| | | |
|---|---|---|
| Judul Skripsi | : | Pengaruh Konsentrasi Air Kelapa Dan Air Cucian Beras Dan Lama Perendaman Terhadap Perkecambahan Benih Kacang Hijau (*Vigna radiata* L.) |
| Nama | : | Srimaulinda |
| NPM | : | 168700042 |
| Fakultas | : | Sains dan Teknologi |

Disetujui Oleh

Komisi Pembimbing

Dr. Kiki Nurtjahja, M.Sc
Pembimbing I

Drs. Riyanto, M.Sc
Pembimbing II

Dr. Faisal Amri Tanjung, S.ST, M.T
Dekan

Dra. Sartini, M.Sc
Ka. Prodi/WD I

Tanggal Lulus : 08 Januari 2021

## ABSTRACT

Coconut water is a natural complex compound that is often used as a natural growth regulator. The use of coconut water as organic material is a way to replace the use of synthetic materials in plants. In addition, the benefits of coconut water are also commensurate with synthetic ingredients containing cytokines. So far, rice washing water is considered waste and just thrown away. but actually the washing water still contains carbohydrates, protein and B vitamins which are essential for plant growth. Efforts should be made to use waste into something useful, namely a hormone that is very important in plant growth. The purpose of this study was to determine the effect of coconut water concentration and rice washing water waste and the length of soaking time on the germination of mung bean seeds. Parameters observed were plumule height, number of radicles and radicle length. The treatments given to mung bean seeds were 100 ml of plain water, 10 ml coconut water + 90 ml rice washing water, 20 ml coconut water + 80 ml rice washing water, 50 ml coconut water + 50 ml rice washing water, 90 ml coconut water + 10 ml rice washing water and 80 ml coconut water + 20 ml rice washing water with a soaking time of 2 hours, 4 hours and 6 hours with 3 repetitions. Based on the results of the study, coconut water and rice washing water had an effect on plumule height where the highest plumula was found in the combination (20 ml coconut water + 80 ml rice washing water with 2 hours of immersion). The highest radicle length was found in the combination (10 ml coconut water + 90 ml rice washing water with 6 hours immersion). The highest number of radicles was found in the combination (50 ml coconut water + 50 ml rice washing water with 6 hours immersion).


***Key words:*** *concentration; immersion time; coconut water; rice washing water*

# CHAPTER I
# INTRODUCTION

## 1.1. Background of Study

In Indonesia, rice water has been deemed effluent and discarded. The lack of utilization effort of waste entails an unavoidable impact on the volume of increasing waste every day. Efforts should be made in order to manage waste into a useful form, which is an important hormone for plant growth. According to Moehyi (1992) in (R., 2015), in the process of cooking rice, it should be cleansed repeatedly until clean. Oftentimes, rice water will be dumped due to valueless it has, however, it contains carbohydrates, proteins, and B vitamins which are essential for plant growth. Coconut water is one of several natural complex compounds that are frequently used as natural growth regulators. The use of coconut water as an organic material can replace the use of synthetic materials in plants. It serves as an alternative since coconuts are accessible and affordable, cheaper than synthetic materials which are difficult to obtain and relatively more expensive. Furthermore, the values of coconut water are comparable with synthetic materials containing cytokinins..

Additionally, growth regulators sourced from nature have advantages, including being more eco-friendly, easy to procure, safer, and cheaper. To the report of Lawalata (2011) in (Kusnadi, 2017), ZPT is a non-nutrient

organic compound, which in small amounts can support, inhibit, and change plant physiological processes.

In the opinion of Arif (2016), hormones or plant growth regulators (PGR) are non-nutrient organic compounds that at low concentrations can accelerate, inhibit, and change plant growth or development. The use of natural growth regulators is regarded to be able to accelerate germination as it contains hormones that stimulate plant growth.

The results of the study by Yustisia (2018) show that administering coconut water to potato plantlets with a concentration of 50 ml obtained the highest plant average (7.88 cm), the highest number of leaves (22.67 pieces), and the highest number of roots (21.11 pieces). These results were obtained due to the presence of nutrients in coconut water which facilitated the growth and development of tissues, therefore cells underwent differentiation. The results of the study (Renvillia, 2016) indicate that the application of coconut water on teak stem cuttings using a concentration of 100% and soaked for 5 hours had a significant effect on shoot length (3.35 cm), high number of roots (3.57 pieces), and shoot diameter (0.34 cm). This occurred because coconut water is a natural ingredient containing cytokinin activity for cell division and encouraging organ formation. The content of cytokinin and auxin hormones in coconut water is reckoned to be the cause of the increase in several growth parameters of teak stem cuttings.

One of the organic materials that can be utilized in the cultivation of bean sprouts is rice water. The results of the study (Bahar, 2016) show that the best rice

water treatment was able to provide the highest plants on land *kangkong* (water spinach), specifically at the age of 2 WAP with a concentration of 1.5 liters, obtaining a height of (7.40 cm), the highest number of leaves (5.73 strands), the longest leaf (4.27 cm), and the highest fresh weight (1.00 g). This is presumably because the rice water contains Plant growth regulators (PGRs) and phosphorus. As yet, rice water is disregarded regardless of the content of various important nutrients for plant growth such as carbohydrates, protein, and B vitamins.

Based on the rich nutritional content of coconut water and rice water waste, both have the potential as natural hormones, therefore research with the title "the effect of the concentration of coconut water and rice water and seed soaking time on the germination of mung beans (Vigna radiata L.)" is necessarily conducted.

### 1.2. Problem of Study

Effect of concentration of coconut water and rice water and seed soaking time on the germination of mung beans.

### 1.3. Objective of Study

To determine the effect of concentration of coconut water and rice water and seed soaking time on the germination of mung beans.

### 1.4. Significance of Study

The results of this study are expected to provide information to the public regarding the use of coconut water and rice water based on the concentration and duration of seed soaking time which are used as natural hormones for the germination of mung beans.

# CHAPTER II
# LITERATURE REVIEW

## 2.1. Definition of Hormones

Phytohormones and plant growth regulators play significant roles in plant growth and development. These growth regulators are divided into 5 main groups; auxins, cytokinins, gibberellins, abscisic acid, and ethylene (Prihatini, 2017). Plant growth regulators are non-nutrient organic compounds that at low concentrations can promote, inhibit or qualitatively change plant growth and development. There are natural and synthetic plant growth regulators that are commonly applied to plants. Natural plant growth regulators are obtained from young plant tissues, including mung bean sprout extract, coconut water, and so on (Arif, 2016).

Research conducted by Purniawati (2015) discovers that administering rice water with a concentration of 0.75 l/plant and coconut water every 9 days to rubber seedlings produced the largest diameter (0.78 cm) and the most leaves (15-16 strands). This is presumably because the content of cytokinins and auxins contained in young coconut water and element K in rice water was able to stimulate the growth of eye stumps of rubber seedlings in cell division, as well as the content of element N that could affect leaf growth. The results of the study (Tustiani, 2017) show that allowing 200 grams of red onion extract in coffee plants could grow coffee cuttings by 50%.

## 2.2. Coconut Water Content

A study carried out by Arif (2016) reveals that coconut water contains the hormones gibberellins, auxins, and cytokinins. Gibberellins function to activate shoots and seed dormancy. Gibberellins stimulate the activity of hydrolytic enzymes, especially α amylase which hydrolyzes starch into glucose compounds. Glucose is the main component in the respiration process. This process is very important because respiration will produce energy used for the cell division process and shoot growth. Auxin functions as the formation of roots and shoots, cell division, and elongation which will increase plant activity so as to encourage shoots to appear sooner. Cytokinins play a role in cell division and accelerate the growth of shoots and stems. According to Savitri (2005) in (Sulistiyorini, 2012), coconut water generally used is procured from young coconut whose flesh is easily scraped off. Coconut water comprises gibberellins (0.460 ppm GA3, 0.25 ppm GA5), cytokinins (0.44 ppm kinetin, 0.247 ppm zeatin), and auxins (0.237 ppm IAA).

Coconut water can increase plant growth. Coconut water is a liquid endosperm of coconut fruit containing biologically active compounds. Coconut water is sterile natural water and reserves high potassium, energy, and chlorine (Yudirachman, 2016). Coconut water accommodates macro elements in form of nitrogen and carbon, as well as microelements which are essential to the body. The nitrogen element is a protein composed of amino, while the carbohydrate content in coconut water includes glucose, sucrose, fructose, sorbitol, inositol, and others. The microelements in coconut water are

vitamin C, nicotinic acid, folic acid, pantothenic acid, biotin, and riboflavin. Additionally, coconut water in particular is rich in potassium (potassium). Coconut water has long been known as a source of growth substances, namely cytokinins (Yudirachman, 2016).

The taxonomy of coconut is classified into kingdom *Plantae*, subkingdom *Tracheobionta*, subdivision *Spermatophyta*, division *Magnoliophyta*, class *Liliopsida*, subclass *Arecidae*, order *Palmales*, family *Palmae*, genus *Cocos*, and species *Cocos nucifera*. Coconut plants are perennial; can reach an age of more than 50 years and even live 80-100 years. Coconut plant morphology encompasses root, stem, leave, flower, and fruit (Yudirachman, 2016).

### 2.3. Rice Water Content

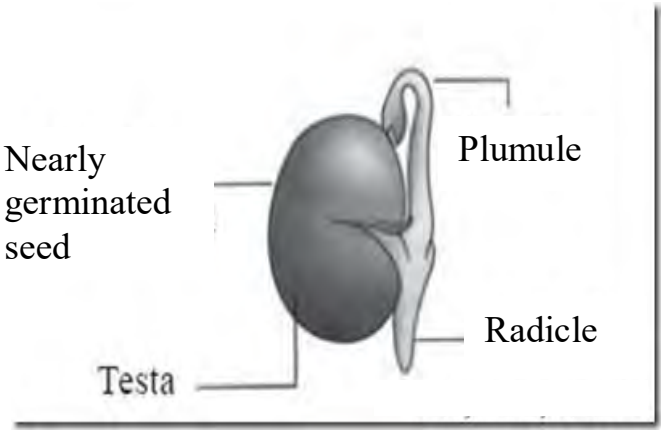
Rice water is effluent produced before cooking rice. According to Yulianingsih (2017), applying a dose of 1000 ml of rice water resulted in the highest fruit weight of 69.17 grams. This is apparently because rice water incorporates phosphorus which forms fruits and encourages plants to ripen properly.

A study by Wati (2017) shows that tomato plants that were treated with rice water in a volume of 60 ml yielded the highest plant (94.38 cm), the most leaves (196.33 strands), and the highest fruit weight (229.28 grams). This is because rice water has a high carbohydrate content, which can be an intermediary for the formation of the hormones auxin and gibberellins.

The auxin hormone is then used to stimulate shoot growth and the development of new shoots, including the increase in the number of leaves, while gibberellins are useful for stimulating root growth. Rice water also contains sulfur which has a role in protein synthesis and is part of the amino acids cysteine, biotin, and thiamine. Sulfur assists stabilize protein structure, oil synthesis, and chlorophyll formation, and reduces the prevalence of disease attacks in the plant body. Simultaneously, rice water entails benefits for the environment and the soil. Rice water can be used as an element of organic fertilizer that can add nutrients. Water-based fertilizers allow plants to absorb it easily so that plants will yield optimal production (Wati, 2017).

### 2.4. Germination

Seed germination is the initial form of an embryo that will develop into a perfect tiller. In germination, seeds always experience growth and development (Romadloni, 2018). Sprouts are also defined as a small growth of plants that emerged from seeds and their lives depend on the food supply contained in the seeds. sprouts will grow and develop into seedlings or seeding, which in the next stage will grow into full-grown ones (Hasanah, 2018).




Source: http://lh3.googleusercontent.com/-TV9McfOI JQ/VfPRwTTRGPI/AAAAAAAAAPg/W6Kn3Z9Akqo/Perkecambahan_thumb.png?imgmax=800

Figure 1. The structure of sprout

According to Tampubolon (2016), it is necessary to treat the seeds prior to germination which aims to break the seed dormancy. Scarification is used to overcome embryo dormancy. Scarification is one of the pre-treatment efforts or initial treatment of seeds to break dormancy and accelerate uniform seed germination.

Germination involves four processes; imbibition, formation of enzyme systems, seed growth, and development until they emerge from the soil surface. At the beginning of seed preparation, sorting the seeds is done by soaking them in water. Damaged seeds will float on the surface of the water. During this process, water imbibition occurs in the mung bean seeds. Imbibition allows seeds to expand, break their cover and trigger metabolic changes in the embryo that cause the seed to grow. The enzymes will digest the materials stored in the

endosperm or cotyledons. The first organ to emerge from the germination process is the radicle or embryonic root. In most dicotyledons, the hypocotyl grows resembling a hook and its growth will push the hook above the soil surface. Hypocotyl with light stimulation will grow straight up elevating cotyledons and epicotyl. The epicotyl then spreads its first leaves which expand and become green. Cotyledons will wither and fall off because food reserves have been exhausted (Sofi, 2014).

According to Mudadina (2006) (Hasanah, 2018), two factors affect seed germination, namely:

1. Seed conditions include seed maturity, mechanical and physical damage, and seed moisture content.
2. Seed external factors include temperature, light, oxygen, relative humidity, and surrounding air composition. External factors are closely related to the disintegration of hormones functioning in germination.

Mung bean sprouts are one of the food products that are widely consumed by the community. Besides being famous in the culinary field, bean sprouts also have good content for the body. According to Astawan (2005) in (Nur, 2018), vitamins found in mung bean sprouts are vitamins A, C, E, K, and B6, thiamine, riboflavin, niacin, pantothenic acid, folate, choline, and β - carotene. The minerals found in bean sprouts are calcium (Ca), iron (Fe), magnesium (Mg), phosphorus (P), potassium (K), sodium (Na), zinc (Zn), copper (Cu), manganese (Mn) and selenium (Se). Essential amino acids in bean sprouts

include tryptophan, threonine, phenylalanine, methionine, lysine, leucine, isoleucine, and valine. Sprouts also provide benefits for the body, including antioxidant substances that can slow down the aging process and inhibit cancer cells. Sprouts are also found beneficial for beauty, helping rejuvenate the skin and smoothing the skin, diminishing dark spots on the face, and treating acne.

# CHAPTER III
# RESEARCH METHODS

## 3.1. Time and Site

This research was conducted at the Biology Laboratory of the Universitas Medan Area from June to July 2020.

## 3.2 Sampling Location

Sampling for coconut water was carried out at the marketplace selling coconut ice as a beverage located in Stabat. Meanwhile, sampling for rice and mung bean seeds was procured from one of the wholesalers located on Jalan Letda Sujono.

## 3.3. Method

This study used an experimental method, the coconuts were those green as much as 2,250 ml for 6 treatments and 3 replications. The coconut water samples were extracted from young coconut with the age of ± 3 months old. Subsequently, it was filtered using filter paper and was ready to use (Pangesti, 2015). Rice water was taken from Setra Ramos rice as much as 2.250 ml for 6 treatments and 3 replications. The rice water used is the first rinsed rice water (Zistalia, 2018).

### 3.4. Research Procedure

#### 3.4.1. Raw Material Preparation and Seed Soaking

Mung bean seeds were obtained from one of the wholesalers located on Jalan Letda Sujono. The seeds used in the study were initially sorted out by soaking the seeds in distilled water for 10 minutes, the afloat seeds were discarded and the submerged seeds were taken for germination (Anggreani, 2017). Seeds were selected according to the nearly same size and shape. Five seeds for each treatment were prepared (Romadloni, 2018). The total treatment consisted of 54 treatments and the total seeds used were 270 green beans. The selected seeds were then soaked in various treatments that had been prepared. Plain water as much as 900 ml was prepared as a control. Coconut water and rice water were also provided as much as 2.250 ml and 2.250 ml, respectively. Each sample was placed into a plastic cup with 6 treatments and 3 replications consisting of:

A1 : 100 ml plain water

A2 : 10 ml coconut water + 90 ml rice water

A3 : 20 ml coconut water + 80 ml rice water

A4 : 50 ml coconut water + 50 ml rice water

A5 : 90 ml coconut water + 10 ml rice water

A6 : 80 ml coconut water + 20 ml rice water
(Rahayu, 2015).

Then, mung bean seeds were soaked for soaking times of 2 hours, 4 hours, and 6 hours (Simangunsong, 2017)

### 3.4.2. Preparation of Planting and Planting Media

The plastic cups were prepared in 54 pieces in this study. The mung bean seeds soaked in various concentrations and times were then placed in a plastic cup covered with a damp tissue, preserved moist by spraying water as necessary, and placed in a dark room. Then the green bean seeds started to germinate 1-3 days later (Safitri, 2019). Sprouts growing in this test's power were measured for the parameters, comprising:

- Height of the plumule (stem); the measurement of stem height was carried out on the sample by measuring from the base of the stem to the highest part of the leaf using a ruler (Enita, 2019) Measurements were carried out 8 times at the age of 0, 1, 2, 3, 4, 5, 6 and 7 days.
- The number of radicles (roots) was conducted by counting the number of roots (Prasetyo, 2014). The calculation was carried out 8 times at the age of 0, 1, 2, 3, 4, 5, 6, and 7 days.
- The length of the radicle (root) was measured using a ruler; measurements were made from the base to the tip of the root. The unit used is a centimeter (cm) (Romly, 2018). This step was carried out 8 times at the age of 0, 1, 2, 3, 4, 5, 6, and 7 days.

Observations were made when the plants aged 0, 1, 2, and 3 days. Parameters measured encompass stem height, stem diameter, number of roots, and root length.

### 3.5. Data Analysis

The data obtained were then analyzed using a factorial randomized block design. This research consists of two factors, namely factor A, including:

A1 : 100 ml plain water

A2 : 10 ml coconut water + 90 ml rice water

A3 : 20 ml coconut water + 80 ml rice water

A4 : 50 ml coconut water + 50 ml rice water

A5 : 90 ml coconut water + 10 ml rice water

A6 : 80 ml coconut water + 20 ml rice water
(Rahayu, 2015).

Meanwhile, factor B is the seed soaking time, namely 2 hours, 4 hours, and 6 hours (Simangunsong, 2017).

# CHAPTER V
# CONCLUSION AND SUGGESTION

## 5.1. Conclusion

Based on the results of the research above, it can be concluded that:

1. Coconut water and rice water affected plumule height, in which the highest plumule height was found in the A3B1 combination (20 ml coconut water + 80 ml rice water with 2 hours of soaking time) and the lowest plumule height was in the A1B2 combination (100 ml plain water with 4 hours of soaking time).
2. Coconut water and rice water affected radicular length, in which the highest radicle length was found in the A2B3 combination (10 ml coconut water+ 90 ml of rice water with 6 hours of soaking time), and the lowest radicle length was found in the A1B1 combination (100 ml of plain water with 2 hours of soaking time).
3. Coconut water and rice water affected the number of radicles, in which the most number of radicles was found in the A4B3 combination (50 ml coconut water + 50 ml rice water with 6 hours of soaking time) and the least number of radicles were found in the A2B1 combination (coconut water 10 ml + 90 ml of rice water with 2 hours of soaking time).

## 5.2. Suggestion

Based on the research that has been carried out, the author suggests that it is necessary to carry out further research on natural hormones from coconut water and rice water on the germination of other seeds, and it is required to retest using concentrations in the research that has been conducted.