

**THE EFFECT OF *Indole-3-Butyric AC ID* (IBA) CONCENTRATION AND
CUTTING LENGTH ON THE PROPAGATION AND GROWTH OF
GRAPE (*Vitis vinifera* L.)**

THESIS

By

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**BACHELOR PROGRAM OF AGROECOTECHNOLOGY
FACULTY OF ANIMAL AND AGRICULTURAL SCIENCES
UNIVERSITAS DIPONEGORO
SEMARANG
2025**

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CUTTING LENGTH ON THE PROPAGATION AND GROWTH OF GRAPE
(*Vitis vinifera* L.)

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degree in the Bachelor Program of Agroecotechnology, Faculty of
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Judul Skripsi : PENGARUH PEMBERIAN KONSENTRASI
Indole-3-Butyric Acid (IBA) DAN PANJANG
STEK YANG BERBEDA TERHADAP
KEBERHASILAN PERBANYAKAN DAN
PERTUMBUHAN TANAMAN ANGGUR
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SUMMARY

KEZIA WINONA HASUGIAN. 23020221140117. 2025. Influence Giving Concentration *Indole-3-Butyric AC ID* (IBA) And Long Cuttings Which Different On the Success of Propagation and Growth of Grape (*Vitis vinifera* L.) (Supervisors: **KARNO** and **ROSYIDA**).

This study aims to determine the effect of different concentrations of *Indole-3-Butyric Acid (IBA)* and cutting stem lengths on the success of propagation and growth of grape plants (*Vitis vinifera* L.). This study was conducted in the greenhouse of SMK Negeri H. Moenadi Ungaran and the Physiology Laboratory. And Plant Breeding, Faculty Animal and Agricultural Sciences, Universitas Diponegoro on December 2, 2024 – March 17, 2025.

The experimental design used was Factorial with 2 factors and 3 test. Factor First is giving concentration auxin synthetic IBA with 5 level that is control or 0 ppm (Z0) , 100 ppm (Z1) , 150 ppm (Z2) , 200 ppm (Z3) , and 250 ppm (Z4) . The second factor was the length of the stem cuttings with 3 treatment levels, namely 15 cm (P1), 20 cm (P2), and 25 cm (P3). The design produced 15 combinations. And 45 unit test with every unit there is 5 stem cuttings This resulted in a total of 225 cuttings. Observed parameters included shoot emergence time, shoot number, shoot length, leaf number, root number, root length, total chlorophyll, and the percentage of live cuttings.

The results showed that soaking the cuttings in IBA solution significantly affected the parameters of the number of shoots, shoot length, number of leaves, number of roots, root length, and total chlorophyll. The length of the cuttings significantly affected the parameters of the time of shoot emergence and the percentage of live cuttings. The interaction between the soaking solution and the length of the cuttings significantly affected the length of shoots, root length, and total chlorophyll. The concentration of 200 ppm show best results on all over Parameters. A stem length of 15 cm indicates the fastest shoot emergence time. The interaction between a 200 ppm IBA soaking solution and a 20 cm stem length increased shoot and root length, as well as total chlorophyll in the leaves.

The conclusion of this study is that the IBA concentration of 200 ppm (Z3) showed the best results in cutting growth. Cuttings with a stem length of 15 cm (P1) showed the fastest shoot emergence time. Soaking cuttings in a solution with a concentration of 200 ppm (Z3) with a cutting length of 20 cm (P2) resulted in the longest average shoot and root length, as well as the highest total chlorophyll.

FOREWORD

Praise I'm grateful to presence Lord Which Maha One Which has give His grace so that writer can finish study and writing thesis well Which titled "Influence Giving Concentration *Indole-3-Butyric AC ID* (IBA) and Different Cutting Lengths on the Success of Propagation and Growth of Grape Plants (*Vitis vinifera* L.)" in a timely manner. The purpose of compilation thesis that is as one of the requirements for obtaining a Bachelor of Agriculture degree.

The author realizes that the preparation of this thesis cannot be separated from the guidance and support of various parties, both directly and indirectly. Therefore, I want to convey thank you as sincerely as possible to:

1. Ir. Karno, M.Appl.Sc., Ph.D. as the Main Supervisor of the Thesis and Rosyida, SP, M.Sc. as the Member Supervisor who have guided, assisted, and provided direction to the author during the research. And compilation Thesis so that can completed with good.
2. Prof. Sugiharto, S.Pt., M.Sc., Ph.D. as Dean of the Faculty of Animal Husbandry and Agriculture along with his staff at the Faculty of Animal Husbandry and Agriculture, Ahmad Ni'matullah Al-Barri, S.Pt., MP, Ph.D as Acting Head of the Department of Agriculture, and Dr. Ir. Eny Fuskhah, M.Si as Head of the Bachelor Program of Agroecotechnology for the opportunity given to the author to pursue undergraduate education in the Bachelor of Agriculture.
3. A'isyah Surya Bintang, S.P, as the Advisor Lecturer (2021 – 2025) who has helped become a parent during the author's study period.

4. All over ranks lecturer teacher Bachelor Program of Agroecotechnology Prof. Dr. Ir. Endang Bi Purbajanti, MS, Prof. Dr. Ir. Syaiful Anwar, M.Sc., Prof. Dr. Mrs. Florentina Kusmiyati, M.Sc., MS, Dr. Ir. Susilo Budiyo, M.Sc., Ir. Didik Wisnu Widjajanto, M.Sc.Res., Ph.D., Ir. Karno, Dr. Ir. Eny Fuskhah, M.Si., Bagus Herwibawa, SP, MP, Ph.D. Rosyida, SP, M.Sc., A'isyah Surya Bintang, SP, M.Sc., Muhammad Ghazi Agam Sas, SP, M. Si., Fajrin Permana Putra, SP, M. Sc, Muhammad Iqbal Fauzan, SP, M.Sc., Septial Arafat, SP, MP, Dr. Dian Safitri, SP, M.Si., Albertus Fajar Irawan, SP, M.Agr., Ph.D. Prof. Dr. Ir. Dwi Retno Lukiwati, MS (Retired), Dr. Ir. Budi Adi Kristanto, MS (Retired) Task), Dr. Ir. Sutarno, MS (Retired) Assignment), and Prof. Dr. Ir. Sumarsono, MS (Alm), who has provided knowledge, experience, and guidance to the author during the study period.
5. Sri Bima Arya Teja, A.Md., Ahmad Baroha, S.Pt., and Iskandar as staff and employees in the Faculty of Animal Husbandry and Agriculture. Educational staff and Laboratory Administrators of the Agroecotechnology Study Program who have assisted the research process.
6. Both parents, Mrs. Paolina Irwan Budiyo and Mr. Chris Def Gogo Hasugian, and younger brother Kaleb Edgar Goel Hasugian who have always provided unlimited help, support, and prayers since the author started his studies until he was able to complete his studies.
7. Friends beloved writer (Aulia, Elsa, Maretha, and Fathin) Which always present and continued to help from the start of the research until the research was completed, and has accompanied the author in the process of working on the thesis.

8. The author's friends since high school, Ingrid Gracelia Saragih, Amelia Widhi Natama Siregar, Sinta Suwanto, and Farisa Aditya Redy who are always present in every story life, loyal support And strengthen in joy and sorrow.
9. Kaleb Tantri Saman, who continues to support the author throughout his studies until the completion of his thesis, is always ready to help, always accompanies him in everything that happens, and loyally supports the author in both good and bad times.
10. All my friends from Agroecotechnology 2021 who have gone through college with me through various ups and downs.
11. All parties who provided assistance in the research and writing of this thesis
All other parties that the author cannot mention all of them, thank you. has help writer in a way direct and no direct to complete the final assignment. The author realizes that there are still many shortcomings in writing thesis This, so that needed criticism and suggestion Which The author hopes that the results of this research will be beneficial to readers, scientific interests, and all competent parties.

Semarang, June 2025

Writer

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CHAPTER I

INTRODUCTION

1.1. Background

Grapes (*Vitis vinifera*) are a fruit plant with a variety of colors and are commonly used to produce fresh grapes, dried grapes, and beverages such as *wine*. Grapes are an important horticultural commodity worldwide, and grape cultivation plays a significant economic role (Wulandari, 2023). Grapes are quite popular in Indonesia and have the potential for further development. Grape cultivation in Indonesia is not comparable to market demand, as evidenced by the import of 101,899 tons of grapes, a deficit in the fruit trade worth more than IDR 5 trillion (Central Bureau of Statistics, 2022). Grape production in Indonesia is not sufficient to meet domestic market demand, so efficient grape cultivation methods are needed, one of which is vegetative propagation through stem cuttings.

Grapes are a plant that can be propagated using the method generative and vegetative. Method cuttings is Wrong One Vegetative propagation techniques in plants are commonly used in the production of quality grape seedlings (Wulandari, 2023). Vegetative propagation is a method of plant propagation to produce new plants that have certain characteristics. identical with plant parent between other with method cuttings And graft.

New plants in cutting propagation are produced in a relatively shorter time, originating from parts of existing plants, without going through... process conception or formation seed, as well as own characteristic genetically identical to the parent plant so that the superior characteristics of the parent plant can be maintained (Sulyo *et al.* , 2019). Stem cuttings are a vegetative propagation method used to produce new plants identical to the parent plant by cutting healthy and mature stems from the parent plant and then growing them in a planting medium to stimulate the growth of roots and shoots of the new plant.

The success of grape cutting propagation is greatly influenced by external factors, one of which is hormones. Auxin is a plant hormone that plays a role. main as regulator enlargement cell and trigger growth plant roots. Auxin is a growth regulator that plays a role in the process elongation cell, hinder shoots lateral, stimulate root growth, and preventing leaf abscission (Sofwan *et al.* , 2018). Auxin is added to plant cuttings to stimulate root cell growth. Administering auxin hormone to plants at the appropriate concentration will have a positive effect on plant development (Pramudito *et al.* , 2018).

IBA (*Indole-3-Butyric Acid*) is a type of synthetic hormone belonging to the auxin group that is capable of stimulating root growth in vegetative propagation, including stem cuttings. IBA is considered... more effective compared to type other due to its stability more

tall. Stability IBA more height compared to type auxin other, This is due to the minimal transfer of IBA to the base of the cuttings and the conversion of IBA to IAA (Wiraswati and Badami, 2018). The concentration of IBA at 100 ppm has not shown a significant effect on the growth progress of stem cuttings. so that need addition concentration IBA on 100 ppm (Oktaviana *et al.* , 2022).

Research on grapevine stem cutting propagation has been extensively conducted, but information on the most effective combination of IBA concentration and cutting length for successful grapevine propagation and growth is still limited. This suggests that gaps for further study, this study aims to determine the effect of providing different concentrations of *Indole-3-Butyric Acid (IBA)* and cutting stem lengths on grape propagation (*Vitis vinifera* L.).

1.2. Objective and Benefits

Objective from study This is:

1. To examine the effect of various concentrations of IBA on the success of grape stem cuttings (*Vitis vinifera* L.).
2. To examine the effect of different stem cutting lengths on the success of grape stem cuttings (*Vitis vinifera* L.).
3. Review influence interaction giving various concentration *Indole-3-Butyric AC ID* (IBA) with long stem cuttings Which different on the success of grape stem cuttings (*Vitis vinifera* L.).

The benefits for this study are :

1. Provides information on the effect of administering various concentrations of *Indole-3-Butyric Acid* (IBA) on the success of grape stem cuttings (*Vitis vinifera* L.).
2. Provides information on the effect of different stem cutting lengths on the success of grape stem cuttings (*Vitis vinifera* L.).
3. Give information about influence interaction between *Indole-3-Butyric acid* concentration *AC ID* (IBA) with long stem cuttings Which different on the success of grape stem cuttings (*Vitis vinifera* L.).

1.3. Research Hypothesis

Hypothesis study being tested is as following:

1. The IBA concentration of 200 ppm is optimum and effective for the success and growth of stem cuttings in grape plants (*Vitis vinifera* L.).
2. Long cuttings 20 cm effective to success And growth stem cuttings in grape plants (*Vitis vinifera* L.).
3. There is an interaction between the concentration of *Indole-3-Butyric Acid* (IBA) and different cutting lengths on the success of stem cutting growth in grape plants (*Vitis vinifera* L.).

CHAPTER II

REVIEW LIBRARY

2.1. Grape Plants (*Vitis vinifera* L.)

Grape plant (*Vitis vinifera* L.) is a plant that can grow in the lowlands and belongs to the family *Vitaceae*. Grape plants are classified as follows:

Kingdom	: Plantae
Division	: Magnoliophyta
Class	: Magnoliopsida
Order	: Vitales
Family	: Vitaceae
Genus	: <i>Vitis</i>
Species	: <i>Vitis vinifera</i> L. (Linné, 1908).

Grapevines can thrive with adequate light intensity and optimal temperatures. Grapevines require a temperature range of 25°C to 32°C for grafting. Temperatures below 25°C or above 32°C slow callus formation and can kill cells in the graft, even with adequate sunlight (Ramadhan, 2022).

Grape plant (*Vitis vinifera* L.) is a horticultural commodity that is popular among some Indonesians. The demand for grapes is increasing. Which tall No accompanied with amount production wine Which

produced, Wine on year 2018 experience decline production by 8% from year 2017, on year 2019 experienced an increase as big as 15% from 2018, and in 2020 production decreased again by 14% from 2019 and production in 2021 increased by 6% from the previous year (BPS, 2021).

The choice of grape variety can affect the growth of cuttings. Grape varieties have different genetic potentials in responding to their growing environment (Oktaviana *et al.*, 2022). Variety Which used that is varieties Red Master, because it has the desired characteristics of high productivity, high adaptability to extreme weather, disease resistance, and good fruit quality. The Red Master grape variety is one of the best grape varieties. One type wine with productivity tall. Characteristics Red Master is the fruit colored red purplish which shaped oval And skin thick, and tends to taste sweet.

Grape plants, apart from being rich in nutrients, are able to cleanse toxins from the liver, help improve kidney function, blood cell formation, are antiviral and anti-cancer, and are able to prevent damage. tooth. Wine own characteristic language so that can neutralize blood that is too acidic and has a detrimental effect on the body (Utami *et al.* , 2016).

2.2. Cuttings Stem Plant Wine (*Vitis vinifera* L.)

Grape production can be increased by plant propagation techniques. Wrong One technique propagation plant wine Which can

applied is cuttings (Oktaviana *et al.*, 2022). Cuttings are a method of propagating propagation vegetative with use part from Plants such as twigs, stems, and shoots. Cuttings are an alternative method of vegetative seedling propagation because they use plant material from vegetative organs in the form of pieces of stems, branches, and twigs (Renvilia *et al.*, 2016). The advantages of plant propagation through cuttings are that the plants have the same characteristics as the parent plant, are inexpensive, and can be done quickly. The advantages of propagation through cuttings are that the characteristics similar with parent, cost more cheap, more fast, simple And the time required is relatively short (Mulyani, 2015)

The origin of the planting material in stem cuttings significantly influences plant growth. Stem cuttings from the base are more commonly used for propagation due to their highest success rate (Luta, 2023). Stem cuttings also have a rapid shoot emergence rate. part base can experience growth more fast (Wiraswati and Badami, 2019). The base of the stem or branch has better growth hormones, so the roots and shoots emerge more quickly compared to other cuttings from which planting material originates (Mulyani, 2015). The highest carbohydrate content is found in the stem stem. Using the base of the stem can speed up the rooting initiation process to a greater extent than the middle and shoots (Fancora *et al.*, 2017).

Parameter grow cuttings is with appear shoots Which signifies success cuttings. Success cuttings can known in a way direct with

observing the emergence of shoots that develop into new plants and roots (Panjaitan *et al.*, 2014). The success of cuttings can also be seen from the time shoots appear, the number of shoots, the length of shoots, and the length of roots. The growth parameters of cutting stems can be determined from the time the shoots break, the number of shoots, and the length of roots. shoots which grow, long shoots and long root (Octaviana *et et al.*, 2022).

The length of the stem cutting plays a role in determining the success of vegetative plant propagation. The food or carbohydrate reserves in the stem cutting are influenced by the length; the longer the stem, the more carbohydrates it contains. This supports the formation of roots and shoots, thus increasing the success of grape cuttings. (Tasnudin And Kadekoh, 2021). Long stem cuttings usually The optimum length of grape cuttings was found to be 20 cm, showing a significant effect on the growth rate, shoot emergence rate, and shoot and root length.

2.3. *Indole-3-Butyric AC ID (IBA)*

Indole-3-Butyric Acid or IBA is a synthetic auxin hormone. Which play a role in speed up growth root. Auxin able to increase the percentage of root formation, accelerate root initiation, increase the number and quality of roots (Simanjuntak, 2021). The IBA hormone has mobility Which Enough low And still on place his gift

so that No hinder growth and development shoots (Sylviana *et et al.*, 2019).

IBA is more effective than NAA and IAA, because IBA is more stable to use in tuning. IBA more stable to oxidase and light, and its chemical properties and mobility within the plant are more stable, as well as its long-lasting effects. These properties of IBA make its use more successful. IBA remains near the given place and does not spread to other parts of the cutting so it does not affect the growth of other parts. (Zasari, 2015). IBA is the best auxin commonly used, because it is non-toxic to plants at high concentrations and is effective in stimulating rooting of several plant species (Prastyo, 2016).

IBA not only plays a role in root formation but also supports shoot growth. Administering IBA at the right concentration will improve the distribution of nutrients and energy from the plant's internal reserves, thus supporting new shoot growth (Zasari, 2015). Response auxin on plant influenced by concentration Which given, where too high a concentration is inhibiting due to competition between molecule auxin For attached on receptors so that only partially bound and not working optimally (Puspita *et al.*, 2020).

IBA is generally used in the form of a solution applied to the part of the plant to be rooted. IBA is dissolved in water. adapt concentration Which needed in propagation cuttings

Stems. The effectiveness of the IBA solution concentration used affects the plant's physiological response to root stimulation. Application of auxin to grapes showed an increase in leaf number, stem diameter, roots, and shoots, with a success rate reaching 100% (Tarmizi and Barunawati, 2022). The right concentration is needed to provide optimal results for grape propagation by stem cuttings. An IBA concentration of 100 ppm has not shown a significant effect on the growth of grape stem cuttings, so an additional IBA concentration above 100 ppm is required (Oktaviana *et al.* , 2022).

CHAPTER III

MATERIAL AND METHOD

The research was conducted from December 2024 to March 2025 at *the Greenhouse of H. Moenadi State Vocational School, Ungaran* with an average daily temperature of 29.90 °C and average daily humidity of 75.47 %. Observations were continued at the Plant Physiology and Breeding Laboratory at the Faculty of Animal and Agricultural Sciences, Universitas Diponegoro, Semarang, Central Java.

3.1. Material Study

Material Which used on study This consists of on tool And Materials. The materials used include *Red Master grape seeds* , water, planting media, and *Indole-3-Butyric Acid* (IBA). The tools used include 15 x 15 polybags, shovels, watering cans, pH meters, TDS, *thermo-hygrometers* , and gloves. hand, scales with accuracy 0.1 g, ruler with accuracy of 0.1 cm, cutting scissors, labels, stationery, scissors, and a camera.

3.2. Method Study

Experimental Design. The research was conducted experimentally using a 5×3 Factorial Design with a Completely Randomized Design (CRD) with 3 replications, resulting in 15 combinations and 45 units. test with every unit there is 5 stem cuttings so that total obtained 225 stem cuttings served on Attachment 1. Factor First is

giving concentration auxin synthetic IBA with 5 level that is control or 0 ppm (Z0) , 100 ppm (Z1) , 150 ppm (Z2) , 200 ppm (Z3) , and 250 ppm (Z4) . The second factor is the length of the stem cuttings with 3 levels of treatment, namely 15 cm (P1), 20 cm (P2), and 25 cm (P3). The area where the cuttings were placed was shaded with paranet and watered in the morning and evening.

Factor 1 Concentration *Indole-3-Butyric AC ID* (IBA) :

Z0 : 0 ppm (Control) Z1

: 50 ppm

Z2 : 100 ppm

Z3 : 150 ppm

Z4 : 200 ppm

Factor 2 Long Stem Cuttings:

P1 : 15 cm

P2 : 20 cm

P3 : 25 cm

Research Procedures . The research includes the preparation of tools and materials, preparation of planting media, preparation of synthetic auxin solution, soaking cuttings, planting, maintenance, harvesting, and observation.

1) **Preparation of tools and materials**

The planting medium consists of a composition of cow manure, soil and rice husks. as much as 1 : 1 : 1. Comparison composition made with calculate volume composition fertilizer pen cow, land, husk in a way The same Lots

then mixed as presented in Appendix 15. *Polybags* are arranged with a distance between *polybags* of 15 cm x 15 cm Appendix 15. The planting medium that has been put into *the polybag* is watered to maintain its humidity. The filled *polybag* is placed in a place that gets enough sunlight according to the layout of the research.

2) Tuning Plant

Cuttings are taken in the afternoon to reduce water evaporation. Cuttings are taken using a sharp knife or pruning shears to avoid damaging the root growth tissue on the plant stem. Cuttings are 15 cm, 20 cm, and 25 cm long pieces of grapevine stem (Red Master) with at least three buds. The base of the cutting is cut at a 45° angle to provide a wider surface area for root growth.

3) Making Solution IBA

The preparation of IBA solution as a treatment was divided into 5 concentrations of IBA, namely 0 ppm (control), 100 ppm, 150 ppm, 200 ppm, and 250 ppm. The preparation of IBA solution was carried out in the Plant Physiology and Breeding Laboratory presented in Appendix 15. The initial stage of preparing IBA solution was to make an IBA stock solution with a concentration of 1000 ppm or 1000 mg/l. The preparation of IBA stock solution was as much as 1.020 g in 10 ml of 96% alcohol then added with distilled water until the volume became 1000 ml. The second stage was to prepare the IBA solution concentration using the dilution formula:

$$V1 \times M1 = V2 \times M2$$

Information :

V1 : Volume of stock solution to be taken M1 :

Concentration solution stock IBA 3000 ppm

V2: Total soak volume 1000 ml

M2 : Concentration the solution that will made

4) Immersion Material Cuttings

Immersion material cuttings that is stem cuttings as much as ½ part soaked in receptacle containing solution fungicide Score during 30 minute on concentration of 1 ml/L, then soaked again in the IBA solution container using a tray according to the treatment concentration that was made previously. by soaking for 3 hours is presented in Appendix 15.

5) Planting

Planting, namely the stem cuttings that have been dried are then planted with depth reach 4 – 6 cm (1/3 part) on media planting in polybags is presented in Appendix 15.

6) Maintenance

The cuttings are watered every day in the morning and evening and placed in a suitable place. Which shady. Watering media done every 2 time a day. If the soil is damp, no watering should be done. Weeds all around plant cleaned in a way mechanical with sickle or with empty hands pull out And clean weeds. Symptom attack pest or

Diseases seen in plants are controlled using pesticides. Fertilization is carried out by administering NPK fertilizer at two times. Sunday after plant, so that growth plant wine Good And Fertilization will then be given every two weeks, with a dose of fertilizer urea 1.7 g/plant, KCl 1.6 g/plant, And SP36 2.2 g/plant is presented in Appendix 15.

Parameter Observation. Parameter Which observed in study This that is:

- 1) Time to emergence of shoots (DAP), calculated from the emergence of the first shoots. appear on day after planting. The emergence shoots marked with the rupture of the bud eyes. Observed daily from 0 HST to 30 HST.
- 2) The number of shoots was calculated from the number of shoots that emerged in each treatment and replication. Observations were made when the leaves began to grow and were already visible, and this was done until the end of the experiment.
study namely 12 MST.
- 3) Shoot length (cm), Shoot length was measured from the length of shoots that grew in each treatment and replication using a meter. Observations were carried out every week until 12 weeks after planting.
- 4) The number of leaves (strands) was counted weekly until the leaves fully opened in each treatment and replication. Observations were made until the end of the study, which was 12 weeks after planting.

- 5) The number of roots is calculated from all the roots that grow in each treatment And test. Observation done until the end research, namely 12 MST.
- 6) Root length (cm) was measured from all roots growing in each replication of the treatment combination. Measurements were taken from the base of the stem to the tip of the longest root using a tape measure at harvest time.
- 7) Total chlorophyll content (mg g^{-1}) was calculated using a spectrophotometer by grinding 0.25 g of sample, then dissolving it in 10 ml of 80% acetone and stirring until the chlorophyll dissolved. The extract was filtered using Whatman filter paper, after which it was placed in a cuvette and its absorbance was measured. with long wave 663 nm And 645 nm. The formula for calculating total chlorophyll can be calculated using the Hendry and Grime (1993) formula in Khafid *et al* . (2021) as follows:

$$\text{Total chlorophyll (mg g}^{-1}\text{)} = 20.2 A_{645 \text{ nm}} + 8.02 A_{663 \text{ nm}}$$

nm Description:

A_{663} = absorbance on long wave 663 nm A_{645} =

absorbance at length wave 645 nm

- 8) Percentage of live cuttings, living cuttings are marked with fresh stems, growing shoots and roots. The percentage of live cuttings is:

$$\text{Live Cuttings} = \frac{\text{Number of Live Cuttings}}{\text{Total cuttings planted}} \times 100\%$$

Data analysis

Model linear which explains every mark influence as following:

$$Y_{ijk} = \mu + Z_i + P_j + (ZP)_{ij} + \epsilon_{ijk}$$

Information :

- Y_{ijk} = Value observation consequence influence type treatment i-th
And length of the jth treatment stem in the kth replication
- μ = Value average middle general
- Z_i = Influence additives concentration IBA on level
to – i
- P_j = Additive effect of stem length at level j
- $(ZP)_{ij}$ = Influence interaction between concentration IBA level to – i And
length of the jth level rod
- ϵ_{ijk} = Influence of experimental error on the ith IBA concentration factor,
stem length jth on kth test to propagation cuttings grape stems .

Hypothesis statistics Which tested is as following:

1. Influence factor concentration IBA

$H_0 : Z_0 = Z_1 = Z_2 = Z_3 = Z_4 = 0$ (No There is influence concentration IBA on the results of grape stem cuttings)

H_1 : Minimum There is One $Z_i \neq 0$. (There is influence concentration IBA on the results of grape stem cuttings)

2. Influence factor IBA concentration

$H_0 : P_1 = P_2 = P_3 = 0$ (There is no effect of the length of the stem treatment on the results of grape stem cuttings)

H_1 : Minimum There is One $P_j \neq 0$. (There is influence long stem treatment of grape stem cuttings)

3. Influence interaction IBA concentration And stem length

$H_0 : Z_0P_1 = Z_0P_2 = Z_0P_3 = Z_1P_1 \dots = 0$ (No There is influence interaction between concentration IBA with long stem treatment to grape stem cuttings)

H1 : There is at least one $Z_i P_j \neq 0$. (There is an interaction effect between IBA concentration and stem length treatment on grape cutting results)

Analysis of Variance (ANOVA) at 5% level was used to analyze the data. results observation There is whether or not influence treatment. Results analysis variety shows influence Which real, so that test Different Real The smallest (BNT) level of 5% is used.

CHAPTER IV

RESULTS AND DISCUSSION

4.1. Compilation Results Analysis Variety Fingerprint

Based on the analysis of variance on all parameters, several results were obtained on all parameters with the treatment of the origin of the planting material and concentration *Indole-3-Butyric AC ID* (IBA). Compilation results analysis the variety can be seen in Table 1.

Table 1. Analysis Parameter Variety Observation

Parameter Observation	Treatment		
	IBA Concentration (Z0/Z1/Z2/Z3/Z4)	Bar Length (P1/P2/P3)	Interaction (Z x P)
Time of Emergence of Shoots (HST)	*(b/b/b/a/c)	*(a B C)	Mr.
Amount Shoots	*(b/bc/bc/a/c)	Mr.	Mr.
Shoot Length (cm)	*(d/b/b/a/c)	Mr.	*P1(g/bcde/b/bcd/ef) P2(fg/def/bcde/a/fg) P3(g/bc/cdef/bcd/ef)
Amount Leaf (strand)	*(b/ab/b/a/b)	Mr.	Mr.
Amount Root	*(c/b/ab/a/b)	Mr.	Mr.
Root Length (cm)	*(c/b/b/a/b)	Mr.	*P1(defg/cdefg/bcdef/b/bc) P2(fg/efg/bcde/a/bcdefg) P3(h/bcdef/bcd/bc/g)
Total Chlorophyll	*(c/bc/ab/a/ab)	Mr.	*P1(cde/ef/ab/abc/bcd) P2(f/bcd/bcd/a/abc) P3(def/bc/bcd/bcd/bcd)
Percentage Living Cuttings	*(bc/abc/ab/a/c)	*(chapter)	Mr.

Note : *Influential real (F-count>F-table) And Mr. = No influential real (F-count<F- table)

Results study show that treatment concentration IBA has a significant effect on the time of emergence of shoots, number of shoots, length shoots, amount leaf, amount root, long root, total chlorophyll. The length of the stem has a significant effect on the parameters of the time of emergence of shoots and the percentage of cuttings life. Interaction treatment concentration IBA And long The stem has a significant effect on shoot length, root length, and total chlorophyll.

4.2. Time Shoots Appear

The treatment of IBA concentration and stem length had a significant effect. to parameter tall plant, as well as No there is interaction between the two treatment. Results time appear shoots on cuttings stem wine for each treatment is presented in Table 2.

Table 2. Time of Shoot Emergence Due to IBA Concentration and Cutting Stem Length

Stem Length (cm)	Concentration IBA (ppm)					Average
	0	100	150	200	250	
	(HST)					
15	9.00	8.33	9.33	6.33	11.67	8.25 ^a
20	10.00	11.67	12.00	8.33	12.33	10.50 ^b
25	12.00	12.00	11.33	10.33	13.00	11.42 ^c
Average	10.33 ^b	10.67 ^b	10.89 ^b	8.33 ^a	12.33 ^c	

Different superscripts on the mean column or mean row indicate significant differences (P<0.05)

Application treatment concentration IBA influential real to time of appearance shoots (Table 2). Concentration IBA 200 ppm show results The best in growing the fastest shoots. IBA concentration treatments were 0 ppm, 100 ppm, 150 ppm, And 250 ppm different real to parameter time appear

shoots cuttings stem wine. Treatment long stem cuttings 15 cm show results best in grow shoots fastest. Long stem cuttings 20 cm and 25 cm show difference real to parameter time grape stem cutting shoots appear.

The fastest shoot emergence time parameter was shown in the 200 ppm IBA concentration treatment with an average of 8.33 days after planting (DAP) (Table 2). This is because soaking the grape cuttings in the IBA hormone solution stimulates cell division in the meristem tissue, which causes root formation. Good root formation increases the efficiency of nutrient and nutrient absorption in plants, thereby accelerating shoot growth. According to Oktaviana *et al.* (2022), the use of IBA hormone has a significant impact on the day of bud break in grape stem cuttings, where the exogenous auxin content stimulates the growth of grape shoots. The application of exogenous auxin at various concentrations can affect the time of shoot emergence, which is influenced by the origin of the planting material used. Sari (2019) explains that the effectiveness of plant growth regulators depends on the source of the planting material, the concentration applied, the location of the hormone's action, and the plant's growth phase.

The fastest shoot emergence time parameter was shown in the treatment of 15 cm stem cutting length with an average of 8.25 days after planting (Table 2). shoots influenced by existence reserves nutrition Which stored. Cuttings with long stem 15 cm show time appear shoots Which

tend more fast compared to with long stem 20 cm And 25 cm, due to the lack of energy distribution throughout the rod, thus reducing focus on formation shoots. Matter This in accordance with research by Tasnudin and Kadekoh (2021) which states that the influence of endogenous auxin and food reserves is sufficient to stimulate cell division. in grow shoots, so that time appear shoots between stem treatments are relatively the same.

Immersion stem cuttings in solution concentration IBA Which appropriate will stimulate growth, while too high a concentration will inhibit growth due to the synthesis of ethylene which is the opposite of auxin. Research by Sholeha *et al.* (2023) shows that auxin endogen And exogenous influence exchange ion H^+ And K^+ , as well as support synthesis protein as source energy. Source energy that is formed will stimulate regeneration process meristem on end the coleoptile becomes a growing point, which develops into a shoot primordia to form a shoot.

4.3. Number of Shoots

Treatment concentration IBA give influence real, but Stem length had no significant effect on the number of shoots, and there was no interaction between the two treatments. The average number of shoots on grape stem cuttings for each treatment is presented in Table 3.

Table 3. Number of Shoots Due to IBA Concentration and Cutting Stem Length

Long Stem (cm)	0	Concentration IBA (ppm)				Average
		100	150	200	250	
		(shoot)				
15	1.33	1.33	1.00	1.67	1.33	1.33
20	1.33	1.67	1.00	2.33	1.33	1.58
25	1.00	1.33	1.33	2.00	1.00	1.42
Average	1.22 ^b	1.44 ^{bc}	1.11 ^{bc}	2.00 ^a	1.22 ^c	

Superscript Which different on line average show difference significant (P<0.05)

Application treatment concentration IBA influential real to number of shoots (Table 3). IBA concentration of 200 ppm showed significantly different results. compared to with treatment concentration IBA IBA 0 ppm, 100 ppm, 150 ppm, and 250 ppm in increasing the number of shoots. The highest number of shoots shown on treatment concentration IBA 200 ppm with an average of 2.00 shoots (Table 3). This is in accordance with research by Kaushik and Shukla (2020) which showed that the 200 ppm IBA treatment produce amount shoots Which more Lots on cuttings stem *Marigold* plants were compared with IBA treatments of 100 ppm and 300 ppm. The appropriate IBA concentration will encourage the regeneration of tissue that is cut due to cutting the stem cutting, resulting in the distribution of nutrients and energy For form shoots. According to Merchant *et al.* (2021), IBA application stimulates meristem activity in the cut wound area in the propagation method vegetative, so that speed up transportation carbohydrate and proteins aimed at the formation of shoots and the development of external shoots.

The length of the cuttings did not significantly affect the number of shoots (Table 3). This could be due to nutrient availability, hormonal activity, and tissue regeneration in the cut area. Amanah *et al.* (2022) stated that the number of shoots, which is part of plant growth, is more influenced by the meristems present in the cuttings used.

4.4. Shoot Length

Treatment concentration IBA give influence real, but stem length does not have a significant effect on the number of shoots parameter, as well as there is interaction between the two treatment. Average long shoots on grape stem cuttings for each treatment is presented in Table 4.

Table 4. Long Shoots Consequence IBA concentration and Length of Stem Cutting

Long Stem (cm)	Concentration IBA (ppm)					Average
	0	100	150	200	250	
			(cm)			
15	10.07 ^g	19.47 ^{bcde}	23.53 ^b	27.20 ^{bcd}	15.18 ^{ef}	20.07
20	13.10 ^{fg}	15.87 ^{def}	19.40 ^{bcde}	33.00 ^a	13.28 ^{fg}	20.34
25	10.10 ^g	21.50 ^{bc}	17.20 ^{bcdef}	21.07 ^{bcd}	14.87 ^{ef}	17.47
Average	11.09 ^d	18.94 ^b	20.04 ^b	27.09 ^a	14.44 ^c	

Superscript Which different on line average or matrix interactions show significant difference (P<0.05)

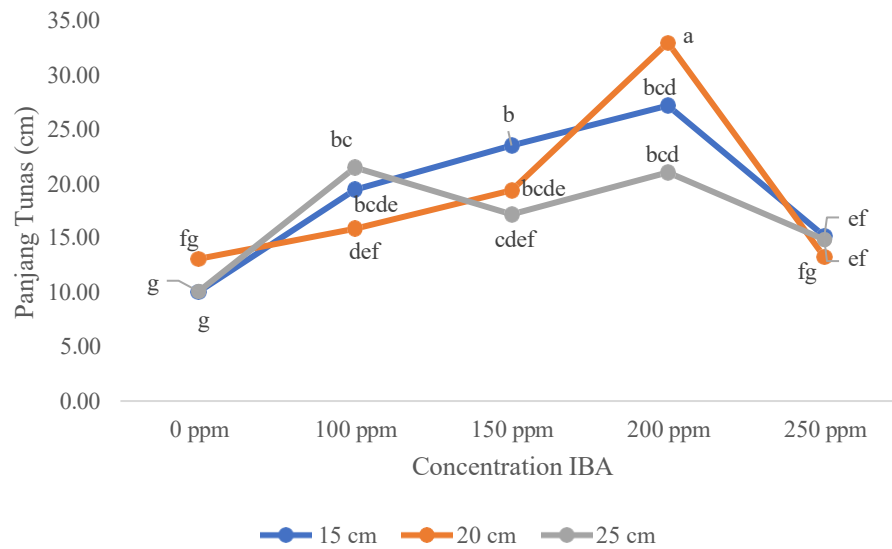


Illustration 1. Interaction Graph of IBA Concentration Treatment and Cutting Stem Length on Grape Cutting Shoot Length

Based on Illustration 1 show existence interaction between IBA concentration treatment and cutting stem length that influence on the number of shoots of grape stem cuttings. The length of shoots in the 15 cm stem length treatment continued to increase up to an IBA concentration of 200 ppm, but decreased after the IBA concentration reached 200 ppm. reached 250 ppm. This indicates that the IBA concentration of 200 ppm is the optimal point, and any higher concentration will be toxic to the cuttings. This is in accordance with research by Primary *et al.* (2022) Which state that use hormone Excess IBA will trigger ethylene synthesis which inhibits the growth of astek.

Treatment with an IBA concentration of 200 ppm with a stem length of 20 cm experienced improvement compared to with treatment IBA 0, 100, 150, and 250 ppm, but No different real between 0, 150, And 250 ppm. Treatment

long stem 20 cm continues to increase until IBA concentration of 200 ppm, but decreased after reaching 250 ppm. This was due to excessive IBA use, which caused a decrease at 250 ppm. Research by Shiri *et al.* (2019) show that Concentration IBA which exceed limit optimal will trigger toxic effects due to the formation of ethylene which inhibits shoot growth.

Shoot length in the 25 cm stem length treatment increased on concentration IBA 100 ppm, decline on concentration 150 ppm, increasing at 200 ppm, and ending with a decrease in concentration 250 ppm. Improvement which happen caused by by existence IBA factor as a stimulant of meristem activity that supports cell division, decreased in treatment 150 ppm can be caused by the ability of the cutting stem which is still not sufficient to utilize IBA optimally, whereas decline on 250 ppm caused by by The formation of ethylene due to the accumulation of excess IBA. This was demonstrated in Ihsan's research (2022) Which state that ethylene Which produced plant It acts opposite to auxin, thus inhibiting growth in cutting propagation. A balance of auxin concentration and plant energy is necessary to support optimal growth.

4.5. Number of Leaves

Treatment concentration IBA give influence real, but stem length no give influence real to parameter amount leaf,

as well as no there is interaction between second treatment. Results amount leaf on grape stem cuttings for each treatment is presented in Table 5.

Table 5. Number of Leaves Due to IBA Concentration and Cutting Stem Length

Stem Length (cm)	Concentration IBA (ppm)					Average
	0	100	150	200	250	
	(strand)					
15	13.33	18.33	16.67	25.33	14.67	18.42
20	17.33	25.33	21.00	28.33	19.33	23.00
25	13.00	16.33	17.33	26.33	14.00	18.25
Average	14.56 ^b	20.00 ^{ab}	18.33 ^b	26.67 ^a	16.00 ^b	

Superscript Which different on line average show difference significant (P<0.05)

Application treatment concentration IBA influential real to number of leaves (Table 5). IBA concentration of 200 ppm showed significantly different results compared to the IBA concentration treatments of 0, 150, and 250 ppm in grow amount leaf. Amount leaf most shown in the 200 ppm IBA concentration treatment with an average of 26.67 leaves (Table 5). This is in accordance with research by Apriliani *et al.* (2015) which showed that the 200 ppm IBA treatment increased the number of leaves in cuttings plant bayur compared with treatment NAA 100 ppm And 200 ppm. This is due to IBA's ability to persist in plant tissue for a relatively long time, thereby stimulating leaf growth. Pamungkas and Nopiyanto (2020) explain that plants naturally own hormone endogen which limited for stimulate growth leaf, so that required addition substance regulator grow to support the optimal leaf growth process.

The length of the cuttings did not significantly affect the number of leaves (Table 5). This is due to the lack of nutrient availability and endogenous hormone content in the cuttings. Masli *et al.* (2015) stated that the low carbohydrate availability in cuttings results in high protein levels, which play a greater role in supporting shoot elongation than leaf formation. The length of the cuttings does not significantly affect the number of leaves, as it is stimulated by external auxin and nutrient reserves concentrated at the base of the cutting. Research by Nofri and Bahar (2021) showed that the application of synthetic auxin at optimal concentrations can increase primary root growth in water apple cuttings.

4.6. Number of Roots

Treatment concentration IBA give influence real, but Stem length had no significant effect on root number, and there was no interaction between the two treatments. The average number of roots on grape stem cuttings for each treatment is presented in Table 6.

Table 6. Number of Roots Due to IBA Concentration and Stem Length Cuttings

Long Stem (cm)	Concentration IBA (ppm)					Average
	0	100	150	200	250	
			(root)			
15	7.67	15.33	15.33	15.33	10.33	13.42
20	8.00	8.33	6.00	18.00	8.67	10.08
25	3.00	10.33	13.00	10.67	8.67	9.25
Average	6.22 ^c	11.33 ^b	11.44 ^{ab}	14.67 ^a	9.22 ^b	

Superscript Which different on line average show difference significant (P<0.05)

Application treatment concentration IBA influential real to Number of roots (Table 6). The 200 ppm IBA concentration showed significantly different results compared to the 0, 100, and 250 ppm IBA concentration treatments in increasing the number of roots. The 0 and 100 ppm treatments showed significant differences in the number of roots of grape cuttings. The best results were shown in the 200 ppm IBA concentration treatment with an average of 14.67 root (Table 6). Matter This in accordance with Hossain and Gony (2020) showed that the number of roots per strawberry plant showed a significant difference in the application of a 200 ppm IBA solution, resulting in a maximum number of roots, more effective than the 100, 300, and 0 ppm treatments. The correct IBA concentration will stimulate cell division in the roots. Pratama *et al.* (2022) stated that auxin produced by plants in meristem tissue has the ability to increase the success of root formation, accelerate the root initiation process, increase the number and improve the quality of roots, and support uniform root growth.

The length of the cuttings did not show any significant difference in the number of roots (Table 6). This may be influenced by the presence of nutrient reserves that are optimally concentrated in the roots. In accordance with results study by Octaviana *et al.* (2022) Which state that the addition of exogenous hormones to the stem cuttings will increase growth due to the availability of optimal food reserves, which marked with emergence root. Nutrition in form carbohydrate in cuttings plays an important role in supporting the root formation process in plants. According to Daskalakis *et al.* (2018), adequate carbohydrate reserves capable provide energy For division And differentiation cells, thus accelerating root formation on grape stem cuttings.

4.7. Root Length

Treatment concentration IBA give influence real, but Stem length had no significant effect on root length, and there was an interaction between the two treatments. The average root length of grape stem cuttings for each treatment is presented in Table 7.

Table 7. Long Root Consequence Concentration IBA And Long Stem Cuttings

Stem Length (cm)	Concentration IBA (ppm)					Average
	0	100	150	200	250	
15	13.13 ^{defg}	13.43 ^{cdefg}	14.20 ^{bcdef}	16.50 ^b	15.23 ^{bcde}	14.32
20	11.93 ^{fg}	12.70 ^{efg}	15.30 ^{bcde}	19.43 ^a	13.90 ^{bcdefg}	14.84
25	7.50 ^h	14.37 ^{bcdef}	15.60 ^{bcd}	15.90 ^{bc}	11.33 ^g	13.34
Average	10.86 ^c	13.50 ^b	15.03 ^b	17.28 ^a	13.49 ^b	

Superscript Which different on line average or matrix interactions show significant difference (P<0.05)

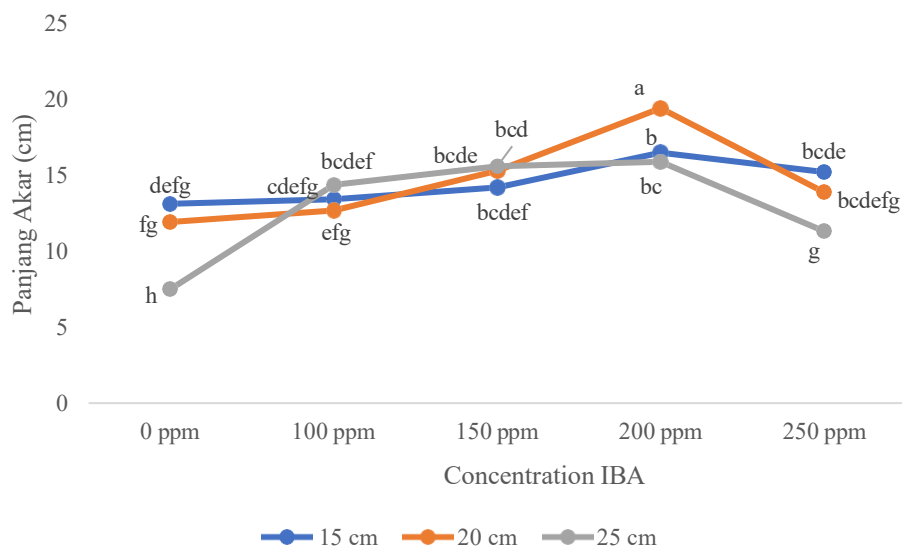


Illustration 2. Interaction Graph of IBA Concentration Treatment and Cutting Stem Length on Grape Cutting Root Length

Based on Illustration 2 show existence interaction between concentration treatment IBA And long stem cuttings Which influential to root length cuttings stem wine. Treatment concentration IBA 200 ppm with The 20 cm stem length increased and was significantly different compared to the 0, 100, 150, and 250 ppm IBA treatments. Root length in the 15 cm stem length treatment continued to increase up to an IBA concentration of 200 ppm, but decreased after the concentration reached 250 ppm. Tamba *et al.* (2019) explained that the application of IBA at an optimal concentration can stimulate root growth through the flow of auxin from the apical meristem to the base area of the plant, which causes carbohydrates to concentrate to support the root formation process. This indicates that the 200 ppm IBA concentration is the optimal point, and the rest will be toxic to cuttings.

The 20 cm stem length treatment continued to increase up to an IBA concentration of 200 ppm, but decreased after reaching 250 ppm. This is because the use of IBA at concentrations of 0 to 200 ppm stimulates optimal cell division leads to increased root length, while when the IBA concentration reaches 250 ppm, root growth is inhibited due to ethylene production. This is consistent with research by Simanjuntak (2021), which states that plant stem cuttings have an optimal IBA concentration limit, exceeding which will inhibit root growth in the cuttings.

Root length in the 25 cm stem length treatment continued to increase until concentration IBA 200 ppm, However experience decline after concentration reach 250 ppm. Improvement which happen This is due to the presence of IBA as a stimulant of meristem activity that supports root elongation, while the decrease at 250 ppm is caused by the formation of ethylene due to the accumulation of excess IBA. This is shown in the research of Mariana *et al.* (2023) which states that the use of auxin at the right concentration will stimulate root elongation. Because existence auxin Which flow from part meristem apical towards the section plant basalt, so that carbohydrates in plants will gather to stimulate root formation. Root elongation in cuttings can be increased by administering auxin, which also plays a role in facilitating absorption element Hara from media planting. Rosalia (2016)

explains that the ability of cuttings to form roots is influenced by the presence of growth regulators, especially auxin, as well as the root formation process. callus in part base cuttings. Use hormone auxin on concentration Which in accordance proven capable speed up growth root length .

Treatment of stem cutting length did not show any significant difference. long root (Table 7). Matter This can influenced by The addition of auxin and nutrient reserves in the stem is optimally concentrated in the roots. This is in accordance with the research results by Pratama *et al.* (2022) which stated that that giving auxin with concentration Which in accordance able to increase root length, making it easier for plants to absorb nutrition And element Hara For grow the flowers. Long stem cuttings No influential significant to long root This is because the availability of external auxin and concentrated nutrient reserves at the base of the cutting are sufficient to stimulate rooting. This is supported by research by Nofri and Bahar (2021), which showed that the concentration of synthetic auxin Which appropriate will add primary root length on cuttings guava water.

4.8. Total Chlorophyll

Treatment concentration IBA give influence real, but Stem length had no significant effect on total chlorophyll parameters, and there was an interaction between the two treatments. The average total chlorophyll content in grape stem cuttings for each treatment is presented in Table 8.

Table 8. Total chlorophyll Concentration IBA And Long Stem Cuttings

Long Stem (cm)	Concentration IBA (ppm)					Average
	0	100	150	200	250	
	(mg g^{-1})					
15	24.05 ^{cde}	18.41 ^{ef}	29.68 ^{ab}	29.01 ^{abc}	25.66 ^{bcd}	25.29
20	17.73 ^f	25.80 ^{bcd}	24.52 ^{bcd}	32.95 ^a	28.36 ^{abc}	25.25
25	21.53 ^{def}	27.59 ^{bc}	26.75 ^{bcd}	25.79 ^{bcd}	25.12 ^{bcd}	25.42
Average	21.10 ^c	23.93 ^{bc}	26.99 ^{ab}	29.25 ^a	26.38 ^{ab}	

Superscript Which different on line average or matrix interactions show significant difference ($P < 0.05$)

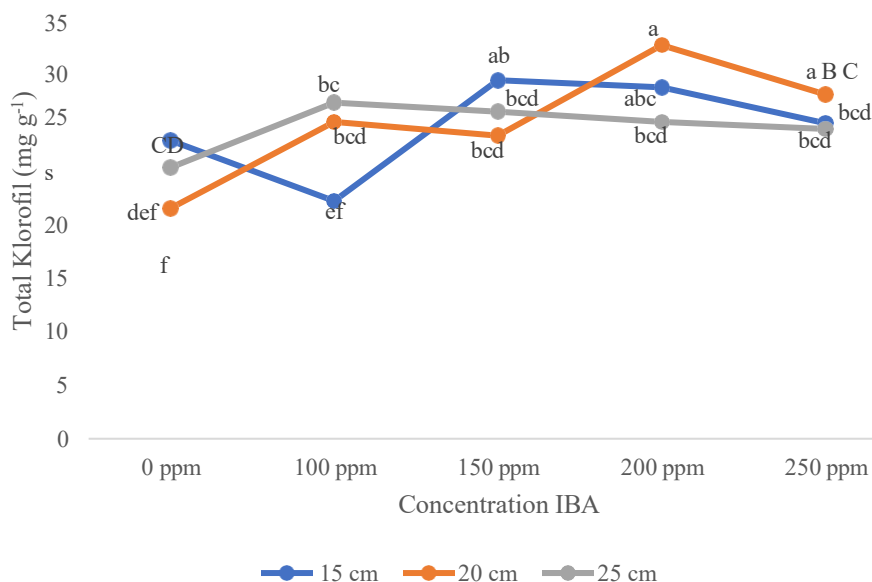


Illustration 3. Interaction Graph of IBA Concentration Treatment and Cutting Stem Length on Total Chlorophyll of Grape Cuttings

Based on Illustration 3 show existence interaction between IBA concentration treatment and stem cutting length that affect the total chlorophyll of grape stem cuttings. The IBA concentration treatment of 200 ppm with a stem length of 20 cm experienced an increase compared to the treatment IBA 0, 100, 150, And 250 ppm, but no different real between 100, 150, And 250 ppm. Treatment long stem 20 cm experience

increase at IBA concentration of 100 ppm, decrease after the concentration reaches 150 ppm, improvement on concentration IBA 200 ppm, And ended with a decrease in the concentration of 250 ppm. Total chlorophyll in the 15 cm stem length treatment decreased to an IBA concentration of 100 ppm, an increase in the concentration of 150 ppm, but experienced a decline again until reach 250 ppm. Matter This can caused by by The initial concentration is not optimal for chlorophyll biosynthesis and then decreases again due to excess IBA hormone which increases ethylene and inhibits it. synthesis chlorophyll. According to Luo *et al.* (2023), use Auxin at optimal levels will stimulate chlorophyll biosynthesis and photosynthesis, while auxin at high levels will inhibit chlorophyll accumulation through repression of chlorophyll biosynthesis genes mediated by ARF7-IAA14, thereby suppressing biosynthesis genes, causing oxidative stress, and chlorophyll degradation.

Parameter total chlorophyll in The 20 cm stem length showed a fluctuating pattern at various IBA concentrations due to the influence of hormone doses on plant metabolism. This is because the use of IBA at concentrations of 0 to 200 ppm stimulates chlorophyll biosynthesis optimally so that total chlorophyll increases, while when total chlorophyll decreases, this occurs because excess IBA triggers oxidative stress and ethylene production. This is in accordance with the statement by Widiyani *et al.* (2024) which states that auxin cuttings are related to chlorophyll in photosynthesis, where giving substance regulator grow will stimulate formation

chlorophyll pigments in leaves thus increasing the rate of photosynthesis and plant production.

Total chlorophyll in the 25 cm stem length treatment continued to increase until concentration IBA 100 ppm, However Keep going experience decline until the concentration reaches 250 ppm. The increase in total chlorophyll in the treatment of 25 cm stem length up to 100 ppm IBA concentration is caused by optimal hormone stimulation of the activity of enzymes that play a role in chlorophyll biosynthesis, thereby supporting maximum chlorophyll formation. The decrease in total chlorophyll after the IBA concentration reaches 150 ppm to 250 ppm is caused by the toxic effect of the hormone auxin which triggers ethylene production as a stress response. Ethylene is antagonistic to auxin and can inhibit the process of chlorophyll synthesis. According to Widiayani *et al.* (2024), cuttings with the addition of auxin are related to chlorophyll in photosynthesis, where the administration of growth regulators will stimulate formation pigment chlorophyll on leaf so that increase the rate of photosynthesis and plant production.

4.9. Percentage Cuttings Life

Treatment concentration IBA give influence real, but stem length No give influence real to parameter percentage live grape cuttings, and there was no interaction between the two treatments. The percentage of live cuttings in grape stem cuttings for each treatment is presented in Table 9.

Table 9. Percentage of Living Cuttings Due to IBA Concentration and Cutting Stem Length

Long Stem (cm)	Concentration IBA (ppm)					Average
	0	100	150	200	250	
			(%)			
15	33.33	33.33	40.00	33.33	26.67	35.00 ^b
20	40.00	40.00	46.67	53.33	40.00	45.00 ^a
25	20.00	33.33	33.33	40.00	20.00	31.67 ^b
Average	31.11 ^{bc}	35.56 ^{abc}	40.00 ^{ab}	42.22 ^a	28.89 ^c	

Different superscripts on the mean column or mean row indicate significant differences (P<0.05)

The application of IBA concentration treatment had a significant effect on the percentage cuttings life (Table 9). Concentration IBA 200 ppm show the results that different real compared to with treatment concentration IBA 0 And 250 ppm in grow percentage cuttings life. Percentage cuttings life best shown on treatment concentration IBA 200 ppm with average of 42.22% (Table 9). The stem length of 20 cm showed significantly different results compared to with treatment long stem 15 cm And 25 cm. Results best parameters percentage live cuttings are found in IBA concentration treatment of 200 ppm and stem length of 45 cm.

Observations showed that the application of 200 ppm IBA produced the best results. This is because the auxin content of IBA stimulates callus formation and vascular tissue differentiation, as well as meristematic activity. This finding is supported by Tarmizi and Barunawati (2022), who stated that auxin application to Ninel grape varieties increased leaf number, stem diameter, and roots. And shoots with level success reach 100%. Success cuttings too supported by optimization absorption water And nutrition through network root

formed, thus strengthening the resistance and regeneration of cuttings during the early growth phase. Research by Jesika *et al* . (2024) showed that the response of grape stem cuttings and the administration of a concentration of 200 ppm provided results highest on variables shoot length, amount leaf, root length and root dry weight.

Treatment with a stem length of 20 cm showed a significant difference in the percentage of live cuttings, which was 45% (Table 9). This could be caused by internal and external factors, including the environment. According to Apriani and Suhartanto (2015), the success of cuttings is influenced by environmental factors, including temperature, humidity, and availability of nutrients, soil, light, and minimal plant-disturbing organisms in the form of pests and diseases. According to Darwo And Yeny (2018), success cuttings influenced by various factors, internal factors in the form of plant type, age of cutting material, uniformity also play an important role in supporting propagation through cuttings.

CHAPTER V

CONCLUSION AND SUGGESTION

5.1. Conclusion

Based on the results of the research that has been carried out, it can be concluded that that concentration IBA 200 ppm (Z3) show results The best in cutting growth. A cutting stem length of 15 cm (P1) indicates the fastest time for shoot emergence. Soaking a 20 x m cutting stem in solution concentration 200 ppm (Z3) produce average long longest shoots and root length, as well as the highest total chlorophyll.

5.2. Suggestion

Based on the research that has been carried out, suggestions that can be given are: that is adapt environment growth especially in *greenhouse* temperature and humidity to avoid fungus or disease in grape cuttings.

REFERENCE

- Amanah, S., Budiastuti, MS, and Sulisty, ATO 2022. Effect of the media type and auxin concentration on the growth of cuttings seedlings of peer (*Piper nigrum*). Cell Biology and Development, 6(1). DOI: 10.13057/cellbioldev/v060105
- Apriani, P., and Suhartanto, MR 2015. Improving the quality of torbangun (*Plectranthus amboinicus* Spreng.) seedlings by selecting the origin of cuttings and providing auxin. Indonesian Horticulture Journal (JHI), 6(2), 109-115. <https://doi.org/10.29244/jhi.6.2.109-115>
- Apriliani, A., Noli, Z. A., and Suwirman, S. 2015. Giving a number of Type and concentration of auxin to induce rooting in bayur shoot cuttings (*Pterospermum javanicum* (jung.) in effort Revegetation plant propagation. UNAND Biology Journal, 4(3), 178 - 187. <https://doi.org/10.25077/jbioua.4.3.%25p.2015>
- Central Statistics Agency. 2022. Fruit Crop Production Statistics. Darwo,
- And Yeny. 2018. Application Type Auxin Synthetic And Amount Eye Shoots on Growth Cuttings Wine (*Vitis vinifera* L.). Proceedings of the National Seminar on Polbangtan Yoma, 2024, 1342 – 1350.
- Daskalakis, L., K. Biniar., D. Bouza., and M. Stavrakaki. 2018. The effect that indolebutyric acid (IBA) and position of cane segments have on the rooting of cuttings from grapevine rootstocks and from Cabernet franc (*Vitis vinifera* L.) under conditions of a hydroponic culture system. Journal Scientia Horticulture, 22 (7), 79- 84. <https://doi.org/10.1016/j.scienta.2017.09.024>
- Hossain, M. M., and Gony, O. 2020. Influence of indole butyric AC ID on root induction in daughter plants of strawberry. Journal of Alied Horticulture, 22(3). <https://doi.org/10.37855/jah.2020.v22i03.37>
- Ihsan, MA 2022. Induction of Gerga Orange Cutting Shoots with Several Concentrations of Indole Butyric Acid and Different Numbers of Leaves. Proceedings of the National Seminar on Coastal Agriculture, 1 (1): 234-245.
- Tpoi, JK, Arsa, IGA, Ndiwa, AS, and Oematan, SS 2024. Growth Response Cuttings Stem Plant Wine (*Vitis vinifera* L.) On the Administration of Several Concentrations of Auxin Growth Regulators. Proceedings of the National Agricultural Seminar, 3 (1): 12-22.

- Kaushik, S., and Shukla, N. 2020. Effect of IBA and NAA and their combination on the shooting of stem cuttings of African marigold (*Tagetes erecta* L.) CV. Center Narangi Gainda. Int. J. Chem. Stud, 8, 1800-1802. <https://doi.org/10.22271/chemi.2020.v8.i3y.9462>
- Kurniastuti, T. 2017. The effect of various cutting lengths on growth seeds wine (*Vitis vinifera* L.). J. AGRI-TEK, 17 (1): 1 – 7.
- Linné, Carl von. 1908. Species plantarum : exhibits plants rite cognition ad genera relatas, cum differentiis specificis, nominibus trivialibus, synonymis selectis, locis natalibus, secundum systema sexuale digestas (Vol. 1). Junk. <https://www.biodiversitylibrary.org/item/84235>
- Luo, W. G., Liang, Q. W., Su, Y., Huang, C., Mo, B. X., Yu, Y., And Xiao, LT 2023. Auxin inhibits chlorophyll accumulation through ARF7-IAA14-mediated repression of chlorophyll biosynthesis genes in Arabidopsis. Frontiers in Plant Science, 14, 1172059. DOI: 10.3389/fpls.2023.1172059
- Mariana, M., Basri, A. H. H., Manullang, W., Goodbye, R. T., And Novita, A. 2023. Optimization Substance Regulator Grow (ZPT) Experience And Material Cuttings on Vegetative Growth of Robusta Coffee Cuttings. AGRIUM: Journal of Agricultural Sciences , 26(1), 68- 75. <https://doi.org/10.30596/agrium.v26i1.13730>
- Masli, M., Biantary, MP, and Emawati, H. 2019. The effect of the growth regulator auxin IAA and shallot extract on the propagation of cuttings meranti fiber (*Shorea parvifolia* Dyer.). J. Agrifor, 28(1), 167- 178.
- Natarajan, A., Selvam, D., Palaniaan, K., Subbaiah Balamurali, A., Perumal, C., Durai, R., and Subiramaniyan, A. 2023. Standardization of the Optimum Effects of Indole 3-Butyric Acid (IBA) to Control Root Knot Nematode, Meloidogyne enterolobii, in Guava (*Psidium guajava* L.). Molecules, 28(4), 1839. 10.3390/molecules28041839
- Nofri, FA, and Edward Bahar. 2021. The Effect of Several Concentrations of Synthetic Auxin Plant Growth Regulators on the Growth of Water Apple Cuttings (*Syzygium aqueum*). SUNGKAI, 9 (2), 43–51. <https://doi.org/10.30606/sungkai.v9i2.909>
- Oktaviana, SQ, Zuhroh, MU, and Hartanti, A. 2022. The effect of variety types and types of synthetic auxins on the growth of grape cuttings (*Vitis vinifera* L.). Agricultural Science Journal, 9(2), 1–12. <https://doi.org/10.51747/agrotechbiz.v9i2.1066>

Finally, S. S. T., And Nopiyanto, R. 2020. Influence substance regulator natural growth of bean sprout extract on the growth of sugarcane budchip seedlings (*Saccharum officinarum* L.) varieties Bulu Lawang (BL). *Journal of Sciences Agriculture*, 16 (1), 68 – 80.

Persea americana mill.) grafting . *J. Agro Complex*, 2 (3): 248 – 253

Pratama, WA, Prijanto, B., and Pikir, JS 2022. The Effect of Cutting Length and Iba Hormone Concentration on the Growth of Plant Cutting Seedlings Moringa (*Moringa oleifera* L.). *Journal Agrotech*, 12(2), 87-94. <https://doi.org/10.31970/agrotech.v12i2.99>

Puspita, N., Sukmawan, Y., and Supriyatdi, D. 2020. Response of Robusta Coffee Cuttings (*Coffea Canephora Pierre Ex Frochner*) to Various Auxin Concentrations. *Agritrop: Jurnal Ilmu-Impun Pertanian (Journal of Agricultural Science)*, 18(2), 186-194
<https://doi.org/10.32528/agritrop.v18i2.3886>

Sari, P., Intara, YI, and Nazari, APD 2019. The effect of the number of leaves and concentration of Rootone-F on the growth of lemon lime seedlings (*Citrus limon* L.) from shoot cuttings. *Ziraa'ah Agricultural Scientific Journal*, 44(3), 365-376.
<https://doi.org/10.31602/zmip.v44i3.2132a>

Merchant, A. R., Khobragade, H. M., Thakre, S. A., Bagde, E., Borkar, G. V., and Mane, A. G. 2021. Effect of IBA and types of cuttings on rooting of *Ixora*. *IJCS*, 9(1), 2594-2596.
<https://doi.org/10.51470/PLANTARCHIVES.2025.v25.sulement-1.007>

Shiri, M., Mudyiwa, RM, Takawira, M., Musara, C., and Gama, T. 2019. Effects of rooting media and indole-3-butyric acid (IBA) concentration on rooting and shoot development of *Duranta erecta* tip cuttings. *African Journal of Plant Science*, 13(10), 279-285. DOI: 10.5897/AJPS2019.1851

Sholeha, N., Hidayat, R., And Dewanti, F. D. 2023. Influence source cuttings and the concentration of the growth regulator rootone-f on the growth of chili plant cuttings herbal medicine (*Piper retrofractum* Vahl.). *Agro Bali: Agricultural Journal*, 6(3), 750-760.

Simanjuntak, BH 2021. Use of Indole-3-Butyric Acid (IBA) to Increase the Growth of Robusta Coffee Stem Cuttings. *Agrin*, 24(2), 111-124.
<https://doi.org/10.37637/ab.v6i3.1319>

- Sofwan, N., Faelasofa, O., Triatmoko AH, and Ifitah, SN 2018. Optimization of natural plant growth regulators (PGRs) from shallot extract (*Allium cepa* fa. *Ascalonicum*) as a root growth promoter for fig cuttings (*Ficus carica*). Vigor: J. Tropical and Subtropical Agricultural Sciences. 3 (2): 46 – 48.
- Sulyo, Y., Prasetya, VJ, Prasetio, RW, and Rahardja, IB 2019. Use of root hormones and hydrogen cyanamide in the propagation of mini rose cuttings with an intermittent misting system. AGROSCIENCE, 4 (1): 61 – 72.
- Tamba, R. A. S., Martino, D., And Sarman. 2019. Influence giving auxin (NAA) to growth shoots grafting eye Sleep. Journal Agroecotenia,2(2),11–20.
<https://doi.org/10.22437/agroecotania.v2i2.8737>
- Tarmizi, MGA, and Barunawati, N. 2022. The Effect of Application Method and Auxin Concentration on the Growth and Success of Grape Cuttings (*Vitis vinifera* L.) Variety Ninel. Thesis, Brawijaya University.
- Tasnudin, T., And Kadekoh, I. 2021. Growth seeds wine (*Vitis vinifera* L.) treated with atonic on various cutting lengths. Agrotekbis: Journal of Agricultural Sciences, 9(3), 612-620.
- Widiayani, N., Jasadina, IM, and Nasruddin, N. (2024). The Effect of Auxin and Cytokinin Concentration on the Success and Growth of Cocoa Cuttings (*Theobroma cacao* L.). Agrivigor Journal, 40-59.
<https://doi.org/10.20956/ja.v15i1.43233>
- Wiraswati, SF, and Badami, K.. 2018. The effect of IBA administration and the origin of cuttings on the vegetative growth of cat's whiskers. Agrovigor: J. Agroecotechnology, 11 (2) : 65 – 70.
<https://doi.org/10.21107/agrovigor.v11i2.4392>
- Wulandari, Y. S. 2023. Mix marketing (marketing mix) seeds wine (*Vitis vinifera*) in the Pulo Gebang grape plantation business. J. Agrimanex: Agribusiness, Rural Management, and Development Extension, 3 (2) : 219-227. <https://doi.org/10.35706/agrimanex.v3i2.8930>
- Zasari, M. 2015. The effect of Indole Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA) on the cutting nodes of the Lampung broadleaf pepper variety. Journal of Agriculture and Environment, 8(2), 56–62.

ATTACHMENT



Attachment 1. *Layout Study*

Z3P2U3	Z1P3U2	Z1P2U2	Z1P1U1	Z4P1U2
Z4P2U3	Z1P2U3	Z0P3U3	Z3P3U3	Z0P2U2
Z2P3U1	Z0P1U3	Z0P2U1	Z4P3U3	Z0P1U2
Z3P3U1	Z3P1U3	Z0P3U2	Z1P1U3	Z4P3U2
Z3P2U1	Z1P3U1	Z2P3U2	Z2P1U1	Z2P3U3
Z2P1U3	Z4P2U1	Z4P2U2	Z0P1U1	Z1P1U2
Z4P1U3	Z4P1U1	Z1P3U3	Z1P2U1	Z2P2U2
Z3P1U2	Z3P2U2	Z2P2U1	Z3P3U2	Z4P3U1
Z2P2U3	Z2P1U2	Z0P3U1	Z0P2U3	Z3P1U1

Information :

Treatment Concentration

IBA Z0 = 0 ppm (control)

Z1 = 100 ppm

Z2 = 150 ppm

Z3 = 200 ppm

Z4 = 250 ppm

Treatment Long Stem Cutting P1

= 15 cm

P2 = 20 cm

P3 = 25 cm

Attachment 2. Calculation Fertilizer

Recommendations Fertilizer Recommendation Plant Wine

N	100 kg N/ha	Urea
P	60 kg P ₂ O ₅ /ha	SP36
K	100 kg K ₂ O/ha	KCl

1 hectare = 10,000 m²

$$\text{Population} = \frac{\text{Wide Land}}{\text{Distance Plant}} = \frac{100,000,000}{40 \text{ cm} \times 20 \text{ cm}} = \frac{100,000,000 \text{ cm}^2}{800 \text{ cm}^2} = 125,000 \text{ population}$$

Need fertilizer per plant :

- Urea (46% N)

$$\text{Need 100\% urea / Ha} = \frac{100}{46} \times 100,000 = 217,391 \text{ g/ha} = 217.39 \text{ kg/ha}$$

$$\text{Per plant} = \frac{217,391}{125,000} = 1.73 \text{ g/plant}$$

- SP36 (36% P₂O₅)

$$\text{Need SP36 100\% / Ha} = \frac{100}{36} \times 60,000 = 166,667 \text{ g/ha} = 166.67 \text{ kg/ha}$$

$$\text{Per plant} = \frac{166,667}{125,000} = 1.33 \text{ g/plant}$$

- KCl (60% K₂O)

$$\text{Need KCl 100\% / Ha} = \frac{100}{36} \times 60,000 = 166,667 \text{ g/ha} = 166.67 \text{ kg/ha}$$

$$\text{Per plant} = \frac{166,667}{125,000} = 1.33 \text{ g/plant}$$

Attachment 3. Calculation Concentration IBA

Calculation amount IBA For make solution stock 1000 ppm with IBA purity of 98%

$$M1 \times C1 = M2 \times C2$$

$$M1 \times 98 = 1000 \times 100$$

$$M1 = 1,020 \text{ mg (diluted with water (1000 ml))}$$

Information :

$$M1 = \text{Mass IBA (mg)}$$

$$C1 = \text{IBA Purity}$$

$$M2 = \text{Mass solution IBA 100\%}$$

$$C2 = \text{IBA Purity 100\%}$$

Dilution each treatment is carried out with method :

a. Concentration 0 ppm

$$V1 \times M1 = V2 \times M2$$

$$V1 \times 1000 = 1000 \times 0$$

$$V1 = 0 \text{ ml solution stock} + 1000 \text{ ml of distilled water}$$

b. Concentration 100

$$\text{ppm } V1 \times M1 = V2$$

$$\times M2$$

$$V1 \times 1000 = 1000 \times 100$$

$$V1 = 100 \text{ ml solution stock} + 900 \text{ ml of distilled water}$$

c. Concentration 150

$$\text{ppm } V1 \times M1 = V2$$

$$\times M2$$

$$V1 \times 1000 = 1000 \times 150$$

$$V1 = 150 \text{ ml solution stock} + 850 \text{ ml of distilled water}$$

d. Concentration 200

$$\text{ppm } V1 \times M1 = V2$$

$$\times M2$$

$$V1 \times 1000 = 1000 \times 200$$

$$V1 = 200 \text{ ml solution stock} + 800 \text{ ml of distilled water}$$

e. Concentration 250

$$\text{ppm } V_1 \times M_1 = V_2$$

$$\times M_2$$

$$V_1 \times 1000 = 1000 \times 250$$

$V_1 = 250$ ml solution stock + 750 ml of distilled water

Attachment 4 . Data Temperature And Humidity Daily

Date	Temperature Daily Flat – Average (°C)	Humidity Daily Flat - Flat (%)
02 December 2024	28.50	84.50
03 December 2024	24.50	77.50
04 December 2024	31.50	67.00
05 December 2024	34.00	61.50
06 December 2024	29.50	72.00
07 December 2024	33.00	66.50
08 December 2024	35.00	60.50
09 December 2024	32.00	67.50
10 December 2024	27.50	81.00
11 December 2024	33.00	62.50
12 December 2024	26.00	84.50
13 December 2024	32.50	69.00
14 December 2024	29.00	76.50
15 December 2024	29.00	81.50
16 December 2024	29.50	75.50
17 December 2024	34.00	67.00
18 December 2024	27.50	82.50
19 December 2024	33.50	67.00
20 December 2024	33.50	63.50
21 December 2024	33.50	76.00
22 December 2024	32.50	68.00
23 December 2024	30.00	73.00
24 December 2024	27.50	82.00
25 December 2024	32.50	70.50
26 December 2024	30.50	73.00
27 December 2024	30.00	71.00
28 December 2024	27.50	83.50
29 December 2024	29.50	76.00
30 December 2024	29.00	75.50
31 December 2024	33.00	60.00
01 January 2025	29.50	75.50
02 January 2025	31.00	74.00
03 January 2025	32.50	71.00
04 January 2025	32.50	67.50
05 January 2025	31.00	69.00
06 January 2025	29.00	76.00
07 January 2025	29.50	72.00
08 January 2025	30.00	71.50
09 January 2025	27.50	77.50

10 January 2025	33.50	64.00
11 January 2025	29.50	73.50
12 January 2025	26.00	87.00
13 January 2025	31.00	69.00
14 January 2025	30.00	75.50
15 January 2025	31.50	70.50
16 January 2025	33.00	65.00
17 January 2025	29.50	73.50
18 January 2025	32.00	67.00
19 January 2025	31.00	71.00
20 January 2025	31.00	66.50
21 January 2025	29.00	74.00
22 January 2025	28.50	77.00
23 January 2025	29.50	74.00
24 January 2025	29.00	74.00
25 January 2025	32.50	66.50
26 January 2025	30.00	74.50
27 January 2025	27.00	84.00
28 January 2025	27.00	81.00
29 January 2025	27.50	77.50
30 January 2025	24.50	87.00
31 January 2025	29.00	75.50
01 February 2025	27.50	79.00
02 February 2025	27.50	81.00
03 February 2025	28.50	82.00
04 February 2025	27.00	85.00
05 February 2025	29.00	78.00
06 February 2025	30.00	76.50
07 February 2025	31.00	74.00
08 February 2025	29.50	81.00
09 February 2025	28.00	83.50
10 February 2025	27.50	86.00
11 February 2025	29.00	79.00
12 February 2025	30.50	75.50
13 February 2025	31.00	73.00
14 February 2025	30.00	77.00
15 February 2025	28.50	82.00
16 February 2025	27.00	85.00
17 February 2025	29.00	78.00
18 February 2025	30.00	76.50
19 February 2025	31.00	74.00
20 February 2025	29.50	81.00
21 February 2025	28.00	83.50
22 February 2025	27.50	86.00

23 February 2025	29.00	79.00
24 February 2025	30.50	75.50
25 February 2025	31.00	73.00
26 February 2025	30.00	77.00
27 February 2025	28.50	82.00
01 March 2025	28.00	83.50
02 March 2025	30.50	77.50
03 March 2025	32.00	72.00
04 March 2025	30.50	75.50
05 March 2025	31.50	74.00
06 March 2025	29.00	81.00
07 March 2025	30.00	79.50
08 March 2025	31.00	76.00
09 March 2025	32.00	74.00
10 March 2025	29.50	78.50
11 March 2025	28.00	82.00
12 March 2025	30.00	78.00
13 March 2025	31.50	73.50
14 March 2025	30.00	76.00
15 March 2025	29.50	81.00
16 March 2025	30.50	77.50
17 March 2025	28.50	84.00
Average	29.90	75.47

Data Temperature And Humidity Daily Vocational School N H Moenadi Ungaran, Semarang Regency, Central Java in December 2024 – January 2025.

Attachment 5. Analysis Data Time Appear Shoots

Stem Length	Test	Concentration IBA					Total	Average
		Z0	Z1	Z2	Z3	Z4		
				(HST)				
P1	1	8.00	8.00	9.00	6.00	13.00	44.00	8.80
	2	10.00	8.00	8.00	7.00	12.00	45.00	9.00
	3	9.00	9.00	11.00	6.00	10.00	45.00	9.00
Sub-Total		27.00	25.00	28.00	19.00	35.00	134.00	
Average		9.00	8.33	9.33	6.33	11.67		8.93
P2	1	11.00	12.00	11.00	9.00	11.00	54.00	10.80
	2	10.00	13.00	12.00	9.00	14.00	58.00	11.60
	3	9.00	10.00	13.00	7.00	12.00	51.00	10.20
Sub-Total		30.00	35.00	36.00	25.00	37.00	163.00	
Average		10.00	11.67	12.00	8.33	12.33		10.87
P3	1	11.00	12.00	11.00	11.00	12.00	57.00	11.40
	2	12.00	11.00	13.00	10.00	13.00	59.00	11.80
	3	13.00	13.00	10.00	10.00	14.00	60.00	12.00
Sub-Total		36.00	36.00	34.00	31.00	39.00	176.00	
Average		12.00	12.00	11.33	10.33	13.00		11.73
Total							473.00	
		93.00	96.00	98.00	75.00	111.00		10.51

Stem Length	Concentration IBA					Average
	Z0	Z1	Z2	Z3	Z4	
				(HST)		
P1	9.00	8.33	9.33	6.33	11.67	8.25
P2	10.00	11.67	12.00	8.33	12.33	10.50
P3	12.00	12.00	11.33	10.33	13.00	11.42
Average	10.33	10.67	10.89	8.33	12.33	

Information : P = Treatment Long Trunk. P1 = 15 cm; P2 = 20 cm; P3 = 25 cm. Z = IBA Concentration. Z0 = 0 ppm; Z1 = 100 ppm; Z2 = 150 ppm; Z3 = 200 ppm; Z4 = 250 ppm. Each replication consists of 5 plants.

1. Degrees Free (db)

$$\begin{aligned}
 \text{Total} & \text{db} = (abr) - 1 = (5.3.3) - 1 = 44 \\
 \text{db Treatment} & = (ab) - 1 = (5.3) - 1 = 14 \\
 \text{db IBA Concentration Treatment} & = (a - 1) = (5 - 1) = 4 \\
 \text{db Treatment Long Stem} & = (b - 1) = (3 - 1) = 2 \\
 \text{db Interaction} & = (a - 1)(b - 1) = (5 - 1)(3 - 1) = 8 \\
 \text{db Error} & = \text{Total db} - \text{Treatment db} = 44 - 14 = 30
 \end{aligned}$$

Attachment 5. (Continued)**2. Factor Correlation (FK)**

$$\begin{aligned}
 \text{FK} &= \frac{\sum Y_{ijk}^2}{abr 473.00} \\
 &= \frac{2}{5.3.3} \\
 &= 4971.76
 \end{aligned}$$

3. Amount Square (JK)

$$\begin{aligned}
 \text{JK Total (JKT)} &= \sum Y_{ijk}^2 - \text{FK} \\
 &= (8.00^2 + 10.00^2 + \dots + 14.00^2) - 4971.76 \\
 &= 191.24
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (JKP)} &= \frac{\sum Y_{ij}^2}{2^r} - \text{FK} \\
 &= \frac{(7.00^2 + 25.00^2 + \dots + 39.00^2)}{3} - 4971.76 \\
 &= 151.24
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (Z)} &= \frac{\sum Y_{ijk}^2}{br} - \text{FK} \\
 &= \frac{(93.00^2 + 96.00^2 + \dots + 111.00^2)}{3.3} - 4971.76 \\
 &= 74.36
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (P)} &= \frac{\sum Y_{ij}^2}{a.r} - \text{FK} \\
 &= \frac{(134.00^2 + 163.00^2 + 176.00^2)}{5.3} - 4971.76 \\
 &= 61.64
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Interaction (ZxP)} &= \text{JKP} - \text{JK (Z)} - \text{JK (P)} \\
 &= 151.24 - 74.36 - 61.64 \\
 &= 15.24
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Error (JKG)} &= \text{Jakarta} - \text{JKP} \\
 &= 191.24 - 151.24 \\
 &= 40.00
 \end{aligned}$$

Attachment 5. (Continued)**4. Square Middle (KT)**

$$\begin{aligned}
 \text{Treatment Card (KTP)} &= \frac{\text{JKP}}{\text{db Treatment}} = \frac{151.24}{14} = 10.80 \\
 \text{KT (Z)} &= \frac{\text{JK (Z)}}{\text{db (Z)}} = \frac{74}{.36} = 37.18 \\
 \text{KT (P)} &= \frac{\text{JK (P)}}{\text{db (P)}} = \frac{2}{61.64} = 15.41 \\
 \text{KT (ZxP)} &= \frac{\text{JK (ZxP)}}{\text{db (ZxP)}} = \frac{4}{15,2} = 1.91 \\
 \text{KT Error (KTG)} &= \frac{\text{JK (G)}}{\text{db G}} = \frac{4}{8} = 1.33 \\
 &= \frac{40.00}{30}
 \end{aligned}$$

5. F-Count

$$\begin{aligned}
 \text{F Calculate Treatment} &= \frac{\text{ID card}}{\text{(G)}} = \frac{10,}{80} = 8.1 \\
 \text{F Count (Z)} &= \frac{\text{KT (Z)}}{\text{KT (G)}} = \frac{37.18}{1.33} = 27.88 \\
 \text{F Count (P)} &= \frac{\text{KT (P)}}{\text{KT (G)}} = \frac{15,}{41} = 11.56 \\
 \text{F Calculate (ZxP)} &= \frac{\text{KT (ZxP)}}{\text{KT (G)}} = \frac{1.33}{5.62} = 1.43 \\
 &= \frac{1.33}{1.33}
 \end{aligned}$$

6. Table Anova

Sources of Diversity	db	JK	KT	F-count	F-table (0.05)
Treatment	14	151.24	10.89	8.10 *	2.04
Concentration IBA (Z)	2	74.36	37.18	27.88 *	3.32
Long Stem (P)	4	61.64	15.41	11.56 *	2.69
Interaction (ZxP)	8	15.24	1.91	1.43 ^{tn}	2.27
Error	30	40	1.33		
Total	44	191.24			

Information : * = Significant (F Count > F Table 5%) And Mr. = No Significant (F Count < F Table 5%).

7. Coefficient Diversity (KK)

$$\begin{aligned}
 \text{KK} &= \frac{\sqrt{\text{KT Error}}}{\text{R ataan Total}} \times 100 \\
 &= \frac{\sqrt{1.33}}{10.51} \times 100 \\
 &= 10.98 \%
 \end{aligned}$$

Attachment 5. (Continued)

Note: If the Coefficient of Diversity (KK) > 20%, then transformation must be carried out.

Conclusion : KK = 10% < 20%, then data already homogeneous.

8. Test Different Real The smallest (BNT) Treatment Concentration (Z)

$$\text{Sd (Error Standard)} = \sqrt{\frac{2 \cdot 1.33}{4 \cdot 3}} = 0.54$$

b . r

$$t(\alpha, db) = 1.70$$

$$\text{LSD } \alpha = \text{Sd xt } (\alpha/2, db) = 0.54 \times 1.70 = 1.11$$

Treatment	Middle Value	Z4	Z2	Z1	Z0	Z3	Notation
Z4	12.33	0.00					c
Z2	10.89	1.44 *	0.00				b
Z1	10.67	1.66 *	0.22 ^{tn}	0.00			b
Z0	10.33	2.00 *	0.56 ^{tn}	0.34 ^{tn}	0.00		b
Z3	8.33	4.00 *	2.56 *	2.34 *	2.00 *	0.00	a

Table Results Test Carry on Treatment Single Z with BNT level 0.05

Treatment	Average	Notation
Z0	10.33	b
Z1	10.67	b
Z2	10.89	b
Z3	8.33	a
Z4	12.33	c

9. Test Different Real The smallest (BNT) Treatment Long Stem (P)

$$\text{Sd (Error Standard)} = \sqrt{\frac{2 \cdot 1.33}{5 \cdot 3}} = 0.42$$

a. r

$$t(\alpha, db) = 1.70$$

$$\text{LSD } \alpha = \text{Sd xt } (\alpha/2, db) = 0.42 \times 1.70 = 0.71$$

Attachment 5. (Continued)

Treatment	Middle Value	P3	P2	P1	Notation
		11.42	10.50	8.25	
P3	11.42	0.00			a
P2	10.50	0.92 *	0.00		b
P1	8.25	3.17 *	2.25 *	0.00	c

Table Results Test Carry on Treatment Single P with BNT level 0.05

Treatment	Average	Notation
P1	8.25	c
P2	10.50	b
P3	11.42	a

Attachment 6. Analysis Data Amount Shoots

Stem Length	Test	Concentration IBA					Total	Average
		Z0	Z1	Z2	Z3	Z4		
				(Sprout)				
P1	1	1.00	2.00	1.00	2.00	1.00	7.00	1.40
	2	2.00	1.00	1.00	2.00	2.00	8.00	1.60
	3	1.00	1.00	1.00	1.00	1.00	5.00	1.00
Sub-Total		4.00	4.00	3.00	5.00	4.00	20.00	
Average		1.33	1.33	1.00	1.67	1.33		1.33
P2	1	1.00	2.00	1.00	2.00	2.00	8.00	1.60
	2	1.00	1.00	1.00	3.00	1.00	6.00	1.20
	3	2.00	2.00	1.00	2.00	1.00	8.00	1.60
Sub-Total		1.33	5.00	3.00	7.00	4.00	22.00	
Average		1.00	1.67	1.00	2.33	1.33		1.53
P3	1	1.00	1.00	1.00	2.00	1.00	6.00	1.20
	2	1.00	1.00	1.00	2.00	1.00	6.00	1.20
	3	1.00	2.00	2.00	2.00	1.00	8.00	1.60
Sub-Total		3.00	4.00	4.00	6.00	3.00	20.00	
Average		1.00	1.33	1.33	2.00	1.00		1.33
Total							63.00	
		11.00	13.00	10.00	18.00	11.00		1.40

Long Stem	Concentration IBA					Average
	Z0	Z1	Z2	Z3	Z4	
			(Sprout)			
P1	1.33	1.33	1.00	1.67	1.33	1.33
P2	1.33	1.67	1.00	2.33	1.33	1.58
P3	1.00	1.33	1.33	2.00	1.00	1.42
Average	1.22	1.44	1.11	2.00	1.22	

Information : P = Treatment Long Trunk. P1 = 15 cm; P2 = 20 cm; P3 = 25 cm. Z = IBA Concentration. Z0 = 0 ppm; Z1 = 100 ppm; Z2 = 150 ppm; Z3 = 200 ppm; Z4 = 250 ppm. Each replicate consisted of 5 plants.

1. Degrees Free (db)

$$\begin{aligned}
 \text{Total} & \text{db} = (abr) - 1 = (5.3.3) - 1 = 44 \\
 \text{db Treatment} & = (ab) - 1 = (5.3) - 1 = 14 \\
 \text{db IBA Concentration Treatment} & = (a - 1) = (5 - 1) = 4 \\
 \text{db Treatment Long Stem} & = (b - 1) = (3 - 1) = 2 \\
 \text{db Interaction} & = (a - 1)(b - 1) = (5 - 1)(3 - 1) = 8 \\
 \text{db Error} & = \text{Total db} - \text{Treatment db} = 44 - 14 = 30
 \end{aligned}$$

Attachment 6. (Continued)**2. Factor Correlation (FK)**

$$\begin{aligned}
 \text{FK} &= \frac{\sum Y_{ijk}^2}{abr} \\
 &= \frac{63.00}{5.3.3} \\
 &= 88.20
 \end{aligned}$$

3. Amount Square (JK)

$$\begin{aligned}
 \text{JK Total (JKT)} &= \sum Y_{ijk}^2 - \text{FK} \\
 &= (1.00^2 + 2.00^2 + \dots + 1.00^2) - 88.20 \\
 &= 12.80
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (JKP)} &= \frac{\sum Y_{ij}^2}{(4,00^2 + 4.00^2 + \dots + 3.00^2)} - \text{FK} \\
 &= \frac{\dots}{3} - 88.20 \\
 &= 6.13
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (Z)} &= \frac{\sum Y_{ijk}^2}{br} - \text{FK} \\
 &= \frac{(10.00^2 + 13.00^2 + \dots + 11.00^2)}{3.3} - 88.20 \\
 &= 4.58
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (P)} &= \frac{\sum Y_{ij}^2}{ar} - \text{FK} \\
 &= \frac{(20.00^2 + 22.00^2 + 20.00^2)}{5.3} - 88.20 \\
 &= 0.40
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Interaction (ZxP)} &= \text{JKP} - \text{JK (Z)} - \text{JK (P)} \\
 &= 6.13 - 4.58 - 0.40 \\
 &= 1.16
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Error (JKG)} &= \text{Jakarta} - \text{JKP} \\
 &= 12.80 - 6.13 \\
 &= 6.67
 \end{aligned}$$

Attachment 6. (Continued)**4. Square Middle (KT)**

$$\begin{aligned}
 \text{Treatment Card (KTP)} &= \frac{\text{JKP}}{\text{db Treatment}} = \frac{6.13}{14} = 0.44 \\
 \text{KT (Z)} &= \frac{\text{JK (Z)}}{\text{db (Z)}} = \frac{4.58}{2} = 2.29 \\
 \text{KT (P)} &= \frac{\text{JK (P)}}{\text{db (P)}} = \frac{0.40}{4} = 0.10 \\
 \text{KT (ZxP)} &= \frac{\text{JK (ZxP)}}{\text{db (ZxP)}} = \frac{1.16}{8} = 0.14 \\
 \text{KT Error (KTG)} &= \frac{\text{JK (G)}}{\text{db G}} = \frac{6.67}{30} = 0.22
 \end{aligned}$$

5. F-Count

$$\begin{aligned}
 \text{F Calculate Treatment} &= \frac{\text{ID card}}{\text{KT (G)}} = \frac{0.44}{0.22} = 1.97 \\
 \text{F Count (Z)} &= \frac{\text{KT (Z)}}{\text{KT (G)}} = \frac{2.29}{0.22} = 10.30 \\
 \text{F Count (P)} &= \frac{\text{KT (P)}}{\text{KT (G)}} = \frac{0.10}{0.10} = 1.00 \\
 \text{F Calculate (ZxP)} &= \frac{\text{KT (ZxP)}}{\text{KT (G)}} = \frac{0.14}{0.22} = 0.65
 \end{aligned}$$

6. Table Anova

Sources of Diversity	db	JK	KT	F-count	F-table (0.05)
Treatment	14	6.13	0.44	1.97 ^{tn}	2.04
Concentration IBA (Z)	2	4.58	2.29	10.30 [*]	3.32
Long Stem (P)	4	0.40	0.10	0.45 ^{tn}	2.69
Interaction (ZxP)	8	1.16	0.14	0.65 ^{tn}	2.27
Error	30	6.67	0.22		
Total	44	12.80			

Information : * = Significant (F Count > F Table 5%) And Mr. = No Significant (F Count < F Table 5%).

7. Coefficient Diversity (KK)

$$\text{KK} = \frac{\sqrt{\text{KT Error}}}{\text{Average Total}} \times 100$$

Attachment 6. (Continued)

$$\begin{aligned} & \sqrt{0.22} \\ &= \frac{\sqrt{0.22}}{1.40} \times 100 \\ &= 33.67 \% \end{aligned}$$

Note: If the Coefficient of Diversity (KK) > 30%, then transformation must be carried out.

Conclusion : KK = 33.67% > 20%, then mandatory data transformed with $\sqrt{3}$.

Appendix 6. (Continued)

Transformation Root Cubic

Stem Length	Test	Concentration IBA					Total	Average
		Z0	Z1	Z2	Z3	Z4		
				(Sprout)				
P1	1	1.00	1.26	1.00	1.26	1.00	5.52	1.10
	2	1.26	1.00	1.00	1.26	1.26	5.78	1.16
	3	1.00	1.00	1.00	1.00	1.00	5.00	1.00
Sub-Total		3.26	3.26	3.00	3.52	3.26	16.30	
Average		1.09	1.09	1.00	1.17	1.09		1.09
P2	1	1.00	1.26	1.00	1.26	1.26	5.78	1.16
	2	1.00	1.00	1.00	1.44	1.00	4.44	1.09
	3	1.26	1.26	1.00	1.26	1.00	5.78	1.16
Sub-Total		3.26	3.52	3.00	3.96	3.26	16.00	
Average		0.75	1.17	1.00	1.32	1.09		1.07
P3	1	1.00	1.00	1.00	1.26	1.00	5.26	1.05
	2	1.00	1.00	1.00	1.26	1.00	5.26	1.05
	3	1.00	1.26	1.26	1.26	1.00	5.78	1.16
Sub-Total		3.00	3.26	3.26	3.78	3.00	16.30	
Average		1.00	1.09	1.09	1.26	1.00		1.09
Total							49.60	
		9.52	10.04	9.26	11.26	9.52		1.10

Long Stem	Concentration IBA					Average	
	Z0	Z1	Z2	Z3	Z4		
				(Sprout)			
P1	1.09	1.09	1.00	1.17	1.09	1.09	
P2	1.09	1.17	1.00	1.32	1.09	1.15	
P3	1.00	1.09	1.09	1.26	1.00	1.11	
Average	1.06	1.12	1.03	1.25	1.06		

Information : P = Treatment Long Trunk, P1 = 15 cm; P2 = 20 cm; P3 = 25 cm, Z = IBA Concentration, Z0 = 0 ppm; Z1 = 100 ppm; Z2 = 150 ppm; Z3 = 200 ppm; Z4 = 250 ppm, Each replication consists of 5 plants.

8. Degrees Free (db)

Total	$db = (abr) - 1 = (5.3.3) - 1 = 44$
db Treatment	$= (ab) - 1 = (5.3) - 1 = 14$
db IBA Concentration Treatment	$= (a - 1) = (5 - 1) = 4$
db Treatment Long Stem	$= (b - 1) = (3 - 1) = 2$
db Interaction	$= (a - 1)(b - 1) = (5 - 1)(3 - 1) = 8$
db Error	$= \text{Total db} - \text{Treatment db} = 44 - 14 = 30$

Attachment 6. (Continued)**9. Factor Correlation (FK)**

$$\begin{aligned}
 \text{FK} &= \frac{\sum Y_{ijk}^2}{abr^4} \\
 &= \frac{9,60^2}{5.3.3} \\
 &= 54.67
 \end{aligned}$$

10. Amount Square (JK)

$$\begin{aligned}
 \text{JK Total (JKT)} &= \sum Y_{ijk}^2 - \text{FK} \\
 &= (1.00^2 + 1.26^2 + \dots + 1.00^2) - 54.67 \\
 &= 0.81
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (JKP)} &= \frac{\sum Y_{ij}^2}{r} - \text{FK} \\
 &= \frac{(3.26^2 + 3.26^2 + \dots + 3.00^2)}{3} - 54.67 \\
 &= 0.38
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (Z)} &= \frac{\sum Y_{ijk}^2}{br} - \text{FK} \\
 &= \frac{(8.52^2 + 10.04^2 + \dots + 9.52^2)}{3.3} - 54.67 \\
 &= 0.29
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (P)} &= \frac{\sum Y_{ij}^2}{ar} - \text{FK} \\
 &= \frac{(16.30^2 + 16.00^2 + 16.30^2)}{5.3} - 54.67 \\
 &= 0.02
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Interaction (ZxP)} &= \text{JKP} - \text{JK (Z)} - \text{JK (P)} \\
 &= 0.38 - 0.29 - 0.02 \\
 &= 0.07
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Error (JKG)} &= \text{Jakarta} - \text{JKP} \\
 &= 0.81 - 0.38 \\
 &= 0.43
 \end{aligned}$$

Attachment 6. (Continued)**11. Square Middle (KT)**

$$\begin{aligned}
 \text{Treatment Card (KTP)} &= \frac{\text{JKP}}{\text{db Treatment}} = \frac{0.81}{14} = 0.03 \\
 \text{KT (Z)} &= \frac{\text{JK (Z)}}{\text{db (Z)}} = \frac{0.29}{2} = 0.14 \\
 \text{KT (P)} &= \frac{\text{JK (P)}}{\text{db (P)}} = \frac{0.02}{4} = 0.01 \\
 \text{KT (ZxP)} &= \frac{\text{JK (ZxP)}}{\text{db (ZxP)}} = \frac{0.07}{8} = 0.01 \\
 \text{KT Error (KTG)} &= \frac{\text{JK (G)}}{\text{db G}} = \frac{0.43}{30} = 0.01
 \end{aligned}$$

12. F-Count

$$\begin{aligned}
 \text{F Calculate Treatment} &= \frac{\text{ID card}}{\text{KT (G)}} = \frac{0.0}{3} = 3.00 \\
 \text{F Count (Z)} &= \frac{\text{KT (Z)}}{\text{KT (G)}} = \frac{0.01}{0.14} = 14.00 \\
 \text{F Count (P)} &= \frac{\text{KT (P)}}{\text{KT (G)}} = \frac{0.01}{0.01} = 1.00 \\
 \text{F Calculate (ZxP)} &= \frac{\text{KT (ZxP)}}{\text{KT (G)}} = \frac{0.01}{0.01} = 1.00
 \end{aligned}$$

13. Table Anova

Sources of Diversity	db	JK	KT	F-count	F-table (0.05)
Treatment	14	0.38	0.03	3.00 ^{tn}	2.04
Concentration IBA (Z)	2	0.29	0.14	14.00 [*]	3.32
Long Stem (P)	4	0.02	0.01	1.00 ^{tn}	2.69
Interaction (ZxP)	8	0.07	0.01	1.00 ^{tn}	2.27
Error	30	0.43	0.01		
Total	44	0.81			

Information : * = Significant (F Count > F Table 5%) And Mr. = No Significant (F Count < F Table 5%).

14. Coefficient Diversity (KK)

$$\text{KK} = \frac{\sqrt{\text{KT Error}}}{\text{Average Total}} \times 100$$

Attachment 6. (Continued)

$$\begin{aligned}
 & \frac{\sqrt{0.01}}{1.10} \times 100 \\
 & = 9.53 \%
 \end{aligned}$$

Note: If the Coefficient of Diversity (KK) > 20%, then transformation must be carried out.

Conclusion : KK = 9.53 % < 20%, so the data is homogeneous.

15. Test Different Real The smallest (BNT) Treatment Concentration (Z)

$$\text{Sd (Error Standard)} = \sqrt{\frac{2 \cdot 0.01}{4 \cdot 3}} = 0.06$$

b . r

$$t(\alpha, db) = 1.70$$

$$\text{LSD } \alpha = \text{Sd xt } (\alpha, db) = 0.06 \times 1.70 = 0.10$$

Table Results Test Carry on Treatment Single Z with BNT level 0.05

Treatment	Middle Value	Z3	Z1	Z4	Z0	Z2	Notation
Z3	1.25	-					a
Z1	1.12	0.13 *	-				b
Z4	1.06	0.19 *	0.06 ^{tn}	-			bc
Z2	1.06	0.19 *	0.06 ^{tn}	-	-		bc
Z0	1.03	0.22 *	0.15 *	0.03 ^{tn}	0.03 ^{tn}	-	c

Table Results Test Carry on Treatment Single Z with BNT level 0.05

Treatment	Average	Notation
Z0	1.06	b
Z1	1.12	bc
Z2	1.03	bc
Z3	1.25	a
Z4	1.06	c

Attachment 7. Analysis Data Long Shoots

Stem Length	Test	Concentration IBA					Total	Average
		Z0	Z1	Z2	Z3	Z4		
				(cm)				
P1	1	7.50	12.00	29.30	18.85	15.60	83.25	16.65
	2	9.50	18.00	20.10	21.20	12.25	81.05	16.21
	3	13.20	28.40	21.20	22.40	17.70	102.90	20.58
Sub-Total		30.20	58.40	70.60	62.45	45.55	267.20	
Average		10.07	19.47	23.53	27.20	15.18		17.81
P2	1	14.60	15.70	18.30	35.10	10.75	94.45	18.89
	2	13.40	14.90	15.90	31.80	15.80	91.80	18.36
	3	11.30	17.00	24.00	32.10	13.28	97.68	19.54
Sub-Total		39.30	47.60	58.20	99.00	38.20	283.93	
Average		13.10	15.87	19.40	33.00	12.73		18.93
P3	1	10.10	17.20	13.50	19.20	11.60	71.60	14.32
	2	10.10	24.30	25.40	21.60	13.10	94.50	18.90
	3	10.10	23.00	12.70	22.40	29.90	88.10	17.62
Sub-Total		30.30	64.50	51.60	63.20	54.60	254.20	
Average		10.10	21.50	17.20	21.07	18.20		16.95
Total							805.33	
		99.80	170.50	180.40	224.65	138.35		17.90

Long Stem	Concentration IBA					Average
	Z0	Z1	Z2	Z3	Z4	
			(cm)			
P1	10.07	19.47	23.53	27.20	15.18	20.07
P2	13.10	15.87	19.40	33.00	13.28	20.34
P3	10.10	21.50	17.20	21.07	14.87	17.47
Average	11.09	18.94	20.04	27.09	14.44	

Information : P = Treatment Long Trunk. P1 = 15 cm; P2 = 20 cm; P3 = 25 cm. Z = IBA Concentration. Z0 = 0 ppm; Z1 = 100 ppm; Z2 = 150 ppm; Z3 = 200 ppm; Z4 = 250 ppm. Each replication consists of 5 plants.

1. Degrees Free (db)

Total	$db = (abr) - 1 = (5.3.3) - 1 = 44$
db Treatment	$= (ab) - 1 = (5.3) - 1 = 14$
db IBA Concentration Treatment	$= (a - 1) = (5 - 1) = 4$
db Treatment Long Stem	$= (b - 1) = (3 - 1) = 2$
db Interaction	$= (a - 1)(b - 1) = (5 - 1)(3 - 1) = 8$
db Error	$= \text{Total db} - \text{Treatment db} = 44 - 14 = 30$

Appendix 7. (Continued)

2. Factor Correlation (FK)

$$\begin{aligned} \text{FK} &= \frac{\sum Y_{ijk}^2}{abr 791.73} \\ &= \frac{5.3.3}{2} \\ &= 14412.19 \end{aligned}$$

3. Amount Square (JK)

$$\begin{aligned} \text{JK Total (JKT)} &= \sum Y_{ijk}^2 - \text{FK} \\ &= (7.50^2 + 12.00^2 + \dots + 19.90^2) - 14412.19 \\ &= 1914.19 \end{aligned}$$

$$\begin{aligned} \text{JK Treatment (JKP)} &= \frac{\sum Y_{ij}^2}{3} - \text{FK} \\ &= \frac{(30.20^2 + 58.40^2 + \dots + 44.60^2)}{3} - 14412.19 \\ &= 1451.34 \end{aligned}$$

$$\begin{aligned} \text{JK Treatment (Z)} &= \frac{\sum Y_{ijk}^2}{br} - \text{FK} \\ &= \frac{(99.80^2 + 170.50^2 + \dots + 128.35^2)}{3.3} - 14412.19 \\ &= 1025.10 \end{aligned}$$

$$\begin{aligned} \text{JK Treatment (P)} &= \frac{\sum Y_{ij}^2}{ar} - \text{FK} \\ &= \frac{(267.20^2 + 283.93^2 + 254.20^2)}{5.3} - 14412.19 \\ &= 29.61 \end{aligned}$$

$$\begin{aligned} \text{JK Interaction (ZxP)} &= \text{JKP} - \text{JK (Z)} - \text{JK (P)} \\ &= 1451.34 - 1025.10 - 29.61 \\ &= 396.64 \end{aligned}$$

$$\begin{aligned} \text{JK Error (JKG)} &= \text{Jakarta} - \text{JKP} \\ &= 1914.19 - 1451.34 \\ &= 462.84 \end{aligned}$$

Attachment 7. (Continued)**4. Square Middle (KT)**

$$\begin{aligned}
 \text{Treatment Card (KTP)} &= \frac{\text{JKP}}{\text{db Treatment}} = \frac{1451.34}{14} = 103.67 \\
 \text{KT (Z)} &= \frac{\text{JK (Z)}}{\text{db (Z)}} = \frac{1025.10}{2} = 512.55 \\
 \text{KT (P)} &= \frac{\text{JK (P)}}{\text{db (P)}} = \frac{29.61}{4} = 7.40 \\
 \text{KT (ZxP)} &= \frac{\text{JK (ZxP)}}{\text{db (ZxP)}} = \frac{396.64}{8} = 49.58 \\
 \text{KT Error (KTG)} &= \frac{\text{JK (G)}}{\text{db G}} = \frac{462.84}{30} = 15.43
 \end{aligned}$$

5. F-Count

$$\begin{aligned}
 \text{F Calculate Treatment} &= \frac{\text{ID card}}{\text{KT (G)}} = \frac{103.67}{15.43} = 6.72 \\
 \text{F Count (Z)} &= \frac{\text{KT (Z)}}{\text{KT (G)}} = \frac{512.55}{15.43} = 33.22 \\
 \text{F Count (P)} &= \frac{\text{KT (P)}}{\text{KT (G)}} = \frac{7.40}{15.43} = 0.48 \\
 \text{F Calculate (ZxP)} &= \frac{\text{KT (ZxP)}}{\text{KT (G)}} = \frac{49.58}{15.43} = 3.21
 \end{aligned}$$

6. Table Anova

Sources of Diversity	db	JK	KT	F-count	F-table (0.05)
Treatment	14	1451.34	103.67	6.72 *	2.04
Concentration IBA (Z)	2	1025.10	512.55	33.22 *	3.32
Long Stem (P)	4	29.61	7.40	0.48 ^{tn}	2.69
Interaction (ZxP)	8	396.64	49.58	3.21 *	2.27
Error	30	462.84	15.43		
Total	44	1914.19			

Information : * = Significant (F Count > F Table 5%) And Mr. = No Significant (F Count < F Table 5%).

7. Coefficient Diversity (KK)

$$\begin{aligned}
 \text{KK} &= \frac{\sqrt{\text{KT Error}}}{\text{R ataan Total}} \times 100 \\
 &= \frac{\sqrt{15.43}}{15.43} \times 100
 \end{aligned}$$

Attachment 7. (Continued)

$$= 21.95 \%$$

Note: If the Coefficient of Diversity (KK) > 20%, then transformation must be carried out.

Conclusion : $KK = 21.95\% > 20\%$, so mandatory data transformed with $\sqrt{2}$.

Appendix 7. (Continued)

Transformation Root Square

Stem Length	Test	Concentration IBA					Total	Average
		Z0	Z1	Z2	Z3	Z4		
				(cm)				
P1	1	2.74	3.46	5.41	4.34	3.95	19.91	3.98
	2	3.08	4.24	4.48	4.60	3.50	19.91	3.98
	3	3.63	5.33	4.60	4.73	4.21	22.51	4.50
Sub-Total		9.45	13.04	14.50	13.68	11.66	62.33	
Average		3.15	4.35	4.83	27.20	3.89		4.16
P2	1	3.82	3.96	4.28	5.92	3.28	21.26	4.25
	2	3.66	3.86	3.99	5.64	3.97	21.12	4.22
	3	3.36	4.12	4.90	5.67	3.41	21.46	4.29
Sub-Total		10.84	11.95	13.16	17.23	10.67	63.85	
Average		3.61	3.98	4.39	5.74	3.56		4.26
P3	1	3.18	4.15	3.67	4.38	3.41	18.79	3.76
	2	3.18	4.93	5.04	4.65	3.62	21.41	4.28
	3	3.18	4.80	3.56	4.73	4.46	20.73	4.15
Sub-Total		9.53	13.87	12.28	13.76	11.49	60.93	
Average		3.18	4.62	4.09	4.59	3.83		4.06
Total							187.34	
		29.83	38.85	39.94	44.67	33.81		4.16

Long Stem	Concentration IBA					Average
	Z0	Z1	Z2	Z3	Z4	
			(cm)			
P1	3.15	4.35	4.83	4.56	3.89	4.22
P2	3.61	3.98	4.39	5.74	3.63	4.43
P3	3.18	4.62	4.09	4.59	3.83	4.12
Average	3.31	4.32	4.44	4.96	3.78	

Information : P = Treatment Long Trunk, P1 = 15 cm; P2 = 20 cm; P3 = 25 cm, Z = IBA Concentration, Z0 = 0 ppm; Z1 = 100 ppm; Z2 = 150 ppm; Z3 = 200 ppm; Z4 = 250 ppm, Each replication consists of 5 plants.

8. Degrees Free (db)

Total	$db = (abr) - 1 = (5.3.3) - 1 = 44$
db Treatment	$= (ab) - 1 = (5.3) - 1 = 14$
db IBA Concentration Treatment	$= (a - 1) = (5 - 1) = 4$
db Treatment Long Stem	$= (b - 1) = (3 - 1) = 2$
db Interaction	$= (a - 1)(b - 1) = (5 - 1)(3 - 1) = 8$
db Error	$= \text{Total db} - \text{Treatment db} = 44 - 14 = 30$

Attachment 7. (Continued)**9. Factor Correlation (FK)**

$$\begin{aligned}
 \text{FK} &= \frac{\sum Y_{ijk}^2}{abr 187.34} \\
 &= \frac{5.3.3}{2} \\
 &= 779.91
 \end{aligned}$$

10. Amount Square (JK)

$$\begin{aligned}
 \text{JK Total (JKT)} &= \sum Y_{ijk}^2 - \text{FK} \\
 &= (1.00^2 + 1.26^2 + \dots + 1.00^2) - 779.91 \\
 &= 25.42
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (JKP)} &= \frac{\sum Y_{ij}^2}{r} - \text{FK} \\
 &= \frac{(2.74^2 + 3.46^2 + \dots + 4.46^2)}{3} - 779.91 \\
 &= 19.15
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (Z)} &= \frac{\sum Y_{ijk}^2}{br} - \text{FK} \\
 &= \frac{(27.11^2 + 38.85^2 + \dots + 33.81^2)}{3.3} - 779.91 \\
 &= 14.44
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (P)} &= \frac{\sum Y_{ij}^2}{ar} - \text{FK} \\
 &= \frac{(62.33^2 + 64.08^2 + 60.93^2)}{5.3} - 779.91 \\
 &= 0.33
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Interaction (ZxP)} &= \text{JKP} - \text{JK (Z)} - \text{JK (P)} \\
 &= 19.15 - 14.44 - 0.33 \\
 &= 4.37
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Error (JKG)} &= \text{Jakarta} - \text{JKP} \\
 &= 25.42 - 19.15 \\
 &= 6.27
 \end{aligned}$$

Attachment 7. (Continued)**11. Square Middle (KT)**

$$\begin{aligned}
 \text{Treatment Card (KTP)} &= \frac{JKP}{db \text{ Treatment}} = \frac{19,1}{5} = 1.37 \\
 \text{KT (Z)} &= \frac{JK (Z)}{db (Z)} = \frac{14}{14.44} = 7.22 \\
 \text{KT (P)} &= \frac{JK (P)}{db (P)} = \frac{2}{0.33} = 0.08 \\
 &= \frac{4}{4.37} \\
 \text{KT (ZxP)} &= \frac{4}{8} = 0.55 \\
 \text{KT Error (KTG)} &= \frac{JK (G)}{db G} = \frac{6.27}{30} = 0.21
 \end{aligned}$$

12. F-Count

$$\begin{aligned}
 \text{F Calculate Treatment} &= \frac{ID \text{ card}}{(G)} = \frac{1.93}{0.21} = 6.54 \\
 \text{F Count (Z)} &= \frac{KT (Z)}{KT (G)} = \frac{7.22}{0.21} = 34.55 \\
 \text{F Count (P)} &= \frac{KT (P)}{KT (G)} = \frac{0,0}{8} = 0.40 \\
 \text{F Calculate (ZxP)} &= \frac{KT (ZxP)}{KT (G)} = \frac{0.21}{0.55} = 2.62
 \end{aligned}$$

13. Table Anova

Sources of Diversity	db	JK	KT	F-count	F-table (0.05)
Treatment	14	19.15	1.37	6.54 *	2.04
Concentration IBA (Z)	2	14.44	7.22	34.55 *	3.32
Long Stem (P)	4	0.33	0.08	0.40 ^{tn}	2.69
Interaction (ZxP)	8	4.37	0.55	2.62 *	2.27
Error	30	6.27	0.21		
Total	44	25.42			

Information : * = Significant (F Count > F Table 5%) And Mr. = No Significant (F Count < F Table 5%).

14. Coefficient Diversity (KK)

$$KK = \frac{\sqrt{KT \text{ Error}}}{\text{Average Total}} \times 100$$

Attachment 7. (Continued)

$$\begin{aligned} & \frac{\sqrt{0.21}}{4.16} \times 100 \\ & = 10.98\% \end{aligned}$$

Note: If the Coefficient of Diversity (KK) > 20%, then transformation must be carried out.

Conclusion : KK = 10.98% < 20%, then the data is homogeneous.

15. Test Different Real The smallest (BNT) Treatment Concentration (Z)

$$\text{Sd (Error Standard)} = \sqrt{\frac{2 \cdot 0.21}{4 \cdot 3}} = 0.22$$

b . r

$$t(\alpha, db) = 1.70$$

$$\text{LSD } \alpha = \text{Sd xt } (\alpha, db) = 0.22 \times 1.70 = 0.37$$

Table Results Test Carry on Treatment Single Z with BNT level 0.05

Treatment	Middle Value	Z3	Z2	Z1	Z4	Z0	Notation
Z3	4.96	-					a
Z2	4.44	0.52 *	-				b
Z1	4.32	0.64 *	0.12 ^{tn}	-			b
Z4	3.78	1.18 *	0.66 *	0.54 *	-		c
Z0	3.31	1.65 *	1.13 *	1.01 *	0.47 *	-	d

Table Results Test Carry on Treatment Single Z with BNT level 0.05

Treatment	Average	Notation
Z0	3.31	d
Z1	4.32	b
Z2	4.44	b
Z3	4.96	a
Z4	3.78	c

16. Test Different Real The smallest (BNT) Interaction Treatment Concentration (Z) and Length of the Stem (P)

$$\text{Sd (Error Standard)} = \sqrt{\frac{2 \cdot 0.21}{3}} = 0.37$$

r

Attachment 7. (Continued)

$$t(\alpha, db) = 1.70$$

$$\text{LSD } \alpha = Sd_{xt}(\alpha, db) = 0.37 \times 1.70 = 0.63$$

Attachment 7. (Continued)

Table Results Test Continue Interaction Treatment Z And Treatment P with BNT level 0.05

Treatment	Middle Value	Z3P2	Z2P1	Z1P3	Z3P3	Z3P1	Z2P2	Z1P1	Z2P3	Z1P2	Z4P1	Z4P3	Z0P2	Z4P2	Z0P3	Z0P1	Notation
Z3P2	5.74	-															a
Z2P1	4.83	0.91 *	-														b
Z1P3	4.62	1.12 *	0.21 ^{tn}	-													bc
Z3P3	4.59	1.15 *	0.24 ^{tn}	0.03 ^{tn}	-												bcd
Z3P1	4.56	1.18 *	0.27 ^{tn}	0.06 ^{tn}	0.03 ^{tn}	-											bcd
Z2P2	4.39	1.35 *	0.44 ^{tn}	0.23 ^{tn}	0.20 ^{tn}	0.17 ^{tn}	-										bcde
Z1P1	4.35	1.39 *	0.48 ^{tn}	0.27 ^{tn}	0.24 ^{tn}	0.21 ^{tn}	0.04 ^{tn}	-									bcde
Z2P3	4.09	1.65 *	0.74 *	0.53 ^{tn}	0.50 ^{tn}	0.47 ^{tn}	0.30 ^{tn}	0.26 ^{tn}	-								cdef
Z1P2	3.98	1.76 *	0.85 *	0.64 *	0.61 ^{tn}	0.58 ^{tn}	0.41 ^{tn}	0.37 ^{tn}	0.11 ^{tn}	-							def
Z4P1	3.89	1.85 *	0.94 *	0.73 *	0.70 *	0.67 *	0.50 ^{tn}	0.46 ^{tn}	0.20 ^{tn}	0.09 ^{tn}	-						ef
Z4P3	3.83	1.91 *	1.00 *	0.79 *	0.76 *	0.73 *	0.56 ^{tn}	0.52 ^{tn}	0.26 ^{tn}	0.15 ^{tn}	0.06 ^{tn}	-					ef
Z0P2	3.61	2.13 *	1.22 *	1.01 *	0.98 *	0.95 *	0.78 *	0.74 *	0.48 ^{tn}	0.37 ^{tn}	0.28 ^{tn}	0.22 ^{tn}	-				fg
Z4P2	3.56	2.18 *	1.27 *	1.06 *	1.03 *	1.00 *	0.83 *	0.79 *	0.53 ^{tn}	0.42 ^{tn}	0.33 ^{tn}	0.27 ^{tn}	0.05 ^{tn}	-			fg
Z0P3	3.18	2.56 *	1.65 *	1.44 *	1.41 *	1.38 *	1.21 *	1.17 *	0.91 *	0.80 *	0.71 *	0.65 *	0.43 ^{tn}	0.38 ^{tn}	-		g
Z0P1	3.15	2.59 *	1.68 *	1.47 *	1.44 *	1.41 *	1.24 *	1.20 *	0.94 *	0.83 *	0.74 *	0.68 *	0.46 ^{tn}	0.41 ^{tn}	0.03 ^{tn}	-	g

Attachment 7. (Continued)**Table Results Test Carry on Treatment Z And Treatment P with BNT level 0.05**

Treatment	Average	Notation
Z0P1	10.07	g
Z0P2	13.10	fg
Z0P3	10.10	g
Z1P1	19.47	bcde
Z1P2	15.87	def
Z1P3	21.50	bc
Z2P1	23.53	b
Z2P2	19.40	bcde
Z2P3	17.20	cdef
Z3P1	27.20	bcd
Z3P2	33.00	a
Z3P3	21.07	bcd
Z4P1	15.18	ef
Z4P2	13.28	fg
Z4P3	14.87	ef

Attachment 8. Data analysis Amount Leaf

Stem Length	Test	Concentration IBA					Total	Average
		Z0	Z1	Z2	Z3	Z4		
				(strand)				
P1	1	10.00	9.00	23.00	46.00	8.00	96.00	19.20
	2	11.00	16.00	10.00	13.00	19.00	69.00	13.80
	3	19.00	30.00	17.00	17.00	17.00	100.00	20.00
Sub-Total		40.00	55.00	50.00	76.00	44.00	265.00	
Average		13.33	18.33	16.67	25.33	14.67		17.67
P2	1	18.00	29.00	8.00	40.00	25.00	120.00	24.00
	2	13.00	15.00	9.00	26.00	19.00	82.00	16.40
	3	21.00	32.00	46.00	19.00	14.00	132.00	26.40
Sub-Total		52.00	76.00	63.00	85.00	58.00	334.00	
Average		17.33	25.33	21.00	28.33	19.33		22.27
P3	1	13.00	7.00	23.00	37.00	18.00	98.00	19.60
	2	13.00	22.00	15.00	25.00	6.00	81.00	16.20
	3	13.00	20.00	14.00	17.00	18.00	82.00	16.40
Sub-Total		39.00	49.00	52.00	79.00	42.00	261.00	
Average		13.00	16.33	17.33	26.33	14.00		17.40
Total							860.00	
		131.00	180.00	165.00	240.00	144.00		19.11

Long Stem	Concentration IBA					Average
	Z0	Z1	Z2	Z3	Z4	
			(strand)			
P1	13.33	18.33	16.67	25.33	14.67	18.42
P2	17.33	25.33	21.00	28.33	19.33	23.00
P3	13.00	16.33	17.33	26.33	14.00	18.25
Average		14.56	20.00	18.33	26.67	16.00

Information : P = Treatment Long Trunk. P1 = 15 cm; P2 = 20 cm; P3 = 25 cm. Z = IBA Concentration. Z0 = 0 ppm; Z1 = 100 ppm; Z2 = 150 ppm; Z3 = 200 ppm; Z4 = 250 ppm. Each replicate consisted of 5 plants.

1. Degrees Free (db)

$$\begin{aligned}
 \text{Total} & \text{db} = (abr) - 1 = (5.3.3) - 1 = 44 \\
 \text{db Treatment} & = (ab) - 1 = (5.3) - 1 = 14 \\
 \text{db IBA Concentration Treatment} & = (a - 1) = (5 - 1) = 4 \\
 \text{db Treatment Long Stem} & = (b - 1) = (3 - 1) = 2 \\
 \text{db Interaction} & = (a - 1)(b - 1) = (5 - 1)(3 - 1) = 8 \\
 \text{db Error} & = \text{Total db} - \text{Treatment db} = 44 - 14 = 30
 \end{aligned}$$

Attachment 8. (Continued)**2. Factor Correlation (FK)**

$$\begin{aligned}
 \text{FK} &= \frac{\sum Y_{ijk}^2}{\text{abr } 790.10} \\
 &= \frac{2}{5.3.3} \\
 &= 16435.56
 \end{aligned}$$

3. Amount Square (JK)

$$\begin{aligned}
 \text{JK Total (JKT)} &= \sum Y_{ijk}^2 - \text{FK} \\
 &= (7.50^2 + 12.00^2 + \dots + 19.90^2) - 16435.56 \\
 &= 4050.44
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (JKP)} &= \frac{\sum Y_{ij}^2}{r} - \text{FK} \\
 &= \frac{(10.00^2 + 9.00^2 + \dots + 18.00^2)}{3} - 16435.56 \\
 &= 1066.44
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (Z)} &= \frac{\sum Y_{ijk}^2}{\text{br}} - \text{FK} \\
 &= \frac{(131.00^2 + 180.00^2 + \dots + 144.00^2)}{3.3} - 16435.56 \\
 &= 800.22
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (P)} &= \frac{\sum Y_{ij}^2}{\text{ar}} - \text{FK} \\
 &= \frac{(265.00^2 + 334.00^2 + 261.00^2)}{5.3} - 16435.56 \\
 &= 224.58
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Interaction (ZxP)} &= \text{JKP} - \text{JK (Z)} - \text{JK (P)} \\
 &= 1066.44 - 800.22 - 224.58 \\
 &= 41.64
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Error (JKG)} &= \text{Jakarta} - \text{JKP} \\
 &= 4050.44 - 1066.44 \\
 &= 2984.00
 \end{aligned}$$

Attachment 8. (Continued)**4. Square Middle (KT)**

$$\begin{aligned}
 \text{Treatment Card (KTP)} &= \frac{\text{JKP}}{\text{db Treatment}} = \frac{1066.44}{14} = 76.17 \\
 \text{KT (P)} &= \frac{\text{JK (P)}}{\text{db (P)}} = \frac{224.58}{4} = 56.14 \\
 \text{KT (Z)} &= \frac{\text{JK (Z)}}{\text{db (Z)}} = \frac{800.22}{2} = 400.11 \\
 \text{KT (ZxP)} &= \frac{\text{JK (ZxP)}}{\text{db (ZxP)}} = \frac{41.64}{8} = 5.21 \\
 \text{KT Error (KTG)} &= \frac{\text{JK (G)}}{\text{db G}} = \frac{2984.00}{30} = 99.47
 \end{aligned}$$

5. F-Count

$$\begin{aligned}
 \text{F Calculate Treatment} &= \frac{\text{ID card}}{\text{KT (G)}} = \frac{76.17}{99.47} = 0.77 \\
 \text{F Count (Z)} &= \frac{\text{KT (Z)}}{\text{KT (G)}} = \frac{400.11}{99.47} = 4.02 \\
 \text{F Count (P)} &= \frac{\text{KT (P)}}{\text{KT (G)}} = \frac{56.14}{99.47} = 0.56 \\
 \text{F Calculate (ZxP)} &= \frac{\text{KT (ZxP)}}{\text{KT (G)}} = \frac{5.21}{99.47} = 0.05
 \end{aligned}$$

6. Table Anova

Sources of Diversity	db	JK	KT	F-count	F-table (0.05)
Treatment	14	1066.44	76.17	0.77 ^{tn}	2.04
Concentration IBA (Z)	2	800.22	400.11	4.02 [*]	3.32
Long Stem (P)	4	224.58	56.14	0.56 ^{tn}	2.69
Interaction (ZxP)	8	41.64	5.21	0.05 ^{tn}	2.27
Error	30	2984	99.47		
Total	44	4050.44			

Information : * = Significant (F Count > F Table 5%) And Mr. = No Significant (F Count < F Table 5%).

7. Coefficient Diversity (KK)

$$\begin{aligned}
 \text{KK} &= \frac{\sqrt{\text{KT Error}}}{\frac{\text{R ataan Total}}{\sqrt{99.47}}} \times 100 \\
 &= \frac{19.11}{19.11} \times 100 \\
 &= 52.19 \%
 \end{aligned}$$

Attachment 8. (Continued)

Note: If the Coefficient of Diversity (KK) > 20%, then transformation must be carried out.

Conclusion : $KK = 52.19\% > 50\%$, then mandatory data transformed with log.

Attachment 8. (Continued) Log**Transformation**

Stem Length	Test	Concentration IBA					Total	Average
		Z0	Z1	Z2	Z3	Z4		
				(strand				
)				
P1	1	1.00	0.95	1.36	1.66	0.90	5.88	1.18
	2	1.04	1.20	1.00	1.11	1.28	5.64	1.13
	3	1.28	1.48	1.23	1.23	1.23	6.45	1.29
Sub-Total		3.32	3.64	3.59	4.01	3.41	17.97	
Average		1.11	1.21	1.20	1.34	1.14		1.20
P2	1	1.26	1.46	0.90	1.60	1.40	6.62	1.32
	2	1.11	1.18	0.95	1.41	1.28	5.94	1.19
	3	1.32	1.51	1.66	1.28	1.15	6.92	1.38
Sub-Total		3.69	4.14	3.52	4.30	3.82	19.47	
Average		1.23	1.38	1.17	1.43	1.27		1.30
P3	1	1.11	0.85	1.36	1.57	1.26	6.14	1.23
	2	1.11	1.34	1.18	1.40	0.78	5.81	1.16
	3	1.11	1.30	1.15	1.23	1.26	6.05	1.21
Sub-Total		3.34	3.49	3.68	4.20	3.29	18.00	
Average		1.11	1.16	1.23	1.40	1.10		1.20
Total							55.44	
		10.35	11.27	10.80	12.50	10.52		1.23

Long Stem	Concentration IBA					Average
	Z0	Z1	Z2	Z3	Z4	
			(strand			
)			
P1	1.11	1.21	1.20	1.34	1.14	1.21
P2	1.23	1.38	1.17	1.43	1.27	1.30
P3	1.11	1.16	1.23	1.40	1.10	1.23
Average		1.15	1.25	1.20	1.39	1.17

Information : P = Stem Length Treatment, P1 = 15 cm; P2 = 20 cm; P3 = 25 cm, Z = IBA concentration, Z0 = 0 ppm; Z1 = 100 ppm; Z2 = 150 ppm; Z3 = 200 ppm; Z4 = 250 ppm, Each replication consists of 5 plants.

8. Degrees Free (db)

$$\begin{aligned}
 \text{Total} & \text{ db} = (abr) - 1 = (5.3.3) - 1 = 44 \\
 \text{db Treatment} & = (ab) - 1 = (5.3) - 1 = 14 \\
 \text{db IBA Concentration Treatment} & = (a - 1) = (5 - 1) = 4 \\
 \text{db Treatment Long Stem} & = (b - 1) = (3 - 1) = 2 \\
 \text{db Interaction} & = (a - 1)(b - 1) = (5 - 1)(3 - 1) = 8 \\
 \text{db Error} & = \text{Total db} - \text{Treatment db} = 44 - 14 = 30
 \end{aligned}$$

Attachment 8. (Continued)**9. Factor Correlation (FK)**

$$\begin{aligned}
 \text{FK} &= \frac{\sum Y_{ijk}^2}{abr} \\
 &= \frac{55.44}{2} \\
 &= \frac{5.3.3}{2} \\
 &= 68.30
 \end{aligned}$$

10. Amount Square (JK)

$$\begin{aligned}
 \text{JK Total (JKT)} &= \sum Y_{ijk}^2 - \text{FK} \\
 &= (1.00^2 + 1.26^2 + \dots + 1.00^2) - 68.30 \\
 &= 1.93
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (JKP)} &= \frac{\sum Y_{ij}^2}{r} - \text{FK} \\
 &= \frac{(1.00^2 + 0.95^2 + \dots + 1.26^2)}{3} - 68.30 \\
 &= 0.51
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (Z)} &= \frac{\sum Y_{ijk}^2}{br} - \text{FK} \\
 &= \frac{(9.33^2 + 11.27^2 + \dots + 10.52^2)}{3.3} - 68.30 \\
 &= 0.33
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (P)} &= \frac{\sum Y_{ij}^2}{ar} - \text{FK} \\
 &= \frac{(17.97^2 + 19.47^2 + 18.00^2)}{5.3} - 68.30 \\
 &= 0.10
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Interaction (ZxP)} &= \text{JKP} - \text{JK (Z)} - \text{JK (P)} \\
 &= 0.51 - 0.33 - 0.10 \\
 &= 0.08
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Error (JKG)} &= \text{Jakarta} - \text{JKP} \\
 &= 1.93 - 0.51 \\
 &= 1.42
 \end{aligned}$$

Attachment 8. (Continued)**11. Square Middle (KT)**

$$\begin{aligned}
 \text{Treatment Card (KTP)} &= \frac{JKP}{db \text{ Treatment}} = \frac{0.51}{14} = 0.04 \\
 \text{KT (Z)} &= \frac{JK (Z)}{db (Z)} = \frac{0.33}{2} = 0.16 \\
 \text{KT (P)} &= \frac{JK (P)}{db (P)} = \frac{0.10}{4} = 0.02 \\
 \text{KT (ZxP)} &= \frac{JK (ZxP)}{db (ZxP)} = \frac{0,0}{8} = 0.01 \\
 \text{KT Error (KTG)} &= \frac{JK (G)}{db G} = \frac{1.42}{30} = 0.05
 \end{aligned}$$

12. F-Count

$$\begin{aligned}
 \text{F Calculate Treatment} &= \frac{ID \text{ card}}{KT (G)} = \frac{0.04}{0,0} = 0.77 \\
 \text{F Count (Z)} &= \frac{KT (Z)}{KT (G)} = \frac{0,0}{5} = 3.48 \\
 \text{F Count (P)} &= \frac{KT (P)}{KT (G)} = \frac{0.16}{0,0} = 0.52 \\
 \text{F Calculate (ZxP)} &= \frac{KT (ZxP)}{KT (G)} = \frac{5}{0,0} = 0.21 \\
 &= \frac{2}{0,0} \\
 &= \frac{5}{0.0} \\
 &= \frac{1}{0,0} \\
 &= \frac{5}{5}
 \end{aligned}$$

13. Table Anova

Sources of Diversity	db	JK	KT	F-count	F-table (0.05)
Treatment	14	0.51	0.04	0.77 ^{tn}	2.04
Concentration IBA (Z)	2	0.33	0.16	3.48 [*]	3.32
Long Stem (P)	4	0.10	0.02	0.52 ^{tn}	2.69
Interaction (ZxP)	8	0.08	0.01	0.21 ^{tn}	2.27
Error	30	1.42	0.05		
Total	44	1.93			

Information : * = Significant (F Count > F Table 5%) And Mr. = No Significant (F Count < F Table 5%).

14. Coefficient Diversity (KK)

$$\sqrt{KT \text{ Error}}$$

$$KK = \frac{\text{Average Total}}{\text{Average Total}} \times 100$$

Attachment 8. (Continued)

$$\begin{aligned} & \frac{\sqrt{0.05}}{1.23} \times 100 \\ & = 17.66 \% \end{aligned}$$

Note: If the Coefficient of Diversity (KK) > 20%, then transformation must be carried out.

Conclusion : KK = 17.66% < 20%, then the data is homogeneous.

15. Test Different Real The smallest (BNT) Treatment Concentration (Z)

$$\text{Sd (Error Standard)} = \sqrt{\frac{2 \cdot 0,05}{4 \cdot 3}} = 0.09$$

b . r

$$t(\alpha, db) = 1.70$$

$$\text{LSD } \alpha = \text{Sd xt } (\alpha, db) = 0.09 \times 1.70 = 0.15$$

Table Results Test Carry on Treatment Single Z with BNT level 0.05

Treatment	Middle Value	Z3	Z1	Z2	Z4	Z0	Notation
Z3	1.39	-					a
Z1	1.25	0.14 ^{tn}	-				ab
Z2	1.20	0.19 [*]	0.05 ^{tn}	-			b
Z4	1.17	0.22 [*]	0.08 ^{tn}	0.03 ^{tn}	-		b
Z0	1.15	0.24 [*]	0.10 ^{tn}	0.05 ^{tn}	0.02 ^{tn}	-	b

Table Results Test Carry on Treatment Single Z with BNT level 0.05

Treatment	Average	Notation
Z0	1.15	b
Z1	1.25	ab
Z2	1.20	b
Z3	1.39	a
Z4	1.17	b

Attachment 9. Analysis Data Amount Root

Stem Length	Test	Concentration IBA					Total	Average
		Z0	Z1	Z2	Z3	Z4		
				(root)				
P1	1	10	12	16	18	7	63.00	12.60
	2	8	19	14	16	9	66.00	13.20
	3	5	15	16	12	15	63.00	12.60
Sub-Total		23.00	46.00	46.00	46.00	31.00	192.00	
Average		7.67	15.33	15.33	15.33	10.33		12.80
P2	1	14	8	6	17	7	52.00	10.40
	2	3	8	5	25	13	54.00	10.80
	3	7	9	7	12	6	41.00	8.20
Sub-Total		24.00	25.00	18.00	54.00	26.00	147.00	
Average		8.00	8.33	6.00	18.00	8.67		9.80
P3	1	4	2	10	12	9	37.00	7.40
	2	3	14	14	9	6	46.00	9.20
	3	2	15	15	11	11	54.00	10.80
Sub-Total		9.00	31.00	39.00	32.00	26.00	137.00	
Average		3.00	10.33	13.00	10.67	8.67		9.13
Total							476.00	
		56.00	102.00	103.00	132.00	83.00		10.58

Long Stem	Concentration IBA					Average
	Z0	Z1	Z2	Z3	Z4	
			(root)			
P1	7.67	15.33	15.33	15.33	10.33	13.42
P2	8.00	8.33	6.00	18.00	8.67	10.08
P3	3.00	10.33	13.00	10.67	8.67	9.25
Average	6.22	11.33	11.44	14.67	9.22	

Information : P = Stem Length Treatment. P1 = 15 cm; P2 = 20 cm; P3 = 25 cm. Z = IBA concentration. Z0 = 0 ppm; Z1 = 100 ppm; Z2 = 150 ppm; Z3 = 200 ppm; Z4 = 250 ppm. Each replication consists of 5 plants.

1. Degrees Free (db)

Total	$db = (abr) - 1 = (5.3.3) - 1 = 44$
db Treatment	$= (ab) - 1 = (5.3) - 1 = 14$
db IBA Concentration Treatment	$= (a - 1) = (5 - 1) = 4$
db Treatment Long Stem	$= (b - 1) = (3 - 1) = 2$
db Interaction	$= (a - 1)(b - 1) = (5 - 1)(3 - 1) = 8$
db Error	$= \text{Total db} - \text{Treatment db} = 44 - 14 = 30$

Attachment 9. (Continued)**2. Factor Correlation (FK)**

$$\begin{aligned}
 \text{FK} &= \frac{\sum Y_{ijk}^2}{abr} \\
 &= \frac{476^2}{5.3.3} \\
 &= 5035.02
 \end{aligned}$$

3. Amount Square (JK)

$$\begin{aligned}
 \text{JK Total (JKT)} &= \sum Y_{ijk}^2 - \text{FK} \\
 &= (10.00^2 + 12,00^2 + \dots + 11.00^2) - 5035.02 \\
 &= 1114.98
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (JKP)} &= \frac{\sum Y_{ij}^2}{r} - \text{FK} \\
 &= \frac{(23,00^2 + 46,00^2 + \dots + 26,00^2)}{3} - 5035.02 \\
 &= 704.31
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (Z)} &= \frac{\sum Y_{ijk}^2}{br} - \text{FK} \\
 &= \frac{(56.00^2 + 102.00^2 + \dots + 83.00^2)}{3.3} - 5035.02 \\
 &= 349.64
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (P)} &= \frac{\sum Y_{ij}^2}{ar} - \text{FK} \\
 &= \frac{(192.00^2 + 147.00^2 + 137.00^2)}{5.3} - 5035.02 \\
 &= 114.44
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Interaction (ZxP)} &= \text{JKP} - \text{JK (Z)} - \text{JK (P)} \\
 &= 704.31 - 349.64 - 114.44 \\
 &= 240.22
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Error (JKG)} &= \text{Jakarta} - \text{JKP} \\
 &= 1114.98 - 704.31 \\
 &= 410.67
 \end{aligned}$$

Attachment 9. (Continued)**4. Square Middle (KT)**

$$\begin{aligned} \text{Treatment Card (KTP)} &= \frac{\text{JKP}}{\text{db Treatment}} = \frac{704.31}{14} = 50.31 \\ \text{KT (Z)} &= \frac{\text{JK (Z)}}{\text{db (Z)}} = \frac{349.64}{2} = 174.82 \\ \text{KT (P)} &= \frac{\text{JK (P)}}{\text{db (P)}} = \frac{114.44}{4} = 28.61 \\ \text{KT (ZxP)} &= \frac{\text{JK (ZxP)}}{\text{db (ZxP)}} = \frac{240.22}{8} = 30.03 \\ \text{KT Error (KTG)} &= \frac{\text{JK (G)}}{\text{db G}} = \frac{410.67}{30} = 13.69 \end{aligned}$$

5. F-Count

$$\begin{aligned} \text{F Calculate Treatment} &= \frac{\text{ID card}}{\text{KT (G)}} = \frac{50.31}{13.69} = 3.68 \\ \text{F Count (Z)} &= \frac{\text{KT (Z)}}{\text{KT (G)}} = \frac{174.82}{13.69} = 12.77 \\ \text{F Count (P)} &= \frac{\text{KT (P)}}{\text{KT (G)}} = \frac{28.61}{13.69} = 2.09 \\ \text{F Calculate (ZxP)} &= \frac{\text{KT (ZxP)}}{\text{KT (G)}} = \frac{30.03}{13.69} = 2.19 \end{aligned}$$

6. Table Anova

Sources of Diversity	db	JK	KT	F-count	F-table (0.05)
Treatment	14	704.31	50.31	3.68	2.04
Concentration IBA (Z)	2	349.64	174.82	12.77	3.32
Long Stem (P)	4	114.44	28.61	2.09	2.69
Interaction (ZxP)	8	240.22	30.03	2.19	2.27
Error	30	410.67	13.69		
Total	44	1114.98			

Information : * = Significant (F Count > F Table 5%) And Mr. = No Significant (F Count < F Table 5%).

7. Coefficient Diversity (KK)

$$\text{KK} = \frac{\sqrt{\text{KT Error}}}{\text{Average Total}} \times 100$$

Attachment 9. (Continued)

$$\begin{aligned} & \frac{\sqrt{13.69}}{10.58} \times 100 \\ & = 34.98 \% \end{aligned}$$

Note: If the Coefficient of Diversity (KK) > 30%, then transformation must be carried out.

Conclusion : KK = 34.98% > 20%, then mandatory data transformed with $\sqrt{3}$.

Appendix 9. (Continued)**Transformation Root Cubic**

Stem Length	Test	Concentration IBA					Total	Average
		Z0	Z1	Z2	Z3	Z4		
				(root)				
P1	1	2.15	2.29	2.52	2.62	1.91	11.50	2.30
	2	2.00	2.67	2.41	2.52	2.08	11.68	2.34
	3	1.71	2.47	2.52	2.29	2.47	11.45	2.29
Sub-Total		5.86	7.42	7.45	7.43	6.46	34.63	
Average		1.95	2.47	2.48	2.48	2.15		2.31
P2	1	2.41	2.00	1.82	2.57	1.91	10.71	2.14
	2	1.44	2.00	1.71	2.92	2.35	10.43	2.09
	3	1.91	2.08	1.91	2.29	1.82	10.01	2.00
Sub-Total		5.77	6.08	5.44	7.78	6.08	31.15	
Average		1.92	2.03	1.81	2.59	2.03		2.08
P3	1	1.59	1.26	2.15	2.29	2.08	9.37	1.87
	2	1.44	2.41	2.41	2.08	1.82	10.16	2.03
	3	1.26	2.47	2.47	2.22	2.22	10.64	2.13
Sub-Total		4.29	6.14	7.03	6.59	6.12	30.17	
Average		1.43	2.05	2.34	2.20	2.04		2.01
Total							95.95	
		15.92	19.64	19.92	21.81	18.66		2.13

Long Stem	Concentration IBA					Average
	Z0	Z1	Z2	Z3	Z4	
			(root)			
P1	1.95	2.47	2.48	2.48	2.15	2.35
P2	1.92	2.03	1.81	2.59	2.03	2.09
P3	1.43	2.05	2.34	2.20	2.04	2.00
Average	1.77	2.18	2.21	2.42	2.07	

Information : P = Stem Length Treatment, P1 = 15 cm; P2 = 20 cm; P3 = 25 cm, Z = IBA concentration, Z0 = 0 ppm; Z1 = 100 ppm; Z2 = 150 ppm; Z3 = 200 ppm; Z4 = 250 ppm, Each replication consists of 5 plants.

8. Degrees Free (db)

$$\begin{aligned}
 \text{Total} &= \text{db} = (abr) - 1 = (5.3.3) - 1 = 44 \\
 \text{db Treatment} &= (\text{ab}) - 1 = (5.3) - 1 = 14 \\
 \text{db IBA Concentration Treatment} &= (a - 1) = (5 - 1) = 4 \\
 \text{db Treatment Long Stem} &= (b - 1) = (3 - 1) = 2 \\
 \text{db Interaction} &= (a - 1)(b - 1) = (5 - 1)(3 - 1) = 8 \\
 \text{db Error} &= \text{Total db} - \text{Treatment db} = 44 - 14 = 30
 \end{aligned}$$

Attachment 9. (Continued)**9. Factor Correlation (FK)**

$$\begin{aligned}
 \text{FK} &= \frac{\sum Y_{ijk}^2}{abr} \\
 &= \frac{95.95}{2} \\
 &= \frac{5.3.3}{204.59}
 \end{aligned}$$

10. Amount Square (JK)

$$\begin{aligned}
 \text{JK Total (JKT)} &= \sum Y_{ijk}^2 - \text{FK} \\
 &= (2.15^2 + 2.29^2 + \dots + 2.22^2) - 204.59 \\
 &= 6.40
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (JKP)} &= \frac{\sum Y_{ij}^2}{r} - \text{FK} \\
 &= \frac{(5.86^2 + 7.4^2 + \dots + 6.12^2)}{3} - 204.59 \\
 &= 3.99
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (Z)} &= \frac{\sum Y_{ijk}^2}{br} - \text{FK} \\
 &= \frac{(15.92^2 + 19.64^2 + \dots + 18.66^2)}{3.3} - 204.59 \\
 &= 2.06
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (P)} &= \frac{\sum Y_{ij}^2}{ar} - \text{FK} \\
 &= \frac{(34.63^2 + 31.15^2 + 30.17^2)}{5.3} - 204.59 \\
 &= 0.73
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Interaction (ZxP)} &= \text{JKP} - \text{JK (Z)} - \text{JK (P)} \\
 &= 3.99 - 2.06 - 0.73 \\
 &= 1.20
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Error (JKG)} &= \text{Jakarta} - \text{JKP} \\
 &= 6.40 - 3.99 \\
 &= 2.40
 \end{aligned}$$

Attachment 9. (Continued)**11. Square Middle (KT)**

$$\begin{aligned} \text{Treatment Card (KTP)} &= \frac{\text{JKP}}{\text{db Treatment}} = \frac{3.99}{14} = 0.29 \\ \text{KT (Z)} &= \frac{\text{JK (Z)}}{\text{db (Z)}} = \frac{2.06}{2} = 1.03 \\ \text{KT (P)} &= \frac{\text{JK (P)}}{\text{db (P)}} = \frac{0.73}{4} = 0.18 \\ \text{KT (ZxP)} &= \frac{\text{JK (ZxP)}}{\text{db (ZxP)}} = \frac{1.20}{8} = 0.15 \\ \text{KT Error (KTG)} &= \frac{\text{JK (G)}}{\text{db G}} = \frac{2.40}{30} = 0.08 \end{aligned}$$

12. F-Count

$$\begin{aligned} \text{F Calculate Treatment} &= \frac{\text{ID card}}{\text{KT (G)}} = \frac{0.29}{0.08} = 3.56 \\ \text{F Count (Z)} &= \frac{\text{KT (Z)}}{\text{KT (G)}} = \frac{1.03}{0.08} = 12.88 \\ \text{F Count (P)} &= \frac{\text{KT (P)}}{\text{KT (G)}} = \frac{0.18}{0.08} = 2.28 \\ \text{F Calculate (ZxP)} &= \frac{\text{KT (ZxP)}}{\text{KT (G)}} = \frac{0.15}{0.03} = 1.87 \end{aligned}$$

13. Table Anova

Sources of Diversity	db	JK	KT	F-count	F-table (0.05)
Treatment	14	3.99	0.29	3.56 *	2.04
Concentration IBA (Z)	2	2.06	1.03	12.88 *	3.32
Long Stem (P)	4	0.73	0.18	2.28 ^{tn}	2.69
Interaction (ZxP)	8	1.20	0.15	1.87 ^{tn}	2.27
Error	30	2.40	0.08		
Total	44	6.40			

Information : * = Significant (F Count > F Table 5%) And Mr. = No Significant (F Count < F Table 5%).

14. Coefficient Diversity (KK)

$$\text{KK} = \frac{\sqrt{\text{KT Error}}}{\text{Average Total}} \times 100$$

Attachment 9. (Continued)

$$\begin{aligned} & \frac{\sqrt{0.08}}{2.13} \times 100 \\ & = 13.27 \% \end{aligned}$$

Note: If the Coefficient of Diversity (KK) > 20%, then transformation must be carried out.

Conclusion : KK = 13.27% < 20%, then the data is homogeneous.

15. Test Different Real The smallest (BNT) Treatment Concentration (Z)

$$\text{Sd (Error Standard)} = \sqrt{\frac{2 \cdot 0.08}{4 \cdot 3}} = 0.13$$

b . r

$$t(\alpha, db) = 1.70$$

$$\text{LSD } \alpha = \text{Sd} \times t(\alpha, db) = 0.13 \times 1.70 = 0.22$$

Table Results Test Carry on Treatment Single Z with BNT level 0.05

Treatment	Middle Value	Z3	Z2	Z1	Z4	Z0	Notation
Z3	2.42	-					a
Z2	2.21	0.21 ^{tn}	-				ab
Z1	2.18	0.24 [*]	0.03 ^{tn}	-			b
Z4	2.07	0.35 [*]	0.14 ^{tn}	0.11 ^{tn}	-		b
Z0	1.77	0.65 [*]	0.44 [*]	0.41 [*]	0.30 [*]	-	c

Table Results Test Carry on Treatment Single Z with BNT level 0.05

Treatment	Average	Notation
Z0	1.77	c
Z1	2.18	b
Z2	2.21	ab
Z3	2.42	a
Z4	2.07	b

Attachment 10. Analysis Data Long Root

Stem Length	Test	Concentration IBA					Z4	Total	Average
		Z0	Z1	Z2	Z3	(cm)			
P1	1	10.30	13.50	15.50	16.80	16.50	72.60	14.52	
	2	13.70	12.00	13.00	17.40	14.20	70.30	14.06	
	3	15.40	14.80	14.10	15.30	15.00	74.60	14.92	
Sub-Total		39.40	40.30	42.60	49.50	45.70	217.50		
Average		13.13	13.43	14.20	16.50	15.23		14.50	
P2	1	13.10	12.10	15.60	19.10	17.20	77.10	15.42	
	2	7.90	11.30	14.30	18.60	14.10	66.20	13.24	
	3	14.80	14.70	16.00	20.60	10.40	76.50	15.30	
Sub-Total		35.80	38.10	45.90	58.30	41.70	219.80		
Average		11.93	12.70	15.30	19.43	13.90		14.65	
P3	1	9.30	14.00	13.50	16.10	11.20	64.10	12.82	
	2	7.60	15.80	16.70	15.60	9.10	64.80	12.96	
	3	5.60	13.30	16.60	16.00	13.70	65.20	13.04	
Sub-Total		22.50	43.10	46.80	47.70	34.00	194.10		
Average		7.50	14.37	15.60	15.90	11.33		12.94	
Total							631.40		
		97.70	121.50	135.30	155.50	121.40		14.03	

Long Stem	Concentration IBA					Z4	Average
	Z0	Z1	Z2	Z3	(cm)		
P1	13.13	13.43	14.20	16.50	15.23		14.32
P2	11.93	12.70	15.30	19.43	13.90		14.84
P3	7.50	14.37	15.60	15.90	11.33		13.34
Average	10.86	13.50	15.03	17.28	13.49		

Information : P = Stem Length Treatment. P1 = 15 cm; P2 = 20 cm; P3 = 25 cm. Z = IBA concentration. Z0 = 0 ppm; Z1 = 100 ppm; Z2 = 150 ppm; Z3 = 200 ppm; Z4 = 250 ppm. Each replication consists of 5 plants.

1. Degrees Free (db)

Total	$db = (abr) - 1 = (5.3.3) - 1 = 44$
db Treatment	$= (ab) - 1 = (5.3) - 1 = 14$
db IBA Concentration Treatment	$= (a - 1) = (5 - 1) = 4$
db Treatment Long Stem	$= (b - 1) = (3 - 1) = 2$
db Interaction	$= (a - 1)(b - 1) = (5 - 1)(3 - 1) = 8$
db Error	$= \text{Total db} - \text{Treatment db} = 44 - 14 = 30$

Attachment 10. (Continued)**2. Factor Correlation (FK)**

$$\begin{aligned}
 \text{FK} &= \frac{\sum Y_{ijk}^2}{abr} \\
 &= \frac{631.40}{2} \\
 &= \frac{5.3.3}{8859.24}
 \end{aligned}$$

3. Amount Square (JK)

$$\begin{aligned}
 \text{JK Total (JKT)} &= \sum Y_{ijk}^2 - \text{FK} \\
 &= (10.30^2 + 13.50^2 + \dots + 11.33^2) - 8859.24 \\
 &= 417.42
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (JKP)} &= \frac{\sum Y_{ij}^2}{r} - \text{FK} \\
 &= \frac{(39.40^2 + 40.30^2 + \dots + 34.00^2)}{3} - 8859.24 \\
 &= 305.15
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (Z)} &= \frac{\sum Y_{ijk}^2}{br} - \text{FK} \\
 &= \frac{(97.70^2 + 121.50^2 + \dots + 121.40^2)}{3.3} - 8859.24 \\
 &= 199.85
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (P)} &= \frac{\sum Y_{ij}^2}{ar} - \text{FK} \\
 &= \frac{(217.50^2 + 219.80^2 + 194.10^2)}{5.3} - 8859.24 \\
 &= 26.96
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Interaction (ZxP)} &= \text{JKP} - \text{JK (Z)} - \text{JK (P)} \\
 &= 305.15 - 26.96 - 199.85 \\
 &= 78.34
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Error (JKG)} &= \text{Jakarta} - \text{JKP} \\
 &= 417.42 - 305.15 \\
 &= 112.27
 \end{aligned}$$

Attachment 10. (Continued)**4. Square Middle (KT)**

$$\begin{aligned}
 \text{Treatment Card (KTP)} &= \frac{\text{JKP}}{\text{db Treatment}} = \frac{305.15}{14} = 21.80 \\
 \text{KT (Z)} &= \frac{\text{JK (Z)}}{\text{db (Z)}} = \frac{199.85}{2} = 99.92 \\
 \text{KT (P)} &= \frac{\text{JK (P)}}{\text{db (P)}} = \frac{26.96}{4} = 6.74 \\
 \text{KT (ZxP)} &= \frac{\text{JK (ZxP)}}{\text{db (ZxP)}} = \frac{78.34}{8} = 9.79 \\
 \text{KT Error (KTG)} &= \frac{\text{JK (G)}}{\text{db G}} = \frac{112.27}{30} = 3.74
 \end{aligned}$$

5. F-Count

$$\begin{aligned}
 \text{F Calculate Treatment} &= \frac{\text{ID card}}{\text{KT (G)}} = \frac{21.80}{3.74} = 5.82 \\
 \text{F Count (Z)} &= \frac{\text{KT (Z)}}{\text{KT (G)}} = \frac{99.92}{3.74} = 26.70 \\
 \text{F Count (P)} &= \frac{\text{KT (P)}}{\text{KT (G)}} = \frac{6.74}{3.74} = 1.80 \\
 \text{F Calculate (ZxP)} &= \frac{\text{KT (ZxP)}}{\text{KT (G)}} = \frac{9.79}{3.74} = 2.62
 \end{aligned}$$

6. Table Anova

Sources of Diversity	db	JK	KT	F-count	F-table (0.05)
Treatment	14	305.15	21.80	5.82 *	2.04
Concentration IBA (Z)	2	199.85	99.92	26.70 *	3.32
Long Stem (P)	4	26.96	6.74	1.80 ^{tn}	2.69
Interaction (ZxP)	8	78.34	9.79	2.62 *	2.27
Error	30	112.27	3.74		
Total	44	417.42			

Information : * = Significant (F Count > F Table 5%) And Mr. = No Significant (F Count < F Table 5%).

7. Coefficient Diversity (KK)

$$\begin{aligned}
 \text{KK} &= \frac{\sqrt{\text{KT Error}}}{\text{R ataan Total}} \times 100 \\
 &= \frac{\sqrt{3.74}}{14.03} \times 100
 \end{aligned}$$

Attachment 10. (Continued)

$$= 13.79 \%$$

Note: If the Coefficient of Diversity (KK) > 20%, then transformation must be carried out.

Conclusion : KK = 13.79% < 20%, then the data is homogeneous.

8. Test Different Real The smallest (BNT) Treatment Concentration (Z)

$$\text{Sd (Error Standard)} = \sqrt{\frac{2 \cdot 3.74}{4 \cdot 3}} = 0.91$$

b . r

$$t(\alpha, db) = 1.70$$

$$\text{LSD } \alpha = \text{Sd xt}(\alpha, db) = 0.91 \times 1.70 = 1.55$$

Table Results Test Carry on Treatment Single Z with BNT level 0.05

Treatment	Middle Value	Z3	Z2	Z1	Z4	Z0	Notation
Z3	17.28	-					a
Z2	15.03	2.25 *	-				b
Z1	13.50	3.78 *	1.53 ^{tn}	-			b
Z4	13.49	3.79 *	1.54 ^{tn}	0.01 ^{tn}	-		b
Z0	10.86	6.42 *	4.17 *	2.64 *	2.63 *	-	c

Table Results Test Carry on Treatment Single Z with BNT level 0.05

Treatment	Average	Notation
Z0	10.86	c
Z1	13.50	b
Z2	15.03	b
Z3	17.28	a
Z4	13.49	b

9. Test Different Real The smallest (BNT) Interaction Treatment Concentration (Z) and Length of the Stem (P)

$$\text{Sd (Error Standard)} = \sqrt{\frac{2 \cdot 3.74}{3}} = 1.57$$

r

$$t(\alpha, db) = 1.70$$

$$\text{LSD } \alpha = \text{Sd xt}(\alpha, db) = 1.57 \times 1.70 = 2.67$$

Attachment 10. (Continued)

Table Results Test Continue Interaction Treatment Z And Treatment P with BNT level 0.05

Treatment	Middle Value	Z3P2	Z3P1	Z3P3	Z2P3	Z2P2	Z4P1	Z1P3	Z2P1	Z4P2	Z1P1	Z0P1	Z1P2	Z0P2	Z4P3	Z0P3	Notation
Z3P2	19.43	-															a
Z3P1	16.50	2.93 *	-														b
Z3P3	15.90	3.53 *	0.60 ^{tn}	-													bc
Z2P3	15.60	3.83 *	0.90 ^{tn}	0.30 ^{tn}	-												bcd
Z2P2	15.30	4.13 *	1.20 ^{tn}	0.60 ^{tn}	0.30 ^{tn}	-											bcde
Z4P1	15.23	4.20 *	1.27 ^{tn}	0.67 ^{tn}	0.37 ^{tn}	0.07 ^{tn}	-										bcde
Z1P3	14.37	5.07 *	2.13 ^{tn}	1.53 ^{tn}	1.23 ^{tn}	0.93 ^{tn}	0.87 ^{tn}	-									bcdef
Z2P1	14.20	5.23 *	2.30 ^{tn}	1.70 ^{tn}	1.40 ^{tn}	1.10 ^{tn}	1.03 ^{tn}	0.17 ^{tn}	-								bcdef
Z4P2	13.90	5.53 *	2.60 ^{tn}	2.00 ^{tn}	1.70 ^{tn}	1.40 ^{tn}	1.33 ^{tn}	0.47 ^{tn}	0.30 ^{tn}	-							bcdefg
Z1P1	13.43	6.00 *	3.07 *	2.47 ^{tn}	2.17 ^{tn}	1.87 ^{tn}	1.80 ^{tn}	0.93 ^{tn}	0.77 ^{tn}	0.47 ^{tn}	-						cdefg
Z0P1	13.13	6.30 *	3.37 *	2.77 *	2.47 ^{tn}	2.17 ^{tn}	2.10 ^{tn}	1.23 ^{tn}	1.07 ^{tn}	0.77 ^{tn}	0.30 ^{tn}	-					defg
Z1P2	12.70	6.73 *	3.80 *	3.20 *	2.90 *	2.60 ^{tn}	2.53 ^{tn}	1.67 ^{tn}	1.50 ^{tn}	1.20 ^{tn}	0.73 ^{tn}	0.43 ^{tn}	-				efg
Z0P2	11.93	7.50 *	4.57 *	3.97 *	3.67 *	3.37 *	3.30 *	2.43 ^{tn}	2.27 ^{tn}	1.97 ^{tn}	1.50 ^{tn}	1.20 ^{tn}	0.77 ^{tn}	-			fg
Z4P3	11.33	8.10 *	5.17 *	4.57 *	4.27 *	3.97 *	3.90 *	3.03 *	2.87 *	2.57 ^{tn}	2.10 ^{tn}	1.80 ^{tn}	1.37 ^{tn}	0.60 ^{tn}	-		g
Z0P3	7.50	11.93 *	9.00 *	8.40 *	8.10 *	7.80 *	7.73 *	6.87 *	6.70 *	6.40 *	5.93 *	5.63 *	5.20 *	4.43 *	3.83 *	-	h

Attachment 10. (Continued)**Table Results Test Carry on Treatment Z And Treatment P with BNT level 0.05**

Treatment	Average	Notation
Z0P1	13.13	defg
Z0P2	11.93	fg
Z0P3	7.50	h
Z1P1	13.43	cdefg
Z1P2	12.70	efg
Z1P3	14.37	bcdef
Z2P1	14.20	bcdef
Z2P2	15.30	bcde
Z2P3	15.60	bcd
Z3P1	16.50	b
Z3P2	19.43	a
Z3P3	15.90	bc
Z4P1	15.23	bcde
Z4P2	13.90	bcdefg
Z4P3	11.33	g

Attachment 11. Total Chlorophyll

$$\text{Total Chlorophyll (mg g}^{-1}\text{)} = 20.2 A_{645 \text{ nm}} + 8.02 A_{663 \text{ nm}}$$

$$\text{Total Chlorophyll Z0P1U1} = 20.2 \times 0.609 + 8.02 \times 1.462 = 24.03 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z0P1U2} = 20.2 \times 0.544 + 8.02 \times 1.335 = 21.70 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z0P1U3} = 20.2 \times 0.673 + 8.02 \times 1.599 = 26.42 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z0P2U1} = 20.2 \times 0.467 + 8.02 \times 1.085 = 18.14 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z0P2U2} = 20.2 \times 0.442 + 8.02 \times 1.041 = 17.28 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z0P2U3} = 20.2 \times 0.461 + 8.02 \times 1.054 = 17.76 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z0P3U1} = 20.2 \times 0.538 + 8.02 \times 1.330 = 21.53 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z0P3U2} = 20.2 \times 0.538 + 8.02 \times 1.330 = 21.53 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z0P3U3} = 20.2 \times 0.538 + 8.02 \times 1.330 = 21.53 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z1P1U1} = 20.2 \times 0.376 + 8.02 \times 0.918 = 14.96 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z1P1U2} = 20.2 \times 0.401 + 8.02 \times 0.996 = 16.09 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z1P1U3} = 20.2 \times 0.629 + 8.02 \times 1.432 = 24.19 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z1P2U1} = 20.2 \times 0.810 + 8.02 \times 1.789 = 30.71 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z1P2U2} = 20.2 \times 0.540 + 8.02 \times 1.294 = 21.29 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z1P2U3} = 20.2 \times 0.651 + 8.02 \times 1.526 = 25.39 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z1P3U1} = 20.2 \times 0.705 + 8.02 \times 1.583 = 26.94 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z1P3U2} = 20.2 \times 0.605 + 8.02 \times 1.442 = 23.79 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z1P3U3} = 20.2 \times 0.866 + 8.02 \times 1.813 = 32.03 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z2P1U1} = 20.2 \times 0.735 + 8.02 \times 1.709 = 28.55 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z2P1U2} = 20.2 \times 0.815 + 8.02 \times 1.786 = 30.79 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z2P1U3} = 20.2 \times 0.900 + 8.02 \times 1.436 = 29.70 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z2P2U1} = 20.2 \times 0.501 + 8.02 \times 1.240 = 20.07 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z2P2U2} = 20.2 \times 0.617 + 8.02 \times 1.615 = 25.42 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z2P2U3} = 20.2 \times 0.729 + 8.02 \times 1.665 = 28.08 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z2P3U1} = 20.2 \times 0.520 + 8.02 \times 1.221 = 20.30 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z2P3U2} = 20.2 \times 0.688 + 8.02 \times 1.593 = 26.67 \text{ mg g}^{-1}$$

Attachment 11. (Continued)

$$\text{Total Chlorophyll Z2P3U3} = 20.2 \times 0.903 + 8.02 \times 1.876 = 33.29 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z3P1U1} = 20.2 \times 0.709 + 8.02 \times 1.675 = 27.76 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z3P1U2} = 20.2 \times 0.711 + 8.02 \times 1.665 = 27.72 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z3P1U3} = 20.2 \times 0.838 + 8.02 \times 1.823 = 31.55 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z3P2U1} = 20.2 \times 0.797 + 8.02 \times 1.796 = 30.50 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z3P2U2} = 20.2 \times 0.994 + 8.02 \times 1.974 = 35.91 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z3P2U3} = 20.2 \times 0.864 + 8.02 \times 1.868 = 32.43 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z3P3U1} = 20.2 \times 0.715 + 8.02 \times 1.619 = 27.43 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z3P3U2} = 20.2 \times 0.584 + 8.02 \times 1.372 = 22.80 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z3P3U3} = 20.2 \times 0.694 + 8.02 \times 1.637 = 27.15 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z4P1U1} = 20.2 \times 0.496 + 8.02 \times 1.190 = 19.56 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z4P1U2} = 20.2 \times 0.900 + 8.02 \times 1.876 = 33.32 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z4P1U3} = 20.2 \times 0.615 + 8.02 \times 1.466 = 24.18 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z4P2U1} = 20.2 \times 0.818 + 8.02 \times 1.796 = 30.93 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z4P2U2} = 20.2 \times 0.660 + 8.02 \times 1.553 = 25.79 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z4P2U3} = 20.2 \times 0.739 + 8.02 \times 1.675 = 28.36 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z4P3U1} = 20.2 \times 0.724 + 8.02 \times 1.637 = 27.75 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z4P3U2} = 20.2 \times 0.697 + 8.02 \times 1.646 = 27.28 \text{ mg g}^{-1}$$

$$\text{Total Chlorophyll Z4P3U3} = 20.2 \times 0.513 + 8.02 \times 1.243 = 20.33 \text{ mg g}^{-1}$$

Attachment 12. Analysis Data Total Chlorophyll

Stem Length	Test	Concentration IBA					Total	Average	
		Z0	Z1	Z2	Z3	Z4			
			(mg g ⁻¹)						
P1	1	24.03	14.96	28.55	27.76	19.56	114.86	22.97	
	2	21.70	16.09	30.79	27.72	33.23	129.53	25.91	
	3	26.42	24.19	29.70	31.55	24.18	136.04	27.21	
Sub-Total		72.15	55.24	89.04	87.03	76.97	380.43		
Average		24.05	18.41	29.68	29.01	25.66		25.36	
P2	1	18.14	30.71	20.07	30.50	30.93	130.35	26.07	
	2	17.28	21.29	25.42	35.91	25.79	125.69	25.14	
	3	17.76	25.39	28.08	32.43	28.36	132.02	26.40	
Sub-Total		53.18	77.39	73.57	98.84	85.08	388.06		
Average		17.73	25.80	24.52	32.95	28.36		25.87	
P3	1	21.53	26.94	20.30	27.43	27.75	123.95	24.79	
	2	21.53	23.79	26.67	22.80	27.28	122.07	24.41	
	3	21.53	32.03	33.29	27.15	20.33	134.33	26.87	
Sub-Total		64.59	82.76	80.26	77.38	75.36	380.35		
Average		21.53	27.59	26.75	25.79	25.12		25.36	
Total							1148.84		
		189.92	215.39	242.87	263.25	237.41		25.53	

Long Stem	Concentration IBA					Average	
	Z0	Z1	Z2	Z3	Z4		
		(mg g ⁻¹)					
P1	24.05	18.41	29.68	29.01	25.66	25.29	
P2	17.73	25.80	24.52	32.95	28.36	25.25	
P3	21.53	27.59	26.75	25.79	25.12	25.42	
Average	21.10	23.93	26.99	29.25	26.38		

Information : P = Stem Length Treatment. P1 = 15 cm; P2 = 20 cm; P3 = 25 cm. Z = IBA concentration. Z0 = 0 ppm; Z1 = 100 ppm; Z2 = 150 ppm; Z3 = 200 ppm; Z4 = 250 ppm. Each replication consists of 5 plants.

1. Degrees Free (db)

$$\begin{aligned}
 \text{Total} & \quad \text{db} = (abr) - 1 = (5.3.3) - 1 = 44 \\
 \text{db Treatment} & \quad = (ab) - 1 = (5.3) - 1 = 14 \\
 \text{db IBA Concentration Treatment} & \quad = (a - 1) = (5 - 1) = 4 \\
 \text{db Treatment Long Stem} & \quad = (b - 1) = (3 - 1) = 2 \\
 \text{db Interaction} & \quad = (a - 1)(b - 1) = (5 - 1)(3 - 1) = 8 \\
 \text{db Error} & \quad = \text{Total db} - \text{Treatment db} = 44 - 14 = 30
 \end{aligned}$$

Attachment 12. (Continued)**2. Factor Correlation (FK)**

$$\begin{aligned}
 \text{FK} &= \frac{\sum Y_{ijk}^2}{\text{abr } 1139.56} \\
 &= \frac{2}{5.3.3} \\
 &= 29329.63
 \end{aligned}$$

3. Amount Square (JK)

$$\begin{aligned}
 \text{JK Total (JKT)} &= \sum Y_{ijk}^2 - \text{FK} \\
 &= (24.03^2 + 14.96^2 + \dots + 11.33^2) - 29329.63 \\
 &= 1131.63
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (JKP)} &= \frac{\sum Y_{ij}^2}{r} - \text{FK} \\
 &= \frac{(72.15^2 + 55.24^2 + \dots + 75.36^2)}{3} - 29329.63 \\
 &= 687.43
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (P)} &= \frac{\sum Y_{ij}^2}{\text{ar}} - \text{FK} \\
 &= \frac{(380.43^2 + 388.06^2 + 380.35^2)}{5.3} - 29329.63 \\
 &= 2.61
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (Z)} &= \frac{\sum Y_{ijk}^2}{\text{br}} - \text{FK} \\
 &= \frac{(180.64^2 + 215.39^2 + \dots + 237.41^2)}{3.3} - 29329.63 \\
 &= 349.52
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Interaction (ZxP)} &= \text{JKP} - \text{JK (Z)} - \text{JK (P)} \\
 &= 687.43 - 2.61 - 349.52 \\
 &= 335.29
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Error (JKG)} &= \text{Jakarta} - \text{JKP} \\
 &= 1131.63 - 6877.43 \\
 &= 444.21
 \end{aligned}$$

Attachment 12. (Continued)**4. Square Middle (KT)**

$$\begin{aligned}
 \text{Treatment Card (KTP)} &= \frac{JKP}{db \text{ Treatment}} = \frac{687.43}{14} = 49.10 \\
 \text{KT (P)} &= \frac{JK (P)}{db (P)} = \frac{2.61}{4} = 0.65 \\
 \text{KT (Z)} &= \frac{JK (Z)}{db (Z)} = \frac{349.52}{2} = 174.76 \\
 \text{KT (ZxP)} &= \frac{JK (ZxP)}{db (ZxP)} = \frac{335.29}{8} = 41.91 \\
 \text{KT Error (KTG)} &= \frac{JK (G)}{db G} = \frac{444.21}{30} = 14.81
 \end{aligned}$$

5. F-Count

$$\begin{aligned}
 \text{F Calculate Treatment} &= \frac{ID \text{ card}}{KT (G)} = \frac{49.10}{14.81} = 3.32 \\
 \text{F Count (P)} &= \frac{KT (P)}{KT (G)} = \frac{0.65}{14.81} = 0.04 \\
 \text{F Count (Z)} &= \frac{KT (Z)}{KT (G)} = \frac{174.76}{14.81} = 11.80 \\
 \text{F Calculate (ZxP)} &= \frac{KT (ZxP)}{KT (G)} = \frac{41.91}{14.81} = 2.83
 \end{aligned}$$

6. Table Anova

Sources of Diversity	db	JK	KT	F-count	F-table (0.05)
Treatment	14	687.43	49.10	3.32 *	2.04
Long Stem (P)	4	2.61	0.65	0.04 ^{tn}	2.69
Concentration IBA (Z)	2	349.52	174.76	11.80 *	3.32
Interaction (ZxP)	8	335.29	41.91	2.83 *	2.27
Error	30	444.21	14.81		
Total	44	1131.63			

Information : * = Significant (F Count > F Table 5%) And Mr. = No Significant (F Count < F Table 5%).

7. Coefficient Diversity (KK)

$$\begin{aligned}
 KK &= \frac{\sqrt{KT \text{ Error}}}{R \text{ ataan Total}} \times 100 \\
 &= \frac{\sqrt{14.81}}{25.53} \times 100
 \end{aligned}$$

Attachment 12. (Continued)

$$= 15.07\%$$

Note: If the Coefficient of Diversity (KK) > 20%, then transformation must be carried out.
Conclusion : KK = 15.07% < 20%, then the data is homogeneous.

8. Test Different Real The smallest (BNT) Treatment Concentration (Z)

$$\text{Sd (Error Standard)} = \sqrt{\frac{2 \cdot 14.81}{4 \cdot 3}} = 1.81$$

b . r

$$t(\alpha, db) = 1.70$$

$$\text{LSD } \alpha = \text{Sd xt}(\alpha, db) = 1.85 \times 1.70 = 3.15$$

Table Results Test Carry on Interaction Treatment Single Z with BNT Level 0.05

Treatment	Mark Middle	Z3	Z2	Z4	Z1	Z0	Notation
Z3	29.25	-					a
Z2	26.99	2.26 ^{tn}	-				ab
Z4	26.38	2.87 ^{tn}	0.61 ^{tn}	-			ab
Z1	23.93	5.32 [*]	3.06 ^{tn}	2.45 ^{tn}	-		bc
Z0	21.10	8.15 [*]	5.89 [*]	5.28 [*]	2.83 ^{tn}	-	c

Table Results Test Carry on Treatment Single Z with BNT level 0.05

Treatment	Average	Notation
Z0	21.10	c
Z1	23.93	bc
Z2	26.99	ab
Z3	29.25	a
Z4	26.38	ab

9. Test Different Real The smallest (BNT) Interaction Treatment Concentration (Z) and Length of the Stem (P)

$$\text{Sd (Error Standard)} = \sqrt{\frac{2 \cdot 14.81}{3}} = 3.14$$

r

$$t(\alpha, db) = 1.70$$

$$\text{LSD } \alpha = \text{Sd xt}(\alpha, db) = 3.14 \times 1.70 = 5.3$$

Attachment 12. (Continued)

Table Results Test Carry on Interaction Treatment Z And Treatment P with BNT Level 0.05

Perlakuan	Nilai Tengah	Z3P2	Z2P1	Z3P1	Z4P2	Z1P3	Z2P3	Z1P2	Z3P3	Z4P1	Z4P3	Z2P2	Z0P1	Z0P3	Z1P1	Z0P2	Notasi
Z3P2	32,95	0,00															a
Z2P1	29,68	3.27 ^{tn}	0.00														ab
Z3P1	29,01	3.94 ^{tn}	0.67 ^{tn}	0.00													a B C
Z4P2	28,36	4.59 ^{tn}	1.32 ^{tn}	0.65 ^{tn}	0.00												a B C
Z1P3	27,59	5.36 [*]	2.09 ^{tn}	1.42 ^{tn}	0.77 ^{tn}	0.00											bc
Z2P3	26,75	6.20 [*]	2.93 ^{tn}	2.26 ^{tn}	1.61 ^{tn}	0.84 ^{tn}	0.00										bcd
Z1P2	25,80	7.15 [*]	3.88 ^{tn}	3.21 ^{tn}	2.56 ^{tn}	1.79 ^{tn}	0.95 ^{tn}	0.00									bcd
Z3P3	25,79	7.16 [*]	3.89 ^{tn}	3.22 ^{tn}	2.57 ^{tn}	1.80 ^{tn}	0.96 ^{tn}	0.01 ^{tn}	0.00								bcd
Z4P1	25,66	7.29 [*]	4.02 ^{tn}	3.35 ^{tn}	2.70 ^{tn}	1.93 ^{tn}	1.09 ^{tn}	0.14 ^{tn}	0.13 ^{tn}	0.00							bcd
Z4P3	25,12	7.83 [*]	4.56 ^{tn}	3.89 ^{tn}	3.24 ^{tn}	2.47 ^{tn}	1.63 ^{tn}	0.68 ^{tn}	0.67 ^{tn}	0.54 ^{tn}	0.00						bcd
Z2P2	24,52	8.43 [*]	5.16 ^{tn}	4.49 ^{tn}	3.84 ^{tn}	3.07 ^{tn}	2.23 ^{tn}	1.28 ^{tn}	1.27 ^{tn}	1.14 ^{tn}	0.60 ^{tn}	0.00					bcd
Z0P1	24,05	8.90 [*]	5.63 [*]	4.96 ^{tn}	4.31 ^{tn}	3.54 ^{tn}	2.70 ^{tn}	1.75 ^{tn}	1.74 ^{tn}	1.61 ^{tn}	1.07 ^{tn}	0.47 ^{tn}	0.00				CDE
Z0P3	21,53	11.42 [*]	8.15 [*]	7.48 [*]	6.83 [*]	6.06 [*]	5.22 ^{tn}	4.27 ^{tn}	4.26 ^{tn}	4.13 ^{tn}	3.59 ^{tn}	2.99 ^{tn}	2.52 ^{tn}	0.00			def
Z1P1	18,41	14.54 [*]	11.27 [*]	10.60 [*]	9.95 [*]	9.18 [*]	8.34 [*]	7.39 [*]	7.38 [*]	7.25 [*]	6.71 [*]	6.11 [*]	5.64 ^{tn}	3.12 ^{tn}	0.00		ef
Z0P2	17,73	15.22 [*]	11.95 [*]	11.28 [*]	10.63 [*]	9.86 [*]	9.02 [*]	8.07 [*]	8.06 [*]	7.93 [*]	7.39 [*]	6.79 [*]	6.32 [*]	3.80 ^{tn}	0.68 ^{tn}	0.00	f

Appendix 12. (Continued)

Table Results Test Carry on Treatment Z And Treatment P with BNT level 0.05

Treatment	Average	Notation
Z0P1	24.05	CDE
Z0P2	17.73	f
Z0P3	21.53	def
Z1P1	18.41	ef
Z1P2	25.80	bcd
Z1P3	27.59	bc
Z2P1	29.68	ab
Z2P2	24.52	bcd
Z2P3	26.75	bcd
Z3P1	29.01	a B C
Z3P2	32.95	a
Z3P3	25.79	bcd
Z4P1	25.66	bcd
Z4P2	28.36	a B C
Z4P3	25.12	bcd

Attachment 13. Analysis Data Percentage Cuttings Life

Stem Length	Test	Z0	Concentration IBA (%)				Z4	Total	Average
			Z1	Z2	Z3	Z4			
P1	1	20.00	20.00	60.00	40.00	40.00	180.00	36.00	
	2	40.00	20.00	20.00	40.00	20.00	140.00	28.00	
	3	40.00	60.00	40.00	40.00	20.00	180.00	40.00	
Sub-Total		100.00	100.00	120.00	120.00	80.00	520.00		
Average		33.33	33.33	40.00	33.33	26.67		33.33	
P2	1	40.00	40.00	40.00	40.00	40.00	200.00	40.00	
	2	40.00	60.00	40.00	60.00	40.00	240.00	48.00	
	3	40.00	20.00	60.00	60.00	40.00	220.00	44.00	
Sub-Total		120.00	120.00	140.00	160.00	120.00	660.00		
Average		40.00	40.00	46.67	53.33	40.00		44.00	
P3	1	20.00	20.00	40.00	20.00	20.00	120.00	24.00	
	2	20.00	40.00	20.00	60.00	20.00	160.00	32.00	
	3	20.00	40.00	40.00	40.00	20.00	160.00	32.00	
Sub-Total		60.00	100.00	100.00	120.00	60.00	440.00		
Average		20.00	33.33	33.33	40.00	20.00		29.33	
Total							1620.00		
		280.00	320.00	360.00	400.00	260.00		36.00	

Long Stem	Z0	Concentration IBA (%)				Z4	Average
		Z1	Z2	Z3	Z4		
P1	33.33	33.33	40.00	40.00	26.67	36.67	
P2	40.00	40.00	46.67	53.33	40.00	45.00	
P3	20.00	33.33	33.33	40.00	20.00	31.67	
Average	31.11	35.56	40.00	44.44	28.89		

Information : P = Stem Length Treatment. P1 = 15cm; P2 = 20 cm; P3 = 25 cm. Z = IBA concentration. Z0 = 0 ppm; Z1 = 100 ppm; Z2 = 150 ppm; Z3 = 200 ppm; Z4 = 250 ppm. Each replication consisted of 5 plants.

1. Degrees Free (db)

$$\begin{aligned}
 \text{Total} & \text{db} = (abr) - 1 = (5.3.3) - 1 = 44 \\
 \text{db Treatment} & = (ab) - 1 = (5.3) - 1 = 14 \\
 \text{db IBA Concentration Treatment} & = (a - 1) = (5 - 1) = 4 \\
 \text{db Treatment Long Stem} & = (b - 1) = (3 - 1) = 2 \\
 \text{db Interaction} & = (a - 1)(b - 1) = (5 - 1)(3 - 1) = 8 \\
 \text{db Error} & = \text{Total db} - \text{db Treatment} = 44 - 14 = 30
 \end{aligned}$$

Appendix 13. (Continued)**2. Factor Correlation (FK)**

$$\begin{aligned}
 \text{FK} &= \frac{\sum Y_{ijk}^2}{abr 1620.00} \\
 &= \frac{5.3.3}{2} \\
 &= 58320.00
 \end{aligned}$$

3. Amount Square (JK)

$$\begin{aligned}
 \text{JK Total (JKT)} &= \sum Y_{ijk}^2 - \text{FK} \\
 &= (20.00^2 + 20.00^2 + \dots + 20.00^2) - 58320.00 \\
 &= 8480.00
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (JKP)} &= \frac{\sum Y_{ij}^2}{r} - \text{FK} \\
 &= \frac{(100.00^2 + 100.00^2 + \dots + 60.00^2)}{3} - 58320.00 \\
 &= 3412.33
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (Z)} &= \frac{\sum Y_{ijk}^2}{br} - \text{FK} \\
 &= \frac{(360.00^2 + 460.00^2 + \dots + 400.00^2)}{5.3} - 58320.00 \\
 &= 1457.78
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (P)} &= \frac{\sum Y_{ij}^2}{ar} - \text{FK} \\
 &= \frac{(520.00^2 + 660.00^2 + 440.00^2)}{3.3} - 58320.00 \\
 &= 1653.33
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Interaction (ZxP)} &= \text{JKP} - \text{JK (Z)} - \text{JK (P)} \\
 &= 3412.33 - 1457.78 - 1653.33 \\
 &= 302.22
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Error (JKG)} &= \text{Jakarta} - \text{JKP} \\
 &= 8480.00 - 3412.33 \\
 &= 5066.67
 \end{aligned}$$

Appendix 13. (Continued)**4. Square Middle (KT)**

$$\begin{aligned}
 \text{Treatment Card (KTP)} &= \frac{\text{JKP}}{\text{db Treatment}} = \frac{3413.33}{14} = 243.81 \\
 \text{KT (Z)} &= \frac{\text{JK (Z)}}{\text{db (Z)}} = \frac{1457.78}{2} = 728.89 \\
 \text{KT (P)} &= \frac{\text{JK (P)}}{\text{db (P)}} = \frac{1653.33}{4} = 413.33 \\
 \text{KT (ZxP)} &= \frac{\text{JK (ZxP)}}{\text{db (ZxP)}} = \frac{302.22}{8} = 37.78 \\
 \text{KT Error (KTG)} &= \frac{\text{JK (G)}}{\text{db G}} = \frac{5066.67}{30} = 168.89
 \end{aligned}$$

5. F-Count

$$\begin{aligned}
 \text{F Calculate Treatment} &= \frac{\text{ID card}}{\text{KT (G)}} = \frac{243.81}{168.89} = 1.36 \\
 \text{F Count (Z)} &= \frac{\text{KT (Z)}}{\text{KT (G)}} = \frac{728.89}{168.89} = 3.25 \\
 \text{F Count (P)} &= \frac{\text{KT (P)}}{\text{KT (G)}} = \frac{413.33}{168.89} = 2.43 \\
 \text{F Calculate (ZxP)} &= \frac{\text{KT (ZxP)}}{\text{KT (G)}} = \frac{37.78}{168.89} = 0.35
 \end{aligned}$$

6. Table Anova

Source Diversity	db	JK	KT	F-count	F-table (0.05)
Treatment	14	3413.33	243.81	1.44 ^{tn}	2.04
Concentration IBA (Z)	2	1457.78	728.89	4.32 [*]	3.32
Long Stem (P)	4	1653.33	413.33	2.45 ^{tn}	2.69
Interaction (ZxP)	8	302.22	37.78	0.22 ^{tn}	2.27
Error	30	5066.67	168.89		
Total	44	8480.00			

Information : * = Significant (F Count > F Table 5%) And Mr. = No Significant (F Count < F Table 5%).

7. Coefficient Diversity (KK)

$$\text{KK} = \frac{\sqrt{\text{KT Error}}}{\text{Average Total}} \times 100$$

Appendix 13. (Continued)

$$\begin{aligned} & \sqrt{168.89} \\ &= \frac{\quad}{36.00} \times 100 \\ &= 36.1 \% \end{aligned}$$

Description: If the Coefficient of Diversity (KK) > 30%, then it must be carried out transformation.

Conclusion : KK = 36.1% > 30%, then mandatory data transformed with $\sqrt{3}$.

Attachment 13. (Continued)**Cubic Transformation**

Stem Length	Test	Concentration IBA					Total	Average
		Z0	Z1	Z2	Z3	Z4		
				(%)				
P1	1	2.71	2.71	3.91	3.42	3.42	16.18	3.24
	2	3.42	2.71	2.71	3.42	2.71	14.98	3.00
	3	3.42	3.91	3.42	3.42	2.71	16.89	3.38
Sub-Total		9.55	9.34	10.05	10.26	8.85	48.06	
Average		3.18	3.11	3.35	3.42	2.95		3.20
P2	1	3.42	3.42	3.42	3.42	3.42	17.10	3.42
	2	3.42	3.91	3.42	3.91	3.42	18.09	3.62
	3	3.42	2.71	3.91	3.91	3.42	17.38	3.48
Sub-Total		10.26	10.05	10.75	11.25	10.26	52.57	
Average		3.42	3.35	3.58	3.75	3.42		3.50
P3	1	2.71	2.71	3.42	2.71	2.71	14.28	2.86
	2	2.71	3.42	2.71	3.91	2.71	15.48	3.10
	3	2.71	3.42	3.42	3.42	2.71	15.69	3.14
Sub-Total		8.14	9.55	9.55	10.05	8.14	45.44	
Average		2.71	3.18	3.18	3.35	2.71		3.03
Total							146.07	
		27.96	28.95	30.36	31.56	27.25		3.25

Long Stem	Concentration IBA					Average
	Z0	Z1	Z2	Z3	Z4	
				(%)		
P1	3.18	3.11	3.35	3.42	2.95	3.27
P2	3.42	3.35	3.58	3.75	3.42	3.53
P3	2.71	3.18	3.18	3.35	2.71	3.11
Average	3.11	3.22	3.37	3.51	3.03	

Information : P = Stem Length Treatment, P1 = 15cm; P2 = 20 cm; P3 = 25 cm, Z = IBA concentration, Z0 = 0 ppm; Z1 = 100 ppm; Z2 = 150 ppm; Z3 = 200 ppm; Z4 = 250 ppm, Each replication consists of 5 plants.

8. Degrees Free (db)

$$\begin{aligned}
 \text{Total} &= \text{db} = (abr) - 1 = (5.3.3) - 1 = 44 \\
 \text{db Treatment} &= (\text{ab}) - 1 = (5.3) - 1 = 14 \\
 \text{db IBA Concentration Treatment} &= (a - 1) = (5 - 1) = 4 \\
 \text{db Treatment Long Stem} &= (b - 1) = (3 - 1) = 2 \\
 \text{db Interaction} &= (a - 1)(b - 1) = (5 - 1)(3 - 1) = 8 \\
 \text{db Error} &= \text{Total db} - \text{db Treatment} = 44 - 14 = 30
 \end{aligned}$$

Appendix 13. (Continued)**9. Factor Correlation (FK)**

$$\begin{aligned}
 \text{FK} &= \frac{\sum Y_{ijk}^2}{abr} \\
 &= \frac{146.07}{2} \\
 &= \frac{5.3 \cdot 3}{2} \\
 &= 474.17
 \end{aligned}$$

10. Amount Square (JK)

$$\begin{aligned}
 \text{JK Total (JKT)} &= \sum Y_{ijk}^2 - \text{FK} \\
 &= (1.30^2 + 1.30^2 + \dots + 1.30^2) - 474.17 \\
 &= 8.32
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (JKP)} &= \frac{\sum Y_{ij}^2}{r} - \text{FK} \\
 &= \frac{(2.71^2 + 2.71^2 + \dots + 2.71^2)}{3} - 474.17 \\
 &= 3.52
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (Z)} &= \frac{\sum Y_{ijk}^2}{br} - \text{FK} \\
 &= \frac{(27.96^2 + 28.95^2 + \dots + 27.25^2)}{3.3} - 474.17 \\
 &= 1.73
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Treatment (P)} &= \frac{\sum Y_{ij}^2}{ar} - \text{FK} \\
 &= \frac{(48.06^2 + 52.57^2 + 45.44^2)}{5.3} - 474.17 \\
 &= 1.37
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Interaction (ZxP)} &= \text{JKP} - \text{JK (Z)} - \text{JK (P)} \\
 &= 3.52 - 1.37 - 1.73 \\
 &= 0.42
 \end{aligned}$$

$$\begin{aligned}
 \text{JK Error (JKG)} &= \text{Jakarta} - \text{JKP} \\
 &= 8.32 - 3.52 \\
 &= 4.80
 \end{aligned}$$

Appendix 13. (Continued)**11. Square Middle (KT)**

$$\begin{aligned} \text{Treatment Card (KTP)} &= \frac{JKP}{db \text{ Treatment}} = \frac{3.52}{14} = 0.25 \\ \text{KT (Z)} &= \frac{JK (Z)}{db (Z)} = \frac{1.37}{2} = 0.68 \\ \text{KT (P)} &= \frac{JK (P)}{db (P)} = \frac{1.73}{4} = 0.43 \\ \text{KT (ZxP)} &= \frac{JK (ZxP)}{db (ZxP)} = \frac{0.42}{8} = 0.05 \\ \text{KT Error (KTG)} &= \frac{JK (G)}{db G} = \frac{4.80}{30} = 0.16 \end{aligned}$$

12. F-Count

$$\begin{aligned} \text{F Calculate Treatment} &= \frac{ID \text{ card}}{KT (G)} = \frac{0.25}{0.16} = 1.57 \\ \text{F Count (Z)} &= \frac{KT (Z)}{KT (G)} = \frac{0.68}{0.16} = 4.27 \\ \text{F Count (P)} &= \frac{KT (P)}{KT (G)} = \frac{0.43}{0.16} = 2.71 \\ \text{F Calculate (ZxP)} &= \frac{KT (ZxP)}{KT (G)} = \frac{0.05}{0.16} = 0.33 \end{aligned}$$

13. Table Anova

Sources of Diversity	db	JK	KT	F-count	F-table (0.05)
Treatment	14	3.52	0.25	1.57 ^{tn}	2.04
Concentration IBA (Z)	2	1.37	0.68	4.27 [*]	3.32
Long Stem (P)	4	1.73	0.43	2.71 [*]	2.69
Interaction (ZxP)	8	0.42	0.05	0.33 ^{tn}	2.27
Error	30	4.80	0.16		
Total	44	8.32			

Information : * = Significant (F Count > F Table 5%) And Mr. = No Significant (F Count < F Table 5%).

14. Coefficient Diversity (KK)

$$KK = \frac{\sqrt{KT \text{ Error}}}{\text{Average Total}} \times 100$$

Appendix 13. (Continued)

$$\begin{aligned}
 &= \frac{\sqrt{3.25}}{0.16} \times 100 \\
 &= 12.32\%
 \end{aligned}$$

Description: If the Coefficient of Diversity (KK) > 20%, then it must be carried out transformation.

Conclusion : KK = 12.32% < 20%, then the data is homogeneous.

15. Test Different Real The smallest (BNT) Treatment Concentration (Z)

$$\text{Sd (Error Standard)} = \sqrt{\frac{2 \cdot 0.03}{4 \cdot 3}} = 0.08$$

b . r

$$t(\alpha, db) = 1.70$$

$$\text{LSD } \alpha = \text{Sd xt } (\alpha, db) = 0.08 \times 1.70 = 0.13$$

Table Results Test Carry on Treatment Single Z with BNT level 0.05

Treatment	Middle Value	Z3	Z2	Z1	Z0	Z4	Notation
		3.51	3.37	3.22	3.11	3.03	
Z3	3.51	0.00					a
Z2	3.37	0.14	0.00				ab
Z1	3.22	0.29	0.15	0.00			a B C
Z0	3.11	0.40	0.26	0.11	0.00		bc
Z4	3.03	0.48	0.34	0.19	0.08	0.00	c

Table Results Test Carry on Treatment Single Z with BNT level 0.05

Treatment	Average	Notation
Z0	3.11	bc
Z1	3.22	a B C
Z2	3.37	ab
Z3	3.51	a
Z4	3.03	c

16. Test Different Real The smallest (BNT) Treatment Long Stem (P)

$$\text{Sd (Error Standard)} = \sqrt{\frac{2 \cdot 0.16}{5 \cdot 3}} = 0.15$$

a . r

$$t(\alpha, db) = 1.70$$

Attachment 13. (Continued)

$$\text{LSD } \alpha = Sd \text{ xt } (\alpha, db) = 0.15 \times 1.70 = 0.25$$

Table Results Test Carry on Treatment Single P with BNT ta raf 0.05

Treatment	Mark Middle	P2 3.53	P3 3.27	P1 3.11	Notation
P2	3.53	0.00			a
P3	3.27	0.26	0.00		b
P1	3.11	0.42	0.16	0.00	b

Table Results Test Carry on Treatment Single P with BNT level 0.05

Treatment	Average	Notation
P1	3.11	b
P2	3.53	a
P3	3.27	b

Attachment 14. Summary Results Research

on Average Shoot Emergence Time Data

Stem Length (cm)	Concentration IBA (ppm)					Average
	0	100	150	200	250	
	(HST)					
15	9.00	8.33	9.33	6.33	11.67	8.25 ^a
20	10.00	11.67	12.00	8.33	12.33	10.50 ^b
25	12.00	12.00	11.33	10.33	13.00	11.42 ^c
Average	10.33 ^b	10.67 ^b	10.89 ^b	8.33 ^a	12.33 ^c	

Data Average Number of Shoots

Long Stem (cm)	Concentration IBA (ppm)					Average
	0	100	150	200	250	
	(shoot)					
15	1.33	1.33	1.00	1.67	1.33	1.33
20	1.33	1.67	1.00	2.33	1.33	1.58
25	1.00	1.33	1.33	2.00	1.00	1.42
Average	1.22 ^b	1.44 ^{bc}	1.11 ^{bc}	2.00 ^a	1.22 ^c	

Data Average Shoot Length

Long Stem (cm)	Concentration IBA (ppm)					Average
	0	100	150	200	250	
	(cm)					
15	10.07 ^g	19.47 ^{bcde}	23.53 ^b	27.20 ^{bcd}	15.18 ^{ef}	20.07
20	13.10 ^{fg}	15.87 ^{def}	19.40 ^{bcde}	33.00 ^a	13.28 ^{fg}	20.34
25	10.10 ^g	21.50 ^{bc}	17.20 ^{bcdef}	21.07 ^{bcd}	14.87 ^{ef}	17.47
Average	11.09 ^d	18.94 ^b	20.04 ^b	27.09 ^a	14.44 ^c	

Data Average Amount Leaf

Long Stem (cm)	Concentration IBA (ppm)					Average
	0	100	150	200	250	
	(strand)					
15	13.33	18.33	16.67	25.33	14.67	18.42
20	17.33	25.33	21.00	28.33	19.33	23.00
25	13.00	16.33	17.33	26.33	14.00	18.25
Average	14.56 ^b	20.00 ^{ab}	18.33 ^b	26.67 ^a	16.00 ^b	

Attachment 15. Documentation Activity Study



Making Growing media



Arrangement *Layout* Study



Sterilization *Greenhouse*



Weighing IBA



Making Solution IBA



Solution IBA 100 ppm



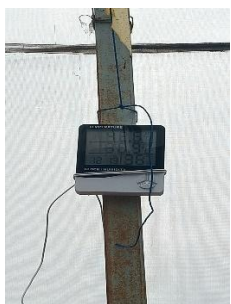
Solution IBA 150 ppm



Solution IBA 200 ppm



Solution IBA 250 ppm



Thermohygrometer Installation



Immersion Stem Cuttings in IBA Solution



Planting



Fertilizer Weighing



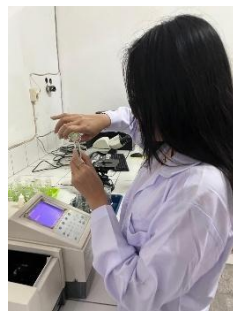
Insecticide Spraying



Fertilization



Observation Parameter



Chlorophyll Test



Harvest



IBA Concentration
Treatment 0 ppm And
Stem length 15 cm



IBA Concentration
Treatment 0 ppm And
Stem length 20 cm



IBA Concentration
Treatment 0 ppm And
Stem length 25 cm



Treatment IBA
Concentration 100
ppm and Length Stem
15 cm



Treatment IBA
Concentration 100
ppm and Length Stem
20 cm



Treatment IBA
Concentration 100
ppm and Length Stem
25 cm



Treatment IBA
Concentration 150
ppm and Length Stem
15 cm



Treatment IBA
Concentration 150
ppm and Length Stem
20 cm



Treatment IBA
Concentration 150
ppm and Length Stem
25 cm



Treatment IBA
Concentration 200
ppm and Length Stem
15 cm



Treatment IBA
Concentration 200
ppm and Length Stem
20 cm



Treatment IBA
Concentration 200
ppm and Length Stem
25 cm



Treatment IBA
Concentration 250
ppm and Length Stem
15 cm



Treatment IBA
Concentration 250
ppm and Length Stem
20 cm



Treatment IBA
Concentration 250
ppm and Length Stem
25 cm

BIOGRAPHY



The author's full name is Kezia Winona Hasugian, born in Palembang on May 15, 2003. The author is the daughter of Mr. Chris Def Gogo Hasugian and Mother Paolina Irwan Budiyo. The author completed his education at SD Sutomo 1 Medan in 2015, SMP Sutomo 1 Medan in 2018 and SMA Sutomo 1 Medan in 2021.

The author continued his education in the Agroecotechnology Undergraduate Program, Department of Agriculture, Faculty of Animal and Agricultural Sciences, Universitas Diponegoro, Semarang. Student activities he has participated in include the Christian Student Association (PMK) as secretary in 2023 and chairman in 2024. The author is also active in many other committees, such as: LKMMPD year 2022, *Leadership Training* year 2023, GORE year 2023, and committee in PMK. The author also became an assistant practical work on eye Biochemistry courses in 2022 and 2023, Fertility and Fertilization Science in 2023 and 2024, Basic Plant Breeding in 2024, Plantation Crop Cultivation in 2024, and assistant courses in Medicinal Plant Production Technology in 2025. The author finished Practice Work Field (street vendor) which titled "Broccoli (*Brassica oleracea L.*) Cultivation Techniques at CV Agroedukasi Caping Merapi, Sleman, Yogyakarta" in 2024.