needed to provide the best growing conditions. However, there is a lack of scientific reports on growth performance of *Mokara* Fuchsia Diamond using FPJ and FFJ as booster.

1.3 Hypothesis

H0: There is no significance changes with selected booster on the growth performance of *Mokara* Fuchsia Diamond

H1: There are significance changes with selected booster on the growth performance of *Mokara* Fuchsia Diamond

1.4 Scope of Study

The scope of this study is to determine the effect of booster which are Fermented Plant Juice (FPJ) and Fermented Fruit Juice (FFJ) on the growth performance of *Mokara* Fuchsia Diamond. Parameter such as number of leaves per plant, plant height, diameter of stems, leaves lengths and width of leaves were measured to determine the effect of FPJ and FFJ on plant growth.

1.5 Significance of Study

The significance of this study is to contribute to the knowledge on the suitability of the tested booster in supporting a good growth performance of *Mokara* Fuchsia Diamond. A better understanding of which booster is most effective, will provide an effective result on growth performance of *Mokara* Fuchsia Diamond which will bring benefit economically to growers. The result will also contribute to a community to produce a perfect *Mokara* Fuchsia Diamond especially for orchids collectors and researchers.

1.6 Objective

The objectives of this study are:

1. To identify the suitable booster that affects the growth performance of *Mokara* Fuchsia Diamond and to observe which treatment is more effective. In supporting the parameters oforchid growth such as plant height, number of leaves, width of leaves, leave lengths and diameter of stem

CHAPTER 2

LITERATURE REVIEW

2.1 History of *Mokara* Orchid

Nowadays, *Mokara* is widely grown in Vietnam. *Mokara* orchids are a significant group of flowering plants that belong to the Orchidaceae genus, which is the largest and most diverse. There are about 700-800 genera in this family, with over 25,000 species worldwide (Shah, 2018). Orchids are excellent garden plants that can be cultivated in beds, pots, baskets, and other containers. They are known for their loud blooms and can be seen in a variety of environments. Orchids are the most interesting and exquisite flower variety because of their long life, enticing structures, and vibrant colors (Thomas, 2008). Orchids have surpassed all other flowering plants in terms of popularity as cut flowers and container plants. Their flowers come in a wide variety of shapes and sizes, demonstrating an impressive amount of diversity. The orchid industry is a significant source of foreign exchange.

Mokara is the common name for artificial blends. It is a hybrid derived from the combination of *Arachnis* X *Ascocentrum* X *Vanda*. The first *Mokara* hybrid was *Mokara* Wai Liang (*Arachnis Isable* X *Ascocenda Red Gem*) (Antony, 2014). It is named after a Singaporean, C.Y. Mok, who registered the first such hybrid in 1969. In terms of shape, the plant has a combination of the three parental genera. Usually, they are very similar to *Aranda*. *Mokara* hybrids are currently the most popular cut flowers, even if they are not stone den-like flowers. Farming and breeding are very similar to *Aranda*. The unique flower shapes in vases can last up to 2 to 3 weeks under proper care.

2.1.1 Hybridization of *Mokara* Orchid

With variable degrees of success, orchid farmers all around the world have created crosses among diverse species and hybrids. The first successful orchid hybridizer, (Mr. John Dominy) created a mix between *Calanthe furcata* and *Calanthe masuca* in 1856. The name Calanthe x Domini was given to the hybrid in honour of its creator, who was the first to blossom from an artificially cultivated hybrid (Petersen, 2018). 20 years after his initial accomplishment, John Dominy was still actively involved in orchid hybridization, producing at least 25 hybrids, according to reports. The development of orchid hybrids really took off once Professor Knudson discovered that orchid seeds might be sprouted in vitro (Arditti, 2007). Orchid hybrids are the progeny of a cross among twogenetically dissimilar individuals. This group of plants has produced intraspecific, intergeneric, and intragenic hybrids. De and Bhattacharjee (2011), recorded and listed that in orchids, inter-generic crossings are widespread, and many hybrids combining 2

genera (bi-generic), 3 genera (trigeneric), 4 genera (tetra-generic), and 5 genera (penta generic)). According to research, *Mokara* belongs to the trigeneric hybrid *Mokara* = *Vanda x Arachnis x Ascocentrum* (Lee, 1994).

2.2 Growth Habit of *Mokara* Orchid

Orchids grow in a variety of ways. On the basis of their growth habits, orchids are classified as sympodial or monopodial (Hossain, 2015). An example of monopodial orchids is *Mokara* orchids. The terminal growth of monopodial orchids is indeterminate. Monopodial means the stems grow from a single bud, leaves are added from the apex each year and the stem grows longer accordingly. This orchid does not have a pseudobulb and has aerial roots (Ng et al., 2000). *Mokara* orchids are inter-generic varieties of *Arachnis x ascocentrum x vanda* that have the most colors of any orchid. It has a wide range of plant habits, flower forms, and colours. Smile orchid is its generic name. *Mokara* are common in wedding bouquets due to their delicacy and bright colors, as well as their striking starfish shape (Ali et al., 2014).

The shapes and sizes of the plants and blooms varies widely, and the shades of the blooms range from white to flushes to yellow rose and the darkest imaginable crimson purple. Orchids can thrive in a wide variety of climates. The majority of cultivated orchids were found in humid tropical forests of South and Central America and were endemic to tropical countries (Rahman & Akhtar, 2014). Mexico, India, Myanmar, China,

Thailand, Malaysia, the Philippines, and Australia are among the countries where they are sold.

2.3 Propagation

Monopodial and sympodial types are more commonly used in commercial applications. In India, natural *Paphiopedilum, Cymbidium, Dendrobium, Vanda* and *Arachnis* genera, as well as elite hybrids, are widely cultivated for cut flower production (De, 2014). A major stumbling barrier to commercial orchid cultivation has been a paucity of high-quality planting materials. Orchids have two ways of reproducing: sexually, by seed (when the seed pod matures, the tiny seeds can be sowed) and asexually via vegetative propagation. Vegetative propagation is a common approach for novices to grow their orchid collection. According to Bhattacharjee and De, (2010), six basic strategies for orchid multiplication through vegetative propagation methods include division, aerial cutting, back bulbs, micropropagation, keiki and seed culture.

Additional ways of propagation include tubers and aerial shoots (Bhattacharjee a& De, 2010). In addition to the above-mentioned conventional ways, new biotechnology applications are being applied to boost floral output, blossom quantity and colour combinations, disease resistance, and plant adaptability. Tissue culture was used to generate transgenic plants, which resulted in the creation of new types (Hussain, 2012). As a result, cutting, air layering, keiki, and tissue culture are the most common methods for propagating *Mokara* orchids.

i) Cutting

Top cuttings are the uppermost sections of the stem of monopodial orchids such as *Vanda, Aerides, Arachnis, and Mokara* that are cut off just under the aerial roots and imbedded in porous media to produce an individual plant.

ii) Air Layering

In this technique, a cut is made 20 to 30 cm below the top of the stem, and the cut piece is covered in sphagnum moss. The rooting material is kept wet, and the layer is separated from the mother plant and planted in miniature pots after the roots have grown. By air-layering or marcotage, *Vanda* and other monopodial orchids may be simply propagated.

iii) Keiki

A keiki is a small plant that develops from one of the stem's nodes rather than from a branch. They are caused by a build-up of growth hormones at a specific site. There are two types of keikis: regular and basal. Instead of a branch, the standard keiki is a tiny plant that grows from one node along the flower stem. This is caused by the concentration of growth hormones at that location, either spontaneously or with the administration of keiki paste, a cytokinin hormone that stimulates growth in orchid inflorescence nodes. The basal keiki is a young plant that grows from the mother plant's base. When keikis are still linked to their mother plant, they can blossom.

iv) Tissue Culture

One of the quickest ways to reproduce vegetative plants is through tissue culture. It grows new plants from extremely minute portions of plants, such as shoot tips, root tips, and pollen grains, in an artificial medium under aseptic conditions. In a short amount of time, thousands or even millions of identical plants can be grown from a little tissue. For large production of commercial species and hybrids, meristem and shoot tip cultures are the most preferred. In monopodials, axillary buds are a good source of explants. Orchid tissues are cultured on both liquid and solid media.

Knudson's C medium, Vacin and Went's medium, Murashige and Skoog's medium are all commonly used media. Additives such coconut water (15%) and banana pulp (10%) have been proven to help promote the growth of shoots. The medium contains mineral salts, carbon sources, vitamins, and plant development regulators. Sucrose increases organogenesis at suboptimal concentrations and protocorm development at supra-optimal concentrations when used as a carbon source. For callus production, vitamins such as thiamine and growth regulators like auxin and cytokinins are utilised.

2.4 Cultivation Condition

One of the simplest orchids to cultivate and maintain is the *Mokara* Orchid. When given the right conditions, *Mokara* Orchids make excellent houseplants that can bloom all year round. As a result, we must give basic care for these plants in order for *Mokara* Orchid to demonstrate substantial improvements in growth performance and the likelihood of having magnificent flowers each year to be considerably increased (De, 2014).

2.4.1 Temperature

The ideal temperature for a *Mokara* Orchid is 65 degrees Fahrenheit (18 ℃) during the day and 55 degrees Fahrenheit (13 ℃) at night. High humidity is also necessary, and the *Mokara* Orchid thrives in an environment with an average humidity of 80% (De, 2014).

2.4.2 Watering

Mokara Orchids, unlike many other Orchid species, need a bit more water than others. In the morning, water them and make sure the liquid is at room temperature. Several minutes of water should be put through the potting mix. During the summer, the plant may need to be watered several times each week. Despite quenching the orchid's thirts, it's critical not to let it stand in water since this might harm the roots (De, 2014).

2.4.3 Air Circulation

Humidity and excellent air circulation are two variables that aid in the growth of *Mokara* Orchids. Investing in a fan and placing it in the room with the Orchids on a low setting is one approach to create optimal air circulation at home De, (2014).

2.4.4 Light

The *Mokara* orchid comes in a variety of hues, including purple, pink, red, orange, and yellow, and may have up to ten blossoms on a single stem. Strong light is necessary for the plant's leaves to remain brilliant green and for regular blossoming to occur. If you're growing a plant inside, place it on a south-facing windowsill where it will get full light for at least part of the day. If you're keeping the plant in a greenhouse, give it around 25 to 35 percent shade throughout the summer, and somewhat less shade on gloomy winter days. During the hot summer months, you may keep a *Mokara* outside, but gradually expose it to strong outside light and maintain it in a position that receives early sun but is shaded during the scorching mid-day and afternoon hours (De, 2014).

2.4.5 Re-Potting

Although *Mokara* Orchids like to have their roots left alone, it's still a good idea to transplant the Orchid if the roots start to grow outside of its current container. To effectively transplant the Orchid, carefully remove it from its present vase. To make this procedure go more smoothly, soak it in water beforehand. This will assist the roots

become more malleable. Transfer to a bigger container (ideally clay) and gently push a combination of chopped tree fern or fir bark through the roots. (De, 2014).

2.5 Growing Media

Growing media vary depending on the type of orchid and the environment in which it is grown (Bhattacharjee & Mukherjee, 1981). Free movement of air around the roots would allow absorption of ambient moisture in a tropical environment, therefore loose packaging with more open compost in the container would be more desirable. To prevent root chilling in temperate climates, dense packaging of more fibrous compost is desired. Various coconut industry by-products, such as coconut husk and fibre, were used as orchid-growing media. Coconut husk was cut into small fragments, carefully cleaned, and dried in the sun before being used to make orchid compost (Thammasiri, 2014). Inert potting ingredients, such as silica gravel, may also be used to successfully cultivate orchids. The benefit of using inert potting materials is that they do not degrade and stay porous and intact forever, allowing greater aeration for roots. Growing media chosen for this experiment are coco cubes and charcoal.

2.5.1 Coco cubes

Coco cubes are used to care for and grow orchids, bromeliads and similar plants that do not require soil. Prevent the formation of excess grass or weeds. In addition, it can absorb and retain water, resist the growth of fungi, and replace pebbles. Coco cubes are

very suitable for aerating plants, keeping air like a sponge. The use of coco cubes promotes healthy growing plants require less water and cheaper chemicals (Kaushal, 2020).

2.5.2 Charcoal

Charcoal is wood that burns slowly at high temperatures (400°C, 750°F) without oxygen, so it neither burns nor ignites (Jamieson, G. (2009). In this process called pyrolysis, water is removed, leaving a pile of carbon, nitrogen and potassium. Charcoal is an important source of rapid water removal. Unlike sphagnum moss, charcoal does not absorb water, so water can flow freely around the moss. Additives that absorb moisture can make our growing area too wet. Charcoal is a medium sufficient to stabilize larger plants. Larger orchids cannot only thrive on sphagnum moss. Roots need something stronger to support themselves. Charcoal is an ideal medium for stabilizing roots and not too heavy (Sipayung,2018).

In addition, charcoal can improve soil fertility. When we water the orchids with fertilizer, charcoal takes longer to absorb these nutrients than in an environment without charcoal and need less fertilizer. It is just a natural source of large amounts of carbon and potassium. Carbon is essentially beneficial to plants. Since charcoal contains air, there is more gas exchange in the environment, which facilitates air flow. This may increase fertility of orchid or at least ensure optimal gas exchange. In either case, our orchid will appreciate the presence of carbon in the growing medium (Sipayung,2018)

2.6 Fermented Plant Juice (FPJ)

Fermented Plant Juice (FPJ) is a fermented extract of particular kinds of plants' saps and chlorophylls. It is high in enzymes and contains lactic acid-producing bacteria and yeast, which may aid plant and animal development (a probiotic). FPJ is easy to prepare using common household appliances and components. The plants that will be utilised to make the FPJ should be foraged in the area (ideally on-site, or as nearby as possible to maximise the effectiveness of the indigenous microorganisms in your context) (Pfeifer,2020).

FPJ is utilised in seed and soil treatments, as well as plant nutrition. It's made up of young shoots from fast-growing plants that are allowed to ferment for 7 days with the help of brown sugar. Brown sugar acts as a food supply for the bacteria that carry out the fermentation process, as well as drawing the juices out of the plant material through osmosis. Chlorophyll (soluble in ethanol) and other plant components are extracted by the weak alcohol created during fermentation. It's safe to eat and non-toxic (Pfeifer,2020).

Fermented plant juices are utilised to improve soil and crop health all over the world. The Natural Farming Method was developed by Dr. Cho - Han Kyu of South Korea in the early 1960s. His natural farming techniques have now expanded over the world since they can be replicated in any place and produced using locally accessible components (what he refers to as indigenous inputs) rather than proprietary ingredients only found or created in one corner of the globe (Pfeifer,2020).

2.6.1 Effects of the Quantity and Quality of FPJ

The most crucial consideration when choosing plants for FPJ is to utilise the growth tips of fast-growing plant species. You may also utilise flowers, flower buds, and young fruits. Plant portions that are hard or woody will produce little or no plant juice. At the time of collecting, the plants should be actively growing. Because of the impact these activities have on plant chemistry, plant portions should be harvested when the plants are in respiration mode (before dawn) rather than photosynthetic mode (during daylight). To preserve the surface microbial communities (lactic acid-producing bacteria and yeasts) that will carry out the fermentation process, avoid collecting plant parts during or after rain (preferably, wait two sunny days after rain ends) and do not rinse gathered plant parts. Inadequate fermentation and/or insufficient yields of plant juice will result from low quantities of these microorganisms (Miller, 2013).

2.6.2 Types of plant go into FPJ

Look for plants that display the following traits to generate a strong fermented plant juice that will revitalise our crop plants, first is early spring growth**.** At the beginning of the growth season, these plants are able to withstand lower temperatures with ease. They are able to withstand considerable temperature changes (from freezing or near to it to quite hot during the day). Second, fast and vigorous growth. The amounts of growth hormones in these plants are usually greater. FPJ derived from these plants may be used to aid target agricultural plants recover from a loss of vigour as well as to avoid or resist disease pressures. Fruits that have been thinned down may also be used to make FPJ.

These early, immature fruits are strong in giberellins, which may assist to thicken foliage and produce more robust fruit when utilised as a feedstock for FPJ. FPJs created from the target crop plants themselves aid in the development of that crop. For example, trimmed lateral buds or branches of tomatoes utilised as an FPJ input will aid in the flourishing of tomatoes. According to Dr. Cho, the same is true for cucurbits (squash, melons, cucumbers, and so on) and sweet potatoes (Miller, 2013).

2.6.3 Fermented Plant Juice (FPJ) used on Plants

FPJ is diluted with water and administered to plants as a soil drench or foliar treatment. Plant material used in the fermentation process traditionally creates FPJ for various stages of plant development. FPJ produced from plant material in the same development phase (vegetative or reproductive) as the plants to be treated should be used in most cases. From germination through early phases of plant development, FPJ prepared from dropwort, mugwort, or bamboo shoots is sprayed. FPJ produced from arrowroot or bamboo shoots is used on nitrogen-deficient (N) vegetative development (leafy) crops. Plants that are just starting to grow flower shoots and need phosphorus (P) are given FPJ derived from green (unripe) fruit. Plants need a lot of calcium (Ca) after they enter the reproductive period (flowering and fruiting). At this step, FPJ prepared from calcium-rich plants or FPJ that has been preserved for more than a year is administered (Miller,2013).

2.7 Fermented Fruit Juice (FFJ)

Fermented fruit juice, or FFJ, is an organic fertiliser that may be used on plants and gardens. This liquid raises nutrient levels in the soil and, as a result, in the plants that grow in it, particularly potassium levels. This combination may be created at home with

a variety of popular fruits for a fraction of the cost of organic liquid fertilisers. The fermentation process takes at least a week, but it might take a month or more. Fermented fruit juice is best made from overripe sweet fruits. Sweet ripe fruits, fruit vegetables, and root crops are used to make FFJ. The fermented extract is thoroughly combined with crude sugar or molasses and kept for a brief time before being sprayed to the plants to encourage blooming and fruit setting (Patra,2017).

2.7.1 Uses and rates of application of Fermented Fruit Juice

Fermented Fruit Juice act as flower inducer and fruit setter. Many organic growers have found that spraying fermented fruit juice produced from a mix of ripe banana, papaya, and squash fruits on the leaves at a rate of 2 to 4 tbsp/gallon of water during the commencement of blooming till fruit set is useful. These mature fruits are high in phosphorus and potassium, which are essential for blooming and fruit set (Nayak,2010).

Besides, Fermented Fruit Juice as soil microorganism activity accelerator. 1 teaspoon of fermented fruit juice per litre of water is applied directly to the soil. Fermented Fruit Juice contains carbs and sugar, which function as a source of energy for soil microorganisms, speeding up their activity. Increased microbial activity means more nutrients are available for plant absorption. Furthermore, FFJ as spray to animal beddings to hasten manure decomposition. Beneficial bacteria in fermented fruit juice aid in breakdown. Last but not least FFJ as a nutritious drink. A 20% Fermented Fruit Juice solution is a great drink for humans and animals alike (Nayak,2010).

2.7.2 Application of Fermented Fruit Juice (FFJ)

The application was based on a dilution of 2 tablespoons Fermented Plant Juice (FPJ) / 10 litre of water, as advised by the manufacturer. When the sun is not out, apply immediately to plant leaves. During the vegetative and reproductive stages, spray the FPJ combination on the leaves and soil of *Mokara* Fuchsia Diamond. Furthermore, leave the container lid open for two weeks after bottling to enable gases to escape and prevent a sticky explosion. Animal feed or compost may be made from solid material. The flavour of FFJ should be sweet and zesty, with a pleasing aroma. It lasts approximately a year when stored properly. Every day, early in the morning, a new application was submitted (Plessas, 2022).

In oil or water, chlorophyll in leaves does not dissolve. Only a very mild alcohol may dissolve it. Enzymes are abundant in leaves, and when they are combined with brown sugar or molasses, they ferment under osmosis pressure, yielding the liquid or juice. To stimulate development, little fruits fermented in brown sugar are employed. Get the little fruits and feed them back to the tree to help it develop bigger fruits. You may also utilise acacia blossoms or blooms, as well as flowers that attract bees. It aids in the breakdown of animal and plant nutrients. It maintains plant nutrients and prevents plant diseases. It protects plants from insects while also resisting them. It facilitates harvesting. Plant hormones are to blame. Leaves and soil should be sprayed (Plessas,2022).

CHAPTER 3

MATERIALS AND METHODS

3.0 Materials and Methods

3.1 Study Sites

This study had been done at the nursery of University Malaysia Kelantan Jeli Campus in Kelantan, Malaysia. The study area specifically located at the coordinate of 5°44'45.3"N latitude and 101°51'57.2"E longitude as shown in Figure 3.1.

Figure 3.1: Satellite location of study sites (5°44'45.3"N and 101°51'57.2"E). Nursery of University Malaysia Kelantan Jeli Campus in Kelantan, Malaysia

Source: Google Maps (2022)

3.2 Plant Material

There are several important materials needed such as 45 samples of keiki from mother plant of *Mokara* Fuchsia Diamond, soil, cocoa cubes, charcoal, pots, water supply, molasses, FFJ, FPJ, name tag and fertilizer (Alpha Omega Fertilizer). The plant material was used to identify the growth of the orchid with different booster as Fermented Fruit Juice and Fermented Plant Juice.

3.2.1 Preparation of FPJ and FFJ

The manufacturing process of FPJ and FFJ were almost same where both boosters use molasses as the main ingredients in their manufacture. However, what differentiates it was in terms of its main ingredients where FPJ was used green vegetables such as mustard, water spinach, and green spinach while FFJ was used ripe fruits such as papayas, pumpkins and bananas.

In this study, for FPJ was used, 1kg of mustard, 1kg of water spinach, 1kg of green spinach while for FFJ was used 1kg of papaya, 1kg of pumpkin and 1kg of banana. The same weight of molasses was added as the weight of vegetables/fruit materials that were 3kg of molasses have been used. Mix vegetables/fruits with 3kg of crude molasses in a large basin. The mixture was placed in a dark plastic container with 25% air space and covered with manila paper tied with a string and kept in cool and shaded place.

After 7 days of fermentation, the liquid extracts were harvested by straining and was stored in plastic bottles. To facilitate air exchange, cover the mouth of the container with a breathable material such as muslin, thick cheesecloth, or a towel. To keep bugs and other impurities out, secure the cover (with thread, rubber bands, etc.). Paper towels may be used, but if they get damp or damaged, they should be changed. Keep the closed container in a well-ventilated place away from direct sunlight, artificial or natural light, and extremes of heat or cold. Do not store in the refrigerator.

After 24 hours, the volume of the plant-material and molasses combination should sink to 2/3 of the container, allowing the fermentation process to proceed effectively. The

microorganisms will not be able to ferment correctly if the container is overly full. Remove a portion of the plant stuff until the container is just 2/3 filled. Add additional of the mixture if the container is less than 2/3 full to avoid mould development. Because not all plants will settle in the same manner after the first 24 hours, it's crucial to monitor and adjust the volume.

The temperature of the environment affects the fermentation process. The warmer, humid weather in Hawai'i speeds up fermentation (3 to 5 days), whereas chilly or cold weather slows it down. When bubbles begin to develop on the second day, fermentation has begun. Fermentation should be completed in no more than 7 days, sincethe quality of FPJ seems to deteriorate beyond that time. When the plant material floats and the liquid settles at the bottom, fermentation is complete (note: if too much brown sugar was used, this separation is not distinct). Furthermore, fermentation is complete when the liquid has a mild alcohol scent from the breakdown of chlorophyll and tastes sweet rather than harsh.

The plant debris was separated from the liquid using a colander or sieve when the fermentation is finished (3 to 7 days). Animal feed or mixed compost may be made from the discarded plant material. Fermented Plant Juice (FPJ) is the liquid, which may be utilised right away or kept in a loosely closed container. A glass or food-grade polyethylene (PE) plastic container were filled halfway with FPJ. The bacteria in the solution are stillactive and releasing gases. The container must have a loose lid or it may explode. Each batch of KNF, like other Korean Natural Farming inputs, should be kept individually. They should only be combined when preparing a solution for immediate use. To keep FPJfrom going bad for a long time, mix in an equivalent quantity of brown sugar by weight.

3.2.2 Applying of FPJ and FFJ

FPJ/ FFJ were diluted with water, aiming for a 1 part per 500 parts water concentration (1:500). FPJ/FFJ should be applied once a week in the late afternoon, ideally an hour before sunset. The solution may be used as a foliar spray or watered over plants or into the soil. The nutrition solution is administered once a week and modified as the plant progresses through the stages of its life cycle, including vegetative and reproductive periods.

3.3 Treatments and Experimental Design

Present research was conducted at the nursery, Universiti Malaysia Kelantan. Two different boosters were used as source for growing including, FFJ and FPJ. There were 45 pots with 6 inch in diameter, used for growing *Mokara* orchids using complete randomized design (CRD). Data were collected once every week. 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). The treatments were details as below:

Table 3.3: Treatments and ratio

Code	Treatment	Ratio
T0	Water (control)	1
T1	Fermented Fruit Juice (FFJ)	1
T2	Fermented Plant Juice (FPJ)	1

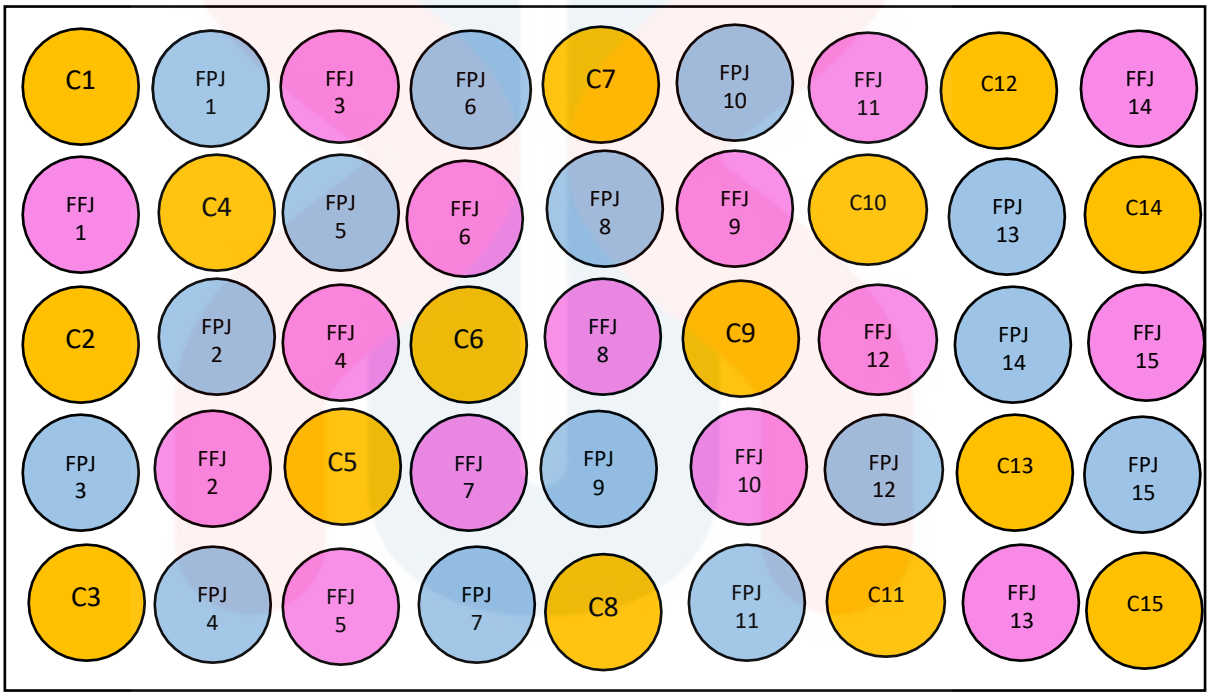

Figure 3.3: Layout of experiment design was complete randomized design (CRD)

3.3.1 Transfer of *Mokara* keiki into the plastic pot

Each booster treatment was tested using 15 samples of *Mokara* keiki, 15 samples for the first treatment which is FFJ, 15 samples for second treatment which is FPJ, and 15 samples were treated with water as control.

3.3.2 Cultivation

Mokara orchid needs to be watered once a day. The purpose is to make sure that the growing media moist. Then, the orchids must be fertilized according to the suitable time which is early morning using suitable fertilizer such as Alpha Omega fertilizer.

3.3.2.1 Alpha Omega Fertilizer

There are two types of Alpha Omega Fertilizer which are Green Alpha Omega and Pink Alpha Omega. Green Alpha Omega specialized in stimulating plant growth while Pink Alpha Omega specialized in stimulating flowering.

In this study, the Green Alpha Omega was used. It is great for orchids since it promotes vigorous development, helps plants grow quickly, and increases biomass while reducing care time. Green Alpha Omega helps healthy plants develop both roots and leaves, promoting rapid orchid growth. It may also assist develop strong roots, resistant leaves, repair weak and unhealthy branches, and keep the plant healthy and green. It is also able to assist plants in better photosynthesizing and absorbing nutrients and sugar.

Green Alpha Omega containing chitosan. Chitosan is a polysaccharide that stimulates the functioning of the plant's disease defense system. Chitosan also stimulates plant development and destroys harmful bacteria directly by dissolving their cell membranes. To ensure the plants received the benefit of Chitosan in Green Alpha Omega, a frequent used is advised. Green Alpha Omega may be used with a solution of 10 or 15 ml / 5 litres of water, sprayed on the tree every 7 or 10 days in the morning or afternoon.

3.4 Parameters

This study was to determine the growth performance of *Mokara* Fucshia Diamond, the growth of a plant can be seen by their height and their leaf count. To determine the hypothesis, the parameter was decided on the height of the *Mokara* Fuchsia Diamond, the length of the leaf and the leaf count. The measurement of height for *Mokara* Fuchsia Diamond was decided to be taken from between stem and root till the tip of the longest leaf. And the leaf lengths were decided from the node of leaf to the tip of leaf. The flower of *Mokara* Fuchsia Diamond was not one of the parameters due to duration for new plantlets to reach maturity and to start blooming requires a long period. Same as near relative to *Mokara* Fuchsia Diamond, *Mokara* hybrids where it required two to five years from juvenile to reach maturity and flowering stages (Hor et al., 2007).

3.5 Data collection

The treatment was continued for 9 weeks and the data were collected every week. The parameters of the study were collected from the measured plant height (cm), diameter of stems (cm), number of leaves, leaves lengths (cm) and width of leaves (cm). Each treatment with 15 replications were measured and counted.

3.6 Statistical Analysis

The data were analyzed by using Statistical Package for Social Science (SPSS) via one-way ANOVA and Duncan test used to search the variance of the data set. The whole data contained three groups of treatments and were calculated by using One- way ANOVA and Duncan test to find the differences between each treatment.

CHAPTER 4

RESULT AND DISCUSSION

The different booster used in the present study showed different reaction. Results of the study were consistent with the hypothesis that there was an effect on *Mokara* Fuchsia Diamond plants growth performance by different booster. The result of the study was reported in the following sections.

4.1 Plant Height

Table 4.1: The plant height of *Mokara* Fuchsia Diamond plants within 9 weeks

Code	Treatment	Mean±SE (cm)
T0	Water (Control)	17.05±0.34[a]
T1	FFJ	17.85±0.18[b]
T2	FPJ	18.34±0.25[b]

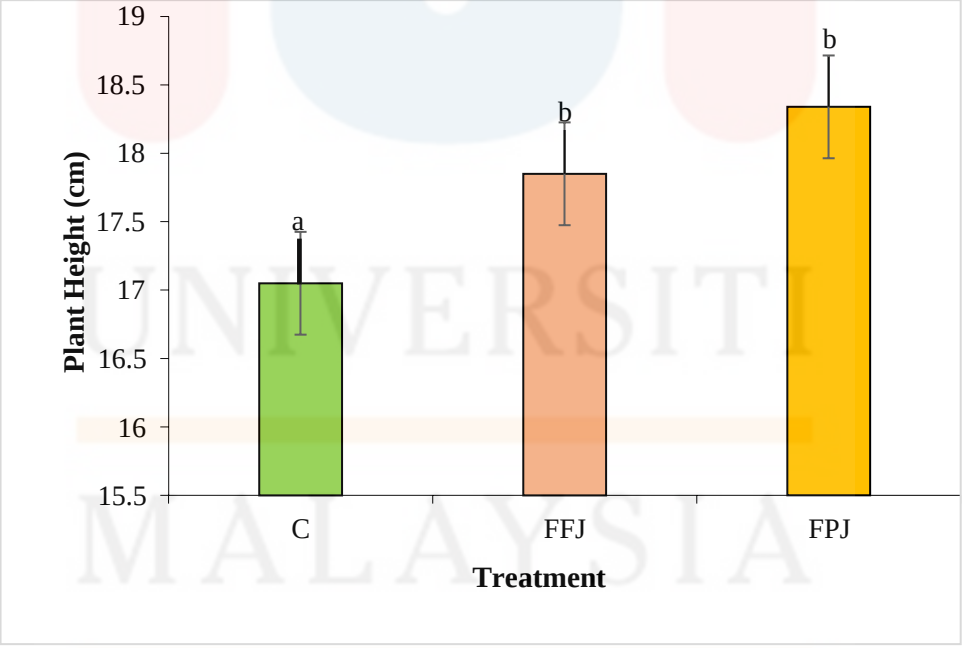

Figure 4.1: The bar graph showed the average of plant height for all three treatments within 9 weeks.

The results of the study showed that there was a significant difference in the plants height among different booster as shown in Table 4.1. Between various treatments used in this study, the highest value treatment for plant height was in FPJ (18.34 cm) followed by FFJ (17.85 cm) after 9 weeks of study. The results shown above indicate that T2(FPJ) and T1(FFJ) treatments were surpass than control (T0) value which is 17.05 cm.

The outcome of the study showed that Fermented Plant Juice (FPJ) was suitable as a booster to *Mokara* Fuchsia Diamond. This could be the main reason why treatments T2 showed good performance compared to other treatments. T2 treatments contain more nitrogen, phosphorus and potassium element in Fermented Plant Juice (FPJ) compare to Fermented Fruit Juice (FFJ). FPJ is high in enzymes and contains lactic acid-producing bacteria and yeast, which may aid plant and animal development (a probiotic) while FFJ contains carbs and sugar, which function as a source of energy for soil microorganisms, speeding up their activity and increased microbial activity means more nutrients are available for plant absorption.

The statistical analysis showed there was a significant effect on treatments on plant height at the $p<0.05$ level for the 3 treatments ($F (2, 402) = 6.101$, $p = <0.002$). Post hoc comparisons using the Duncan test indicated that the mean score for *Mokara* Fuchsia Diamond applied with treatment T2 ($M = 18.3393$, $SD = 2.9048$) was significantly different than T1 ($M = 17.8459$, $SD = 2.1181$), and *Mokara* Fuchsia Diamond applied with control treatments only T0 ($M = 17.0474$), $SD = 3.9097$).

4.2 Leaf Length

Table 4.2: The leaf length of *Mokara* Fuchsia Diamond plants within 9 weeks

Code	Treatment	Mean±SE (cm)
T0	Water (Control)	9.15±0.09[a]
T1	FFJ	9.59±0.13[b]
T2	FPJ	9.8±0.11[b]

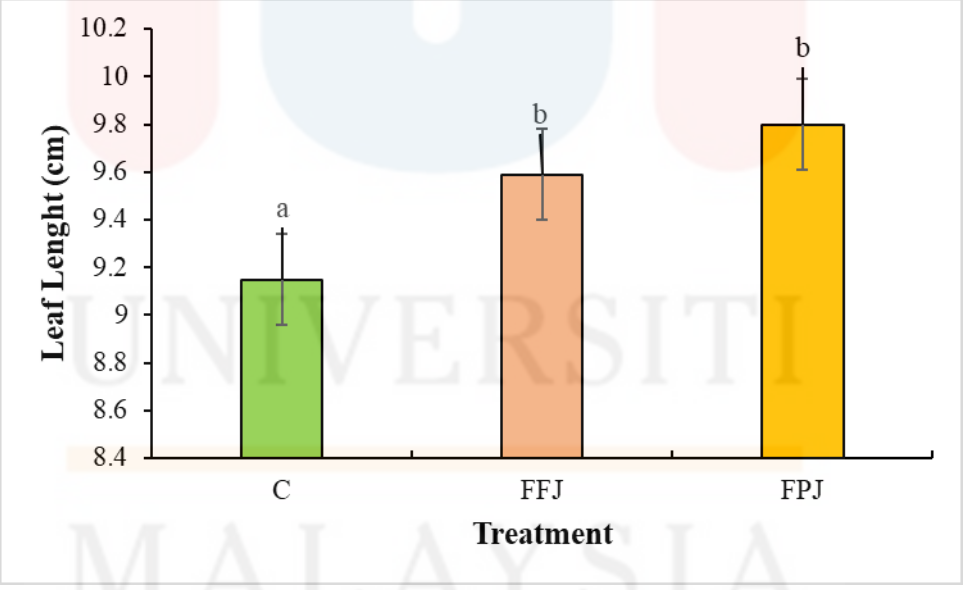

Figure 4.2: The bar graph showed the differences in the average of leaf length for all three treatments within 9 weeks

The results in Table 4.2 showed the average of leaf length among the treatments. The highest growth can be seen in T2 (FPJ) compared to other treatments. The T2 treatments came out with highest value which is 9.8 cm followed by T1 (FFJ) treatment with value of 9.59 cm and T0 treatments were revealed poor growth in leaf length than other treatments with value only 9.15 cm.

The outcome of the study showed that Fermented Plant Juice (FPJ) was suitable as a booster to *Mokara* Fuchsia Diamond. This could be the main reason why treatments T2 showed good performance compared to other treatments. T2 treatments contain more nitrogen, phosphorus and potassium element in Fermented Plant Juice (FPJ) compared to Fermented Fruit Juice (FFJ). According to Wang & Chang (2017), low nitrogen levels may cause poor plant development, pale-green leaves, and reduced leaf abscission. N-rich soil encourages leaf growth and blossom production.

Similarly, the statistical analysis showed there was a significant pattern of leaf length at the $p<0.05$ level for the 3 treatments ($F (2, 402) = 8.975$, $p = <0.000$). Post hoc comparisons using the Duncan test indicated that the mean score for *Mokara* Fuchsia Diamond applied with treatment T2 ($M = 9.8007$, $SD = 1.31339$) was significantly different than T1 ($M = 9.5948$, $SD = 1.46498$),) and *Mokara* Fuchsia Diamond applied with control treatments only ($M = 9.1481$, $SD = 1.07286$).

4.3 Number of leaves

Table 4.3: The number of leaves of *Mokara* Fuchsia Diamond plants within 9 weeks

Code	Treatment	Mean±SE
T0	Water (Control)	11.41±0.13[a]
T1	FFJ	11.76±0.20[a]
T2	FPJ	13.50±0.26[b]

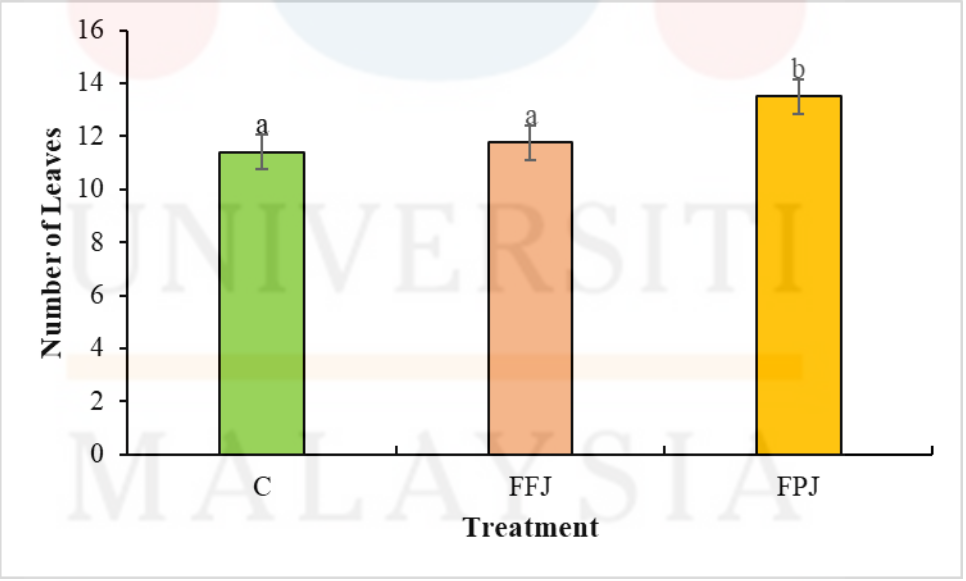

Figure 4.3: The bar graph showed the differences in the average of number of leaves for all three treatments within 9 weeks.

The result in Figure 4.3 showed the number of leaves of *Mokara* Fuchsia Diamond was differed among treatments. Among all the three treatments used in this study, the highest number of leaves was observed in the T2 treatment (Table 4.3) which is Fermented plant Juice (FPJ) with the value of 13.50. Then, it followed by T1, Fermented Fruit Juice (FFJ) with number of leaves value is 11.76. The number of leaves in T0 followed T1 closely at 11.41. The development of leaf was crucial in plants growth because it is to ensure the photosynthesis process and gas exchange occured sufficiently.

The outcome of the study showed that Fermented Plant Juice (FPJ) was suitable as a booster to *Mokara* Fuchsia Diamond. This could be the main reason why treatments T2 showed good performance between other treatments. This result demonstrated that the usage of FPJ, which contains more NPK than FFJ, has a genuine impact. According to Khalid (2009), the intake of nutrients in the plant influences the rise in the number of leaves in a plant. Fertilizer impacts the number of leaves, demonstrating the existence of intracellular processes. According to Park (2018), protein is the major component of protoplasm that acts as a centre of metabolic activities in plants, which will further stimulate cell division and elongation. When the cell divides, it forms a network, which subsequently grows into a leaf. Leaf buds are impacted by nutrient content and absorbed water as they emerge from meristematic cells. The production of leaf buds increases as nutrient absorption increases.

Meanwhile, the statistical analysis showed there was a significant pattern of number of leaves at the $p<0.05$ level for the 3 treatments $F(2,402) = 29.849$, $p = <0.000$). Post hoc comparisons using the Duncan test indicated that the mean score for *Mokara* Fuchsia Diamond applied with treatment T2 ($M = 13.50$, $SD = 3.049$) was significantly

different than T1 (M = 11.76, SD = 2.345). Mokara Fuchsia Diamond applied with control treatments only (M = 11.41, SD = 1.498).

4.4 Leaves Width

Table 4.4: The width of leaves of *Mokara* Fuchsia Diamond plants within 9 weeks

Code	Treatment	Mean±SE
T0	Water (Control)	1.65±0.02[a]
T1	FFJ	1.77±0.20[b]
T2	FPJ	1.87±0.61[b]

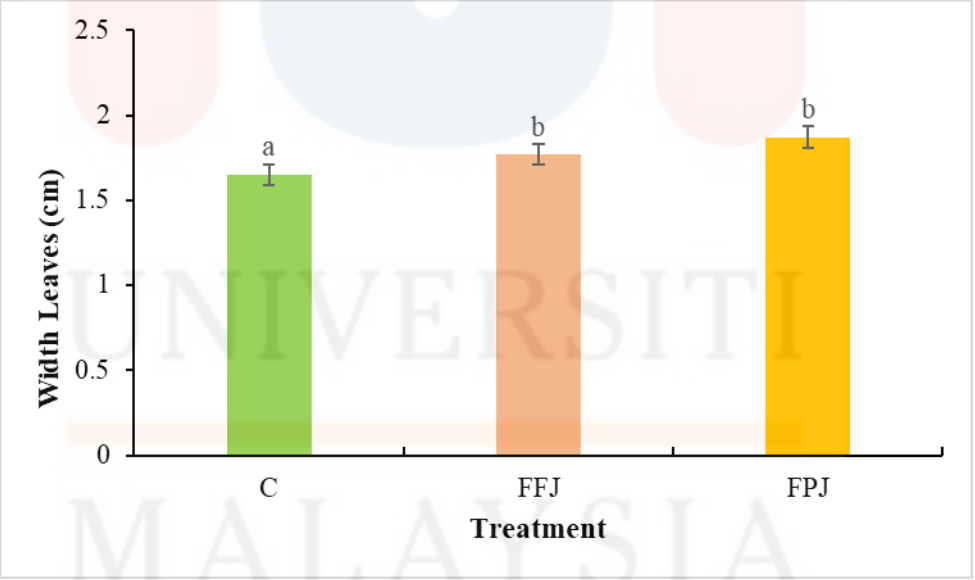

Figure 4.4: The bar graph showed the differences of leaves width average among the three treatments within 9 weeks

The results of this study showed that there was a significant difference in the leaves width among different booster as shown in Table 4.4. Between various treatments used in this study, the highest value treatment for leaves width was in FPJ (1.87 cm) followed by FFJ (1.77 cm) after 9 weeks of study. The results shown above indicate that T2(FPJ) and T1(FFJ) treatments were surpass than control (T0) value which is 1.65 cm.

The outcome of the study showed that Fermented Plant Juice (FPJ) was suitable as a booster to *Mokara* Fuchsia Diamond. This could be the main reason why treatments T2 showed good performance between other treatments. T2 treatments contain more nitrogen, phosphorus and potassium element in Fermented Plant Juice (FPJ) compare to Fermented Fruit Juice (FFJ). About 90% of nutrients may be absorbed by fertilisation through leaves. As a result, the best way to fertilise orchids is via their leaves (Widiastoety, 2010). It is because orchids cannot take nutrients through their roots, the use of leaf feeding is a common method in orchid cultivation (Mondal et al., 2014).

The statistical analysis showed there was a significant effect on treatments on width leaves at the $p<0.05$ level for the 3 treatments ($F (2, 402) = 8.333$, $p = <0.000$). Post hoc comparisons using the Duncan test indicated that the mean score for *Mokara* Fuchsia Diamond applied with treatment T2 ($M = 1.8689$, $SD = 0.70789$) was significantly different than T1 ($M = 1.7652$, $SD = 0.25047$), and *Mokara* Fuchsia Diamond applied with control treatments only ($M = 1.6459$, $SD = 0.20288$).

4.5 Stem Diameter

Table 4.5: The stem diameter of *Mokara* Fuchsia Diamond plants within 9 weeks

Code	Treatment	Mean±SE
T0	Water (Control)	2.76±0.46[a]
T1	FFJ	2.96±0.32[b]
T2	FPJ	3.27±0.32[c]

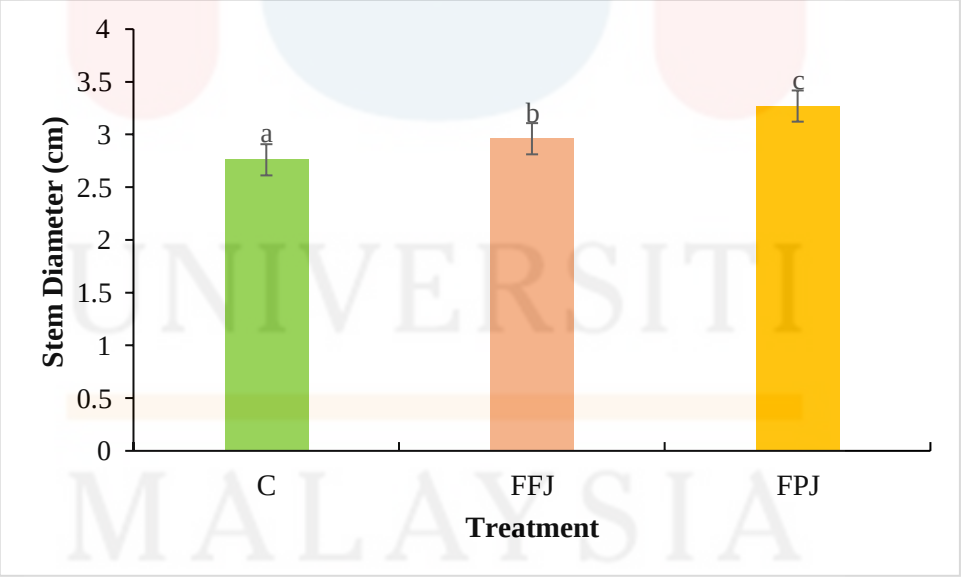

Figure 4.5: The bar graph showed the difference of stem diameter among the three treatments within 9 weeks

The results of the study showed that there was a significant difference in the stem diameter among different booster as shown in Table 4.5. Between various treatments used in this study, the highest value treatment for stem diameter was in T2 (FPJ) which is 3.27 cm followed by T1 (FFJ) with value is 2.96 cm after 9 weeks of study. The results shown above indicate that T2 (FPJ) and T1 (FFJ) treatments were surpass than control (T0) value which is 2.76 cm.

The outcome of the study showed that Fermented Plant Juice (FPJ) was suitable as a booster to *Mokara* Fuchsia Diamond. This could be the main reason why treatments T2 showed good performance between other treatments. T2 treatments contain more nitrogen, phosphorus and potassium element in Fermented Plant Juice (FPJ) compare to Fermented Fruit Juice (FFJ). The requirement for P and K rises as a person grows. The goal of this research was to standardise a fertiliser mixture that included N, P, and K in acceptable concentrations that could be sprayed on *Mokara* sp. orchids for optimal growth, development, and commercial output (Kabir, (2012).

The statistical analysis showed there was a significant effect on treatments on stem diameter at the $p<0.05$ level for the 3 treatments ($F (2, 402) = 47.802$, $p = <0.000$). Post hoc comparisons using the Duncan test indicated that the mean score for *Mokara* Fuchsia Diamond applied with treatment T2 ($M = 3.2741$, $SD = 0.36772$) was significantly different than T1 ($M = 2.9563$, $SD = 0.37349$), and *Mokara* Fuchsia Diamond applied with control treatments only ($M = 2.7622$, $SD = 0.53947$).

CHAPTER 5

CONCLUSION AND RECOMMENDATION

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In the present study, different booster significantly influenced the growth performance of *Mokara* Fuchsia Diamond. The objective of conducted this study was achieved by the Fermented Plant Juice (FPJ) as a suitable booster on growth performance of *Mokara* Fuchsia Diamond. Second objective was achieved when *Mokara* Fuchsia Diamond that fertilized with Fermented Plant Juice (FPJ) showed the excellent formation of plant height, leaves length, leaves width, greatest increased in stem diameter and higher number of leaves. Fermented Plant Juice (FPJ) was proven the best booster for *Mokara* Fuchsia Diamond. To achieve complete effects of the treatments it is recommended that the use booster of fermented plant juice (FPJ) as booster should be in 2:1 ratio (2 tablespoons: 1 litre of water). It is also recommended to conduct the experiment on other *Mokara* varieties with more replications. Other parameters also needed to be tested and evaluated such as nutrients contents on medium, pH value and the chlorophyll contents also should be tested.

REFERENCES

Ali, M. D., Dash, P. K., Islam, M. M., Ahmed, M., & Mondal, T. (2014). Effect of NPK spray formulation on growth of two cultivars of orchid (Mokara spp.). *Journal of Agriculture and Veterinary Science*, *7*(5), 31-42.

Antony, J. J. J., Sundarasekar, J., Rathinam, X., Subramaniam, S., & Marimuthu, K. (2014). MICROSCOPICAL ANALYSIS OF IN VITRO MOKARA BROGA GIANT ORCHID. Emirates Journal of Food and Agriculture, 73-81.

Arditti, J., & Code, B. I. M. (2007, June). Plenary presentation: history of orchid propagation. In Proceedings Asia Pacific Conference on Plant Tissue and Agribiotechnology (APaCPA) (Vol. 17, p. 21).

Bhattacharjee, D. K., & Hossain, M. M. (2015). Effect of plant growth regulators and explants on propagation on a monopodial and sympodial orchid: A study in vitro. J. Orchid Soc. India, 29, 91-102.

Bhattacharjee, S. K. & De, L. C. (2010). 'Advanced Commercial Floriculture'(2nd and Enlarged Edition,): In 2 volumes. pp. 798. Published by Aavishkar Publishers & Distributors, Jaipur, Rajasthan.

Casey Pfeifer. Fermented Plant Juice, 5 May,2020, https://www.7thgenerationdesign.com/nutrient-cycling-for-homesteads-part-5-fermented-plant-juice-fpj/. Accessed on 13 January,2022.

Dalayap, R. M., Torres, M. A. J., & Demayo, C. G. (2011). Landmark and outline methods in describing petal, sepal and labellum shapes of the flower of Mokara orchid varieties. Int. J. Agric. Biol, 13(5), 652-658

De, L. C. & Bhattacharjee, S.K. (2011). 'Ornamental Crop Breeding', Pp. 438, Published by Aavishkar Publishers & Distributors, Jaipur, Rajasthan.

De, L. C. (2014). 'Production Technology of Commercial Flowers': In 2 volumes Pp. 599. Published by Pointer Publisher, Jaipur, Rajasthan

De, L. C., Khan, A. M., Kumar, R., & Medhi, R. P. (2014). Orchid farming—a remunerative approach for farmers livelihood. *Int. J. Sci. Res*, *3*, 468-471.

De, L. C., Pathak, P., Rao, A. N., & Rajeevan, P. K. (2015). 6 Production of Quality Planting Materials. In Commercial Orchids (pp. 118-123). De Gruyter Open Poland.

Hejazi, S. M., Sheikhzadeh, M., Abtahi, S. M., & Zadhoush, A. (2012). A simple review of soil reinforcement by using natural and synthetic fibers. Construction and building materials, 30, 100-116.https://homeguides.sfgate.com/make-fermented-fruit-plant-food-63700.html Accessed on 13 January 2022.

Hussain, A., Qarshi, I. A., Nazir, H., & Ullah, I. (2012). Plant tissue culture: current status and opportunities. *Recent advances in plant in vitro culture*, *6*(10), 1-28.

Jagirdar SAP, MH Laghari and MS Panhwar. 1984. Effect of fertilizer on growth and yield of potato. Pakistan J. Agri. Research 5(3):162-164.

Jamieson, G. (2009). Mycorrhiza, and the Gardening Benefits of Charcoal.

Kabir, M. I., Mortuza, M. G., & Islam, M. O. (2012). Morphological features growth and development of Dendrobium sp. orchid as influenced by nutrient spray. Journal of Environmental Science and Natural Resources, 5(1), 309-318.

Kaushal, S., & Kumari, P. (2020). Growing media in floriculture crops. *Journal of Pharmacognosy and Phytochemistry*, *9*(2), 1056-1061.

Khalid, A., Arshad, M., Shaharoona, B., & Mahmood, T. (2009). Plant growth promoting rhizobacteria and sustainable agriculture. In Microbial strategies for crop improvement (pp. 133-160). Springer, Berlin, Heidelberg.

Lee, Y. H. (1994). Genomic and meiotic analysis of Mokara orchids. Journal of Heredity, 85(1), 39-43.

Miller, S. A., Ikeda, D. M., Weinert Jr, E., Chang, K. C., McGinn, J. M., Keliihoomalu, C., & DuPonte, M. W. (2013). Natural Farming: fermented plant juice. Tropical Agriculture and Human Resouces, 2, 1-7.

Nayak, B. S., Marshall, J. R., Isitor, G., & Adogwa, A. (2010). Hypoglycemic and hepatoprotective activity of fermented fruit juice of Morinda citrifolia (Noni) in diabetic rats. *Evidence-Based Complementary and Alternative Medicine, 2011*.

Ng, C. K. Y., & Hew, C. S. (2000). Orchid pseudobulbs–false'bulbs with a genuine importance in orchid growth and survival!. *Scientia Horticulturae*, *83*(3-4), 165-172.

Park, S. Y., Huh, Y. S., & Paek, K. Y. (2018). Common protocols in orchid micropropagation. In Orchid Propagation: From Laboratories to Greenhouses—Methods and Protocols (pp. 179-193). Humana Press, New York, NY.

Patra, J. K., Sahoo, S. K., & Swain, M. R. (2017). Nutritional and antioxidant potential of Aegle marmelos fermented fruit juice. Proceedings of the National Academy of Sciences, India Section B: Biological Sciences, 87(3), 769-775.

Petersen, K. (2018). Hybridizers and the Hybridized: Orchid Growing as Hybrid" Nature?"

Petruzzello, Melissa. "epiphyte". Encyclopedia Britannica, 12 Mar. 2020, https://www.britannica.com/plant/epiphyte. Accessed 11 January 2022.

Plessas, S. (2022). Advancements in the Use of Fermented Fruit Juices by Lactic Acid Bacteria as Functional Foods: Prospects and Challenges of Lactiplantibacillus (Lpb.) plantarum subsp. plantarum Application. Fermentation, 8(1), 6.

Rahman, M. M., & Akhtar, T. (2014). A preliminary study on the Orchids of National Botanical Garden, Mirpur, Dhaka, Bangladesh. *Jahangirnagar University Journal of Biological Sciences*, *3*(2), 81-84.

Shah, H. P., Singh, A., Patel, D. P., & Tandel, M. B. (2018). Influence of Inorganic and Organic Fertilizers on Growth and Yield of Dendrobium Orchid cv. Sonia 17. Int. J. Curr. Microbiol. App. Sci, 7(11), 299-304.

Singh J, M Singh, MS Saimbni and KS Kooner. 1993. Growth and yield of potato cultivars as affected by plant density and potassium levels. J. Indian Potato Assoc. 20(3-4):279- 282

Sipayung, P., Matanari, J., Lafau, M. B., Sulastri, Y. S., Ginting, B. B., Sihombing, D. R., ... & Giawa, T. (2018, November). The effect of activated charcoal dose and benzyl amino purine concentration on the growth of orchid plantlets in murashige and skoog media in vitro. In IOP Conference Series: Earth and Environmental Science (Vol. 205, No. 1, p. 012025). IOP Publishing.

Temmink, R. J., Fritz, C., van Dijk, G., Hensgens, G., Lamers, L. P., Krebs, M., ... & Joosten, H. (2017). Sphagnum farming in a eutrophic world: The importance of optimal nutrient stoichiometry. *Ecological Engineering*, *98*, 196-205.

Thammasiri, K. (2014, February). Current status of orchid production in Thailand. In *II International Orchid Symposium 1078* (pp. 25-33).

Thomas, B., & Lekharani, C. (2008). Assessment of floral characters in commercial varieties of monopodial orchids. Journal of Ornamental Horticulture, 11(1), 15-20.

Wang, Y. T., & Chang, Y. C. A. (2017). Effects of nitrogen and the various forms of nitrogen on Phalaenopsis orchid—A review. HortTechnology, 27(2), 144-149.

Xing, X., Gai, X., Liu, Q., Hart, M. M., & Guo, S. (2015). Mycorrhizal fungal diversity and community composition in a lithophytic and epiphytic orchid. *Mycorrhiza*, *25*(4), 289-296.

APPENDIX A

Table A: Descriptives. All parameters

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
HEIGHT	CONTROL	135	17.0474	3.90974	.33650	16.3819	17.7129	9.50	26.00
	FFJ	135	17.8459	2.11814	.18230	17.4854	18.2065	14.00	25.00
	FPJ	135	18.3393	2.90478	.25000	17.8448	18.8337	13.00	24.00
	Total	405	17.7442	3.10499	.15429	17.4409	18.0475	9.50	26.00
LEAF_LENGTH	CONTROL	135	9.1481	1.07286	.09234	8.9655	9.3308	6.50	12.00
	FFJ	135	9.5948	1.46498	.12609	9.3454	9.8442	1.20	12.00
	FPJ	135	9.8007	1.31339	.11304	9.5772	10.0243	7.50	14.30
	Total	405	9.5146	1.31915	.06555	9.3857	9.6434	1.20	14.30
LEAF_WIDTH	CONTROL	135	1.6459	.20288	.01746	1.6114	1.6805	1.00	2.10
	FFJ	135	1.7652	.25047	.02156	1.7225	1.8078	1.20	2.60
	FPJ	135	1.8689	.70789	.06093	1.7484	1.9894	1.20	9.50
	Total	405	1.7600	.45715	.02272	1.7153	1.8047	1.00	9.50
STEM_DIAMETER	CONTROL	135	2.7622	.53947	.04643	2.6704	2.8541	2.00	4.00
	FFJ	135	2.9563	.37349	.03214	2.8927	3.0199	2.00	4.00
	FPJ	135	3.2741	.36772	.03165	3.2115	3.3367	.90	4.00
	Total	405	2.9975	.48195	.02395	2.9505	3.0446	.90	4.00
LEAF_NO	CONTROL	135	11.41	1.498	.129	11.16	11.67	9	15
	FFJ	135	11.76	2.345	.202	11.36	12.15	9	19
	FPJ	135	13.50	3.049	.262	12.98	14.02	8	22
	Total	405	12.22	2.548	.127	11.98	12.47	8	22

Table B: Test of Homogeneity of Variances. All parameters

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
HEIGHT	Based on Mean	31.563	2	402	.000
	Based on Median	31.447	2	402	.000
	Based on Median and with adjusted df	31.447	2	349.168	.000
	Based on trimmed mean	31.193	2	402	.000
LEAF_LENGTH	Based on Mean	.659	2	402	.518
	Based on Median	.673	2	402	.511
	Based on Median and with adjusted df	.673	2	351.762	.511
	Based on trimmed mean	.621	2	402	.538
LEAF_WIDTH	Based on Mean	2.111	2	402	.122
	Based on Median	1.623	2	402	.199
	Based on Median and with adjusted df	1.623	2	160.560	.201
	Based on trimmed mean	1.584	2	402	.206
STEM_DIAMETER	Based on Mean	23.452	2	402	.000
	Based on Median	19.879	2	402	.000
	Based on Median and with adjusted df	19.879	2	386.211	.000
	Based on trimmed mean	24.728	2	402	.000
LEAF_NO	Based on Mean	17.611	2	402	.000
	Based on Median	16.853	2	402	.000
	Based on Median and with adjusted df	16.853	2	336.714	.000
	Based on trimmed mean	17.334	2	402	.000

Table C: ANOVA: All parameters which are Plant height, Leaf length, Leaf width, Stem diameter and Number of leaves

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
HEIGHT	Between Groups	114.745	2	57.373	6.101	.002
	Within Groups	3780.194	402	9.403		
	Total	3894.939	404			
LEAF_LENGTH	Between Groups	30.051	2	15.025	8.975	.000
	Within Groups	672.973	402	1.674		
	Total	703.024	404			
LEAF_WIDTH	Between Groups	3.361	2	1.681	8.333	.000
	Within Groups	81.071	402	.202		
	Total	84.432	404			
STEM_DIAMETER	Between Groups	18.029	2	9.014	47.802	.000
	Within Groups	75.809	402	.189		
	Total	93.838	404			
LEAF_NO	Between Groups	339.101	2	169.551	29.849	.000
	Within Groups	2283.452	402	5.680		
	Total	2622.553	404			

Table D: Robust Test of Equality of Means. All parameters

Robust Tests of Equality of Means

		Statistic[a]	df1	df2	Sig.
HEIGHT	Welch	4.744	2	253.267	.009
	Brown-Forsythe	6.101	2	328.136	.003
LEAF_LENGTH	Welch	10.787	2	263.351	.000
	Brown-Forsythe	8.975	2	379.475	.000
LEAF_WIDTH	Welch	13.167	2	242.150	.000
	Brown-Forsythe	8.333	2	191.040	.000
STEM_DIAMETER	Welch	48.398	2	262.004	.000
	Brown-Forsythe	47.802	2	350.282	.000
LEAF_NO	Welch	25.491	2	246.413	.000
	Brown-Forsythe	29.849	2	319.708	.000

a. Asymptotically F distributed.

Post Hoc Tests

Homogeneous Subsets

Table 1: Duncan: Plant Height

HEIGHT

Duncan[a]

SAMPLE	N	Subset for alpha = 0.05	
		1	2
CONTROL	135	17.0474	
FFJ	135		17.8459
FPJ	135		18.3393
Sig.		1.000	.187

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 135.000.

Table 2: Duncan: Leaf Length

LEAF_LENGTH

Duncan[a]

SAMPLE	N	Subset for alpha = 0.05	
		1	2
CONTROL	135	9.1481	
FFJ	135		9.5948
FPJ	135		9.8007
Sig.		1.000	.192

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 135.000.

Table 3: Duncan: Leaf Width

LEAF_WIDTH

Duncan[a]

SAMPLE	N	Subset for alpha = 0.05	
		1	2
CONTROL	135	1.6459	
FFJ	135		1.7652
FPJ	135		1.8689
Sig.		1.000	.059

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 135.000.

Table 4: Duncan: Stem Diameter

STEM_DIAMETER

Duncan[a]

SAMPLE	N	Subset for alpha = 0.05		
		1	2	3
CONTROL	135	2.7622		
FFJ	135		2.9563	
FPJ	135			3.2741
Sig.		1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 135.000.

Table 5: Duncan: Number of Leaves

LEAF_NO

Duncan[a]

SAMPLE	N	Subset for alpha = 0.05	
		1	2
CONTROL	135	11.41	
FFJ	135	11.76	
FPJ	135		13.50
Sig.		.241	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 135.000.

APPENDIX B

Figure B.1: Re-potting *Mokara* Fuchsia Diamond

Figure B.2: Fermented Plant Juice (FPJ) and Fermented Fruit Juice in bottle of spray

Figure B.3: Transfer FPJ and FFJ into plastic bottles after harvest

Figure B.4: Plant height of *Mokara* Fuchsia Diamond

Figure B.5: 45 pots of *Mokara* Fuchsia Diamond with 3 treatment and 15 replications for each treatment.

Figure B.6: Spray FPJ and FFJ to soil and leaves of *Mokara* Fuchsia Diamond

EFFECT OF DIFFERENT BOOSTER ON GROWTH PERFORMANCE OF MOKARA ORCHID

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