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RUBBER PLANT GROWTH RESPONSE (HEVEA BRASILIENCY) ON PROVISION OF LOCAL MICROORGANISMS OF BANANA SKIN AND EGG SHELLS IN NURSERY

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Abstract

The aim of this study was to examine the Growth Response of Rubber Plants (Hevea Brasiliency) to the Provision of Local Microorganisms in Banana Peel and Egg Body in Nursery. The data obtained in the field are then analyzed statistically with variance and if the results are significantly different then it is continued by using Duncan's Distance Test. This study used a factorial Randomized Block Design (RAK) with 2 (two) factors. The results of this study showed that the application of banana peel mole had a significant effect on the growth of rubber plant height at 8 WAP, the provision of egg shells did not significantly affect all parameters observed, the interaction of giving banana peel mole and egg shell did not significantly affect all parameters observed.

Keywords: Growth Response, Microorganism Provision

INTRODUCTION

A. Background

Rubber is believed to be named after Joseph Priestley who in 1970 discovered that dried latex could erase pencil writing. When rubber was brought to England, he observed that it could erase pencil marks on paper. This is the beginning of the name rubber in English. In its place of origin, in Central and South America, rubber has been collected for a long time. The Mesoamerican civilization used rubber from Castilla elastic. The ancient Central Americans used rubber balls in their game (see Mesoamerican ball game). According to Bernal Diaz del Castillo, the Spanish Conquistadors were amazed at the reflection of the Aztec rubber ball and thought that the ball was possessed by a demonic spirit. In Brazil local people make waterproof clothes from rubber.

Indonesia has great potential to become a major producer of rubber plantations in the coming decades. Based on the 2007 IRSG (International Rubber Study Group) study, it is predicted that the world's natural rubber production will reach around 13 million tons by 2035 and Indonesia will become the largest natural rubber producing country with a production of around 4 million tons. Indonesia's potential to become a major producer of natural rubber in the world can be realized through increased productivity (Kadir, 2014).

Wrong One effort that is made in farming without using chemicals that will damage the environment is the use of local microorganisms (Moles). A technology from a forgotten past has been unearthed again. Plant fertilizers utilize local micro bio organisms towards environmentally friendly agriculture and free from chemical fertilizers and drugs. Mol material

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is easy to find in Indonesia and easy to process. In addition, Mole can save 20-25% of the total production cost. Mole is a microorganism that is used as a starter in the manufacture of solid organic fertilizer and liquid fertilizer. The main ingredients of Mole consist of several components, namely: carbohydrates, glucose and a source of microorganisms as the basic material for solution fermentation. Moles can come from agricultural products, plantations, or household organic waste. Carbohydrates as a source of nutrition for microorganisms can be obtained from organic waste, rice washing water sprits, cassava, wheat, elephant grass, and other leaves. Sources of microorganisms come from rotten fruit skins, shrimp paste, golden snails and stale rice (Aseph, 2013).

Banana peels contain large amounts of water, reaching 68.90%, the second element contained in banana peels is quite large, namely carbohydrates by 18.50%. The rest consists of protein, iron and other nutrients. Banana peel contains 15% potassium and 12% phosphorus which are high enough to be used as fertilizer. Banana peel mole fertilizers are potential sources of potassium fertilizer with a K2O content of 46.5% dry matter. Besides containing potassium and phosphorus, banana peels also contain magnesium, sulfur and sodium. Potassium is a micro nutrient that helps the formation of proteins, carbohydrates, sugars and helps transport sugar from leaves to fruit, strengthens plant tissues and increases resistance to disease (Suci Ramadani, 2012).

Based on the results of research on liquid organic fertilizer from kepok banana peels conducted by Rambitan (2013), it showed that liquid organic fertilizer banana peels had a significant effect on plant growth parameters of elephant variety peanut, a dose of 250 ml of fertilizer showed the best results for the average stem height, number of leaves and wet weight of peanut plant pods.

Results Ryan's research (2012), showed that in his research, the highest chili plant height was produced by treatment with organic fertilizer containing dried eggshell extract. This is because the dried eggshell extract contains Calcium (Ca) which is a nutrient needed by plants other than N, P, Mg and Fe.

Likewise, the results of Isniati's research (2009), show that in composted fertilizers with the addition of eggshell flour, the average percentage of NPK is N 0.675%, P 49.553%, K 0.76%. The eggshell content shows that a good quality eggshell from the outer layer contains about 2.2 grams of potassium carbonate. About 95% of dry egg shells contain calcium carbonate with a weight of 5.5 grams. Egg shells also contain 0.3% phosphorus containing micro elements (magnesium, sodium, potassium, zinc, manganese and copper) as much as 0.3% (Nurjayanti, et al, 2012).

B. Problem Formulation

In order to increase as well as fulfil the need for good and quality rubber, various efforts must be made. So that efforts to increase rubber seedlings can be fulfilled, several factors must always be considered that affect their life and growth. One of them by utilizing local microorganism’s banana peel and egg shells.

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The reason for using banana peel waste as the main ingredient for making liquid organic fertilizer is because banana peel waste has benefits for growth, accelerating flowering and seeding in plants. One of the advantages of liquid fertilizer is that it is more effective and efficient when applied to leaves, flowers and stems. Banana peel contains carbohydrates, fats, proteins, 15% protein, 2% phosphorus, iron, B vitamins, vitamin C and water. One of the good ingredients for plants is the content of potassium and phosphorus which are good for growth, flowering and seeding (Machodania, et al, 2015).

While egg shells are waste that can be used to meet the needs of plants. The main content in egg shells is calcium carbonate by 90%. Calcium carbonate is an important nutrient needed by plants to grow healthy because calcium plays a role in strengthening plants, stimulating root growth, and for thickening cell walls and seed formation (Butcher and Richard, 2012).

C. Research Aims and Objectives

1. Research Purpose

To obtain one of the local mole doses of banana peel and egg shell dosage levels that can produce the best growth of rubber (Hevea brasilinsis Muel Arg) seedlings.

2. Research Objectives

To obtain one local mole dose of banana peel and eggshell dose level and the best combination between one local mole dose of banana peel and eggshell dose level that can produce the best growth of rubber plant seeds (Hevea brasilinsis Muel Arg).

D. Research Use

1. Scientific aspect

As one of the requirements to complete undergraduate studies (S1) at the Faculty of Agriculture, Al-Washliyah University, Medan.

2. Practical aspect

As information material for the general public in the cultivation of rubber plants and for students who need it

LITERATURE REVIEW/FRAMEWORK/HYPOTHESES

A. Literature Review

2.1. Plant Botany

The classification of rubber plants (Hevea brasiliensis Mul Arg) is as follows:

Kingdom : Plantae
Division : Spermatophyta
Class : Dicotyledonae
Order : Euphorbiales

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Family : Euphorbiaceae

Gnus : Hevea

Species : Hevea brasiliensisMuel Arg (Basuki and Tjasadihardja., 2012).

2.2. Plant Morphology

1. Root

Rubber plants have roots consisting of taproots, lateral roots attached to taproots and fibrous roots. In plants that are 3 years old, the taproot depth reaches 1.5 meters, when the plant is 7 years old; the taproot has reached a depth of more than 2.5 meters. In loose soil conditions, the taproot has reached a depth of 40-80 cm. Lateral roots function to absorb water and nutrients from the soil. In fertile soil fibrous roots are still found to a depth of 45 cm. Fibrous roots will reach a maximum number in spring and in autumn reach a minimum number (Basuki and Tjasadihardja, 2012).

2. Trunk

Rubber plants are trees that grow tall and have fairly large trunks. Mature tree height reaches 15-25 meters. Rubber plant stems usually grow straight and have high branches. Some rubber trees have a tendency to grow slightly tilted. The stems of this rubber plant contain a sap known as latex (Setiawan and Andoko, 2015).

3. Leaves

The kart leaves are alternate; the petiole is long and consists of 3 leaflets that are shiny and smooth. Ptiola thin, green, 3.5 – 30 cm long, short-stemmed leaflets that are oblong or oblong in shape, narrow and tense base, pointed tip, dark green upper side and slightly bright underside, 3 – 35 long cm and 2.5-12.5 cm wide (Sianturi, 2015).

4. Flowers

Flower Rubber consists of male and female flowers that are found in rare parasol panicles. At the tip of the leaf there are five narrow canopies. The flower markings are 4-8 mm long; the female flowers are hairy, slightly larger than the male flowers and contain three ovules. Male flowers have ten stamens arranged into one pole. The anthers are divided into 2 compositions and are arranged higher than the others (Marsono and Sigit, 2016).

Flower this compound is found at the ends of leafy twigs. Each garland is branched. The female flowers grow at the ends of the branches, while the male flowers are found in all parts of the bouquet. The number of male flowers is much more than the female flowers. Flowers form yellow "bells". The size of the female flower is larger than the male flower. When the female flower opens, a pistil with three pistil stalks will appear. Male flowers when ripe will release yellow pollen. Rubber flowers have an attractive smell and color with a slightly sticky pollen and pistil (Marsono and Sigit, 2016).

5. Fruit

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Rubber fruit has a clear division of space. Each room is spherical. The number of spaces is usually three, sometimes up to six. The diameter of the fruit is about 3-5 cm. when it is ripe, the fruit will burst by itself. This seed splitting is related to the natural reproduction of rubber plants, namely the seeds are thrown far away and will grow in a supportive environment (Marsono and Sigit, 2016)

2.3. Growing Conditions

1. Climate

Rubber plants are tropical plants that grow LS and LU. This plant grows optimally in the lowlands of 0-200 meters above sea level. The higher the location, the slower the growth and the lower the latex yield. An altitude of more than 600 meters above sea level is not suitable for the growth of rubber plants (Anggraini, 2015).$15^0 15^0$ Bulk Annual rainfall that is suitable for rubber plant growth is not less than 2000 mm, optimally between 2000-4000 mm/year, ie at an altitude of up to 200 meters above sea level. For good rubber growth requires a temperature between C and an average temperature of C. Wind also affects the growth of rubber. Strong winds in certain seasons can cause damage to rubber plants from certain clones that are sensitive to strong winds (Anggraini, 2015).$25 - 35^0 28^0$

The appropriate relative humidity (RH) for rubber plants is on average between 75-90%. The duration of irradiation and the intensity of sunlight greatly determine plant productivity. In areas with less rain, the limiting factor is the lack of water, preferably in areas that have less rain. Too much rain, sunlight is a limiting factor, in a day rubber plants need sunlight with a high enough intensity between 5-7 hours. Strong winds can cause broken stems, branches or fallen (Sianturi, 2015).

2. Land

Various types of soil can be adapted to the conditions for growing rubber plants, both young and old volcanic soils and even peat soils < 2 m. volcanic soil has good physical properties, especially structure. Texture, water depth, aeration and drainage, but generally poor chemical properties due to low nutrient content. Alluvial soil is usually quite fertile, but its physical properties, especially drainage and aeration, are not good (Anwar, 2016).

Rubber plants are plantation crops that have a fairly high tolerance for soil fertility. This plant does not demand soil fertility that is too high. This plant can still grow well in the pH range of 3.5-7.5. However, rubber plants will produce maximum on fertile soil with a pH between 5.0-60 (Setiawan, 2015)

2.4. Local Microorganisms Banana Peel

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Banana peel is a waste that pollutes the air because it causes unpleasant odors and reduces the beauty of the environment. In essence, organic waste such as banana peels can be used as organic fertilizer because it provides nutrients for plants. Timan (2012) stated that banana peel waste is an organic substance that can be used for composting. The content in banana peel is 82.12% water content, 7.32% organic C, 0.21% total nitrogen, 35% C/N ratio, 0.07% P2O5 and 0.88% K2O. In addition to the banana peel, the part of the banana plant that can be used as fertilizer is the banana weevil. Banana hump contains nutrients and microbes needed by plants. According to the Indonesian Directorate of Nutrition, 1981 in Rukmana (2014), states that the nutrients contained in the banana hump are 43 calories, 00 cal, 0.35 gram protein, 11.60 gram carbohydrate, calcium 15.00 gram, phosphorus 60.00 gram, iron 0.50 gram, vitamin B1 12.00 gram, vitamin V 86.00 mg, water 86, 00%, 100% edible portion. The nutritional content in the banana weevil also has the potential to be used as a source of local microorganisms because the nutritional content in the banana weevil can be used as a food source so that the microbes develop properly. Microbes that develop in the roots will affect the absorption of nutrients, Aspergillus nigger, and Azotobacter Sp (Timan, 2012). The nutritional content in the banana weevil also has the potential to be used as a source of local microorganisms because the nutritional content in the banana weevil can be used as a food source so that the microbial microbes develop properly. Microbes that develop in the roots will affect the absorption of nutrients, Aspergillus nigger, and Azotobacter Sp (Timan, 2012). The nutritional content in the banana weevil also has the potential to be used as a source of local microorganisms because the nutritional content in the banana weevil can be used as a food source so that the microbes develop properly. Microbes that develop in the roots will affect the absorption of nutrients, Aspergillus nigger, and Azotobacter Sp (Timan, 2012).

2.5. Egg Shell

Egg shells also include organic waste that has not been managed properly. Egg shells contain 97% calcium carbonate and contain an average of 3% phosphorus and 3% magnesium, sodium, potassium, zinc, manganese and copper. Egg shell contains 0.121% potassium, 8.977% calcium, 0.394% phosphorus and 10.541% magnesium. This large enough calcium content in eggshells is used as organic fertilizer for plants (Aditya, 2014). Utilization of waste banana peels and eggshells as raw materials for making liquid fertilizer is one of the waste management efforts in accordance with Government Regulation of the Republic of Indonesia Number 81 of 2012 concerning the management of household waste and similar household waste.

The essential element as a limiting element in plant growth other than phosphate and potassium is nitrogen. Nitrogen is a major nutrient for plant growth. Nitrogen is needed for the formation or growth of vegetative plant parts such as leaves, stems and roots.

The contribution of N nutrients is obtained by adding macroalgae such as G. gigas. Research conducted by Zahra (2014) shows that G. gigas contains nutrients N, P and K with very high criteria, namely N of 1.082%, P of 0.046% and K of 1.071%. Another reason for choosing the addition of G.gigas liquid organic fertilizer in addition to the high N, P and K content, this macroalgae also has a soft, gel-like thallus substance that has a high enough ability to absorb and store water.

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The ability of this G.gigas which is found in liquid organics in addition to its high N, P and K content, this macroalgae also has a soft, gel-like thallus substance which has a high enough ability to absorb and store water, also this G.gigas can add fertilizer moisture, where the moisture of organic matter will help the soil as a growing medium to optimize plant growth. The combination of banana peel, eggshell and G. gigas is expected to produce liquid organic fertilizer with high N, P and K content as essential elements needed for plant growth (Anonymous, 2018)

2.6. Mechanism of Nutrient Absorption through Roots and Leaves

Mass flow (mass flo) is the movement of nutrients or ions that are transported with water in the flow process due to transpiration, so together with water because of the difference in water pressure with the atmosphere so that water moves a lot in plants causing the transport of nutrients such as Ca, , sulfate and magnesium to roots from areas out of reach of water. This process has an important role for ions with high concentrations in soil solution, for example and (Abdi, et al, 2015).$NO_3NO^3Ca^{++}$

Diffusion, is the transportation of nutrients or ions that occurs due to the movement of heat due to differences in concentration (from a high to low concentration environment), so the distance from the soil solution to the roots is very important.

Root interception or exchange through contact or direct contact, is the movement of nutrients or ions from the complex in the soil, directly to the root surface (cell wall) without going through the solution phase (Nasution et al., 2014).

Leaves have mouthparts known as stomata. Most of the stomata are located on the underside of the leaf. This leaf mouth serves to regulate the evaporation of water from the plant so that water from the roots can reach the leaves. When the air temperature is too hot, the stomata will close so the plant will not dry out. It is better if the air is not too hot, the stomata will open so that water on the leaf surface can enter the leaf tissue by itself, and the nutrients in the leaves will enter the leaf tissue (Sutarta, 2015).

The mechanism of nutrient uptake through leaves occurs due to diffusion and osmosis through the stomata holes, so the mechanism is related to the opening and closing of stomata. The opening of the stomata is a mechanical process that is regulated by the turgor pressure itself which is directly proportional to the carbon dioxide content of the space under the stomata. Increased turgor pressure of stomata plants along with water (Amalia, 2016)

B. Framework of Thought

To increase the success in breeding a plant, it can be done by using organic materials in the nursery process, which can support the growth of seedlings so that better quality seeds are obtained. Provision of local micro-organisms banana peel and egg shell is one of the organic materials that need to be tried to be able to provide nutrients for the growth of rubber seedlings.

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So far, the doses of local micro-organisms used for banana peels and egg shells are still varied, where high doses do not necessarily produce quality rubber seeds, as well as at doses that are too low.

In addition, good plant growth can be achieved by creating plant growth media, especially conditions for good soil physical properties for roots. Soil maintenance by giving local microorganism's banana peels and egg shells is an effort to maintain soil fertility. For this reason, it is necessary to find the optimal dose which is used to produce quality rubber seeds both in terms of quality and quantity. Therefore, in this study, the dose of kepok banana peel fertilizer used was a different concentration from the research by Rambitan (2013), namely 75 ml and 150 ml. The choice of concentration is due to the differences in the plants used so that the dose of fertilizer needed by the plants will certainly vary.

C. Hypothesis

1 It is suspected that there is one level of local microorganism of banana peel that can provide optimal growth of rubber plant seeds.
2 It is suspected that there is one level of egg shell that can provide optimal growth of rubber plant seeds
3 It is suspected that there is a combination of local microorganism levels of banana peel and egg shell that can provide optimal growth of rubber plant seeds

RESEARCH MATERIALS AND METHODS

A. Place and Time of Research

The research was conducted in the farmer's garden on Jalan Eka Suka 11, Pangkalan Mansur Village, and Medan Johor District with an altitude of ± 15 meters above sea level. The research period will start from April to June 2020.

B. Materials and Tools

The materials used in this study were GT 260 rubber seed, banana peel mole, egg shell, sand, top soil, polybag, fungicide Dithe M-45 and insecticide Sevin 85 EC. While the tools used are plastic barrels, machetes tripe, chord, hoe, rake, gembor, hand sprayer, analytical scale, schalifer, meter, marker, raffia rope, bamboo and stationery.

C. Research Design

This study used a factorial randomized block design (RAK) with 2 (two) factors studied, namely:

Factor I: Giving Mole of banana peel (M) consists of 3 levels, namely:

M_o= Control

= 75 ml/0.5 litters of water/polybag M_1

= 150 ml/litter of water/polybag M_2

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Factor II: Giving egg shells (T) consists of 4 levels, namely:

= ControlT_o

= 100gr /polybag T_1

= 200gr /polybag T_2

= 300gr /polybag T_3

The number of treatment combinations is 3 x 4 = 12 combinations, namely:

$M_oT_oM_1T_oM_2T_o$

$M_oT_1M_1T_1M_2T_1$

$M_oT_2M_1T_2M_2T_2$

$M_oT_3M_1T_3M_2T_3$

Number of repetitions : 3test

Number of trial plots : 36plot

Number of plants per plot : 4plant

Number of sample plants per plot : 3plant

Total sample plants : 108plant

Total number of plants : 144plant

Plot size : 50cm x 50cm

Distance between plots : 30 cm

Distance between tests : 50 cm

The linear model that it is assumed that the factorial randomized block design (RAK) in this study is:

$$Yijk = + pi + j + k + (\alpha\beta)jk + ijk$$

Where:

Y ijk = the result of the observation of the M factor at the k-th level and the T factor in the i-th test

□ = Middle value effect

pi = Effect of block at level i

j = Effect of factor M on j. level

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k = Effect of the T factor on the k-th level

(αβ) jk = The effect of the combination of factor M at the j-th level and T-factor at the k-th level

ijk = The error effect of the M factor at the j-th level and the T-factor at the k-th level in the i-th test

D. Research Implementation

1. Land Preparation

Area First, the plants are cleaned of nuisance plants evenly by using a tripe machete and a hoe.

2. Seed Selection

Seed selection is very important before we start farming, because if the seeds are not selected beforehand, this will increase our chances of failure in crop cultivation.

3. Filling Polybags and Planting Sprouts into Polybags

The polybag is first filled with top soil and sand with a ratio of 1: 1 which we have provided in the planting area, and then the sprouts are taken and then put into a polybag which already contains top soil and sand.

4. Manufacture of standard treatment signs and benchmarks

The signposts are made with bamboo that has been cut into pieces with a size of 30 cm, and standard stakes using bamboo measuring 2 cm.

5. Making Banana Peel Moles

Waste banana peels chopped or mashed, brown sugar solution with coconut water, put all banana peel ingredients into a bucket and tightly closed, ferment for two weeks, open the lid of the bucket every morning for five minutes to get rid of the gas formed so it doesn't explode.

Wash the egg shells, and then hang them in the sun to dry, to facilitate the next process. Then the egg shells are pounded or blended until completely smooth. Once smooth, it can be used as a mixture of planting media or used to sprinkle the soil around plants, especially plants in polybags.

6. Application of Banana Peel and Egg Shell Mole

Application of banana peel mole by watering around the plant according to the treatment dose. Meanwhile, the application of eggshell fertilizer was sown by hand on the soil in polybags according to the treatment dose. The application of local mole of banana peel and egg shell

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simultaneously according to the treatment that has been determined after planting rubber seedlings.

7. Maintenance

a. Sprinkling

Watering is done in the morning and evening according to weather conditions, if it rains no watering is done.

b. Insertion

Insertion is done when plants that do not grow normally or die. Insertion was stopped 2 weeks after planting. Inserts are taken from reserve or barrier plants.

c. Weed Weeding

Weeding is done by pulling weeds up to the roots in the plant area, and weeding intervals according to weed growth in the field.

E. Observation Variable

1. Plant Height (cm)

Tall Plants were measured two weeks after planting to eight weeks after planting using a meter from standard stakes to growing points.

2. Rod Diameter (mm)

Diameter stems were measured two weeks after planting to eight weeks after planting using a calliper.

3. Head Wet Weight (cm)

The wet weight of the crown was carried out after the end of the study, then the plant stems and leaves were cleaned of dirt and then air-dried, then weighed using an analytical balance.

4. Head Dry Weight (gr)

The dry weight of the crown was carried out after the end of the study, then the plant stems and leaves were cleaned, put the stems and leaves of the plant into an envelope that had been perforated, then the stems and leaves of the plants that were in the envelope were put in an oven at a temperature of 100C and then weighed.60^{o}

5. Root Wet Weight (gr)

The wet weight of the roots was carried out after the end of the study, then the plant roots were cleaned of dirt and then air-dried, then weighed using an analytical balance.

6. Root Dry Weight (gr)

The weight of root drying was carried out after the end of the study, then the plant roots were cleaned, put the roots into an envelope that had been perforated, then the plant roots that were in the envelope were put into the oven at a temperature of 100C and then weighed.60^{o}

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F. Data Analysis

Data that obtained in the field for further statistical analysis with variance and if the results are significantly different then proceed with using Duncan's Distance Test

RESULTS AND DISCUSSION

1. Plant Height (cm)

Data on the average height of rubber plants from the age of 2-8 WAP are presented in appendices 1, 3, 5, and 7, while the results of variance are in appendices 2, 4, 6 and 8.

The results of the analysis showed that the application of banana peel mole and egg shell had a significant effect on the age of 8 WAP, while the interaction of the two treatment factors was not significant on the height of the rubber plant.

The average height of rubber plants at the age of 8 WAP is presented in Table 1 below:

Table 1: Effect of Mole of Banana Peel and Egg Shell on Plant Height (cm) Age 8 WAP

Treatment T0 T1 T2 T3 Average
M0 88.57 89.90 104.87 103.37 96.88 b
M1 110.43 98.63 119.80 105.27 108.53 a
M2 113.33 105.10 92.67 104.13 103.81 a
Average 104.11 97.88 105.78 104.26

Description: Numbers followed by unequal letters in the same column are significantly different at 5% level

From Table 1, it can be seen that the administration of banana peel moles to the best plant height in the M1 treatment (75ml/0.05 litters of water) was 108.53 cm, which was significantly different from the M0 treatment (control) which was 96.88 cm and the M2 treatment. (150 ml/0.5 litters of water) is 103.81 cm.

The regression relationship of plant height to the application of banana peel moles has the equation = 68.23 + 36.73 x - 8.29 and the value = 0.98 (Figure 1).$x^2$$R^2$

Figure 1: Relationship of Plant Height (cm) to Giving Mole of Banana Peel at 8 WAP

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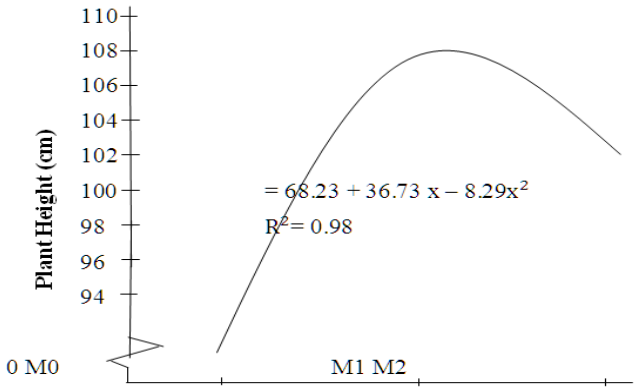

Dosage of Banana Peel Moles (ml/l. water)

From the picture above, it can be seen that there is a positive relationship with plant height by giving banana peel moles. In the treatment M1 (75 ml/0.5 litter water) showed optimal results for plant height, while the lowest M0 (control) and M2 (150 ml/litter water) experienced stunted growth. This happens because the nutrients contained in the banana peel fruit mole are sufficient, if excessive administration will become a toxin to the plant itself. In accordance with the opinion of Novizan (2012) which states that fertilization that is not in accordance with the needs of the plant can cause the plant to experience deficiency or excess so that growth and yield are not optimal.

2. Rod Diameter (mm)

Data on the average stem diameter from ages 2 to 8 WAP are presented in appendices 9, 10, 11 and 12, while the variance results are in appendices 13, 14, 15 and 16.

The results of the analysis showed that the application of banana peel mole and egg shell and the interaction of the two treatment factors had no significant effect on the diameter of the rubber plant stem at the age of 8 WAP.

The average stem diameter of rubber plants at the age of 8 WAP is presented in Table 2 below:

Table 2: Effect of Mole of Banana Peel and Egg Shell on Stem Diameter at 8 WAP

Treatment T0 T1 T2 T3 Average
M0 4.17 4.12 4.10 3.78 4.04
M1 3.73 3.86 4.19 4.13 4.05
M2 3.98 3.92 3.89 4.02 3.95
Average 3.96 3.97 4.06 4.04 4.01

Note: Numbers followed by unequal letters in the same column are significantly different at the 5% level.

In Table 2 it can be seen that the administration of banana peel mole and egg shell administration, as well as their interactions at observations of 2 WAP to 8 WAP did not

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significantly affect the stem diameter of rubber plants. This is because the micronutrients present in the banana peel mole and egg shell are not sufficient to support the growth and development process of rubber plant stem diameter. Zahrah (2014) stated that the deficiency and excess of nutrients including N, P and K will adversely affect growth and production.

3. Number of Leaves (strands)

Data on the average number of leaves of rubber plants from the age of 2-8 WAP are presented in appendices 17, 19, 21 and 23, while the variance results are in appendices 18, 20, 22 and 24.

Results the analysis showed that giving moles of banana peel and egg shells as well as the interaction of the two treatment factors had no significant effect on the number of leaves of rubber plants aged 8 WAP.

The average number of leaves of rubber plants at the age of 8 WAP is presented in Table 3 below:

Table 3: The Effect of Giving Moles of Banana Peel and Egg Shell on the Number of Leaves (strands) Age 8 WAP

Treatment T0 T1 T2 T3 Average
M0 13.00 14.67 17.67 16.56 15.48
M1 18.11 17.11 15.78 14.89 16.47
M2 16.56 17.44 13.56 19.67 16.81
Average 15.89 16.41 15.67 17.04 16.25

Note: Numbers followed by unequal letters in the same column are significantly different at the 5% level.

On Table 3 can be seen that the administration of banana peel mole and egg shell administration, as well as their interactions at observations of 2 WAP to 8 WAP did not significantly affect the number of leaves of rubber plants. This is due to the imbalance of giving banana peel moles and egg shells through the soil (environment) which can cause ineffectiveness of root work in nutrient absorption so that growth is not optimal. Furthermore, Gardner (2007) states that plant growth (vegetative and generative) is strongly influenced by genetic control factors (genetic) in addition to environmental factors (environment) including the availability of nutrients in the soil (soil fertility) so that it affects the appearance of plants (phenotype).

4. Canopy Wet Weight (gr)

Data on the average wet weight of rubber plant canopy at the age of 8 WAP is presented in appendix 25 and the results of the variance in appendix 26.

The results of the analysis showed that the administration of banana peel and egg shell moles and the interaction of the two treatment factors had no significant effect on the wet weight of the rubber plant canopy at the age of 8 WAP.

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The average wet weight of rubber plant canopy at the age of 8 weeks is presented in Table 4 below:

Table 4: The Effect of Giving Banana Peel and Egg Shell Mole on the Wet Weight of the Head (gr) Age 8 WAP

Treatment T0 T1 T2 T3 Average
M0 3.70 4.16 4.19 5.47 4.38
M1 4.07 4.59 5.50 5.02 4.80
M2 5.75 4.88 6.05 5.20 5.47
Average 4.51 4.54 5.25 5.22 4.88

Description: Numbers followed by unequal letters in the same column are significantly different at 5% level

FromTable 4 can be seen that the application of banana peel and egg shell moles, as well as their interactions did not significantly affect the wet weight of the rubber plant canopy. This is due to the effect of nutrient deficiency and hot weather on the research area, resulting in high evapotranspiration which can make plants lack of water and this can slow down the photosynthesis process which will result in stunted plants. In line with the opinion of Dwijosapoetro (2009) which states that plant growth and development is influenced by genetic factors and environmental factors, genetic factors are the appearance of pure seeds of certain species or varieties.

5. Head Dry Weight (gr)

Data on average dry weight of rubber plant crowns aged 8 WAP are presented in Appendix 27 and the results of variance in Appendix 28.

The results of the analysis showed that giving moles of banana peel and egg shells as well as the interaction of the two treatment factors had no significant effect on the dry weight of the crown of rubber plants aged 8 WAP.

The average dry weight of rubber plants at the age of 8 WAP is presented in Table 5 below:

Table 5: Effect of Mole of Banana Peel and Egg Shell on Head Dry Weight (gr) Age 8 WAP

Treatment T0 T1 T2 T3 Average
M0 0.48 0.41 0.49 0.52 0.48
M1 0.61 0.55 0.67 0.58 0.60
M2 0.67 0.46 0.64 0.80 0.64
Average 0.59 0.47 0.60 0.63 0.57

Note: Numbers followed by unequal letters in the same column are significantly different at the 5% level.

OnTable 5 can be seen that the administration of banana peel mole and egg shell administration, as well as their interactions did not significantly affect the dry weight of the rubber plant

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canopy. This is due to the effect of nutrient deficiency so that the vegetative growth of the plant becomes stunted which will lead to a decrease in the dry weight of the rubber plant canopy. Zahrah (2011) stated that the deficiency and excess of nutrients including N, P and K will adversely affect growth and production.

6. Root Wet Weight (gr)

The average wet weight data of rubber plant roots at the age of 8 WAP is presented in appendix 29 and the results of the variance in appendix 30.

The results of the analysis showed that the administration of moles of banana peel and egg shells, as well as the interaction of the two treatment factors had no significant effect on the wet weight of the roots of rubber plants aged 8 WAP.

The average wet weight of rubber plant roots at the age of 8 WAP is presented in Table 6 below:

Table 6: Effect of Mole of Banana Peel and Egg Shell on Root Wet Weight (gr) Age 8 WAP

Treatment T0 T1 T2 T3 Average
M0 2.41 2.05 2.47 2.64 2.39
M1 2.10 2.72 3.36 2.73 2.73
M2 3.36 2.33 3.01 2.93 2.91
Average 2.62 2.37 2.95 2.77 2.68

Note: Numbers followed by unequal letters in the same column are significantly different at the 5% level.

OnTable 6 can be seen that the application of banana peel mole and egg shell administration, as well as their interactions did not significantly affect the wet weight of rubber plant roots. This is due to the very hot weather in the research area, resulting in very high evapotranspiration which makes the soil harden so that the root system is inhibited, this will reduce the wet weight of plant roots.

Dwijosapoetro (2009) states that plant growth and development is influenced by genetic factors and environmental factors. Genetic factors are the appearance of pure seeds of a particular species or variety.

7. Root Dry Weight (gr)

DataThe average dry weight of the roots of rubber plants aged 8 WAP is presented in Appendix 31, and the results of the variance are in Appendix 32.

ResultsThe analysis showed that the administration of banana peel mole and egg shell and the interaction of the two treatment factors had no significant effect on the dry weight of the roots of rubber plants aged 8 WAP.

The average dry weight of rubber plant roots aged 8 WAP is presented in Table 7 below:

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Table 7: Effect of Mole of Banana Peel and Egg Shell on Root Dry Weight at 8 WAP

Treatment T0 T1 T2 T3 Average
M0 0.48 0.41 0.49 0.52 0.48
M1 0.61 0.55 0.67 0.58 0.60
M2 0.67 0.46 0.64 0.80 0.64
Average 0.59 0.47 0.60 0.63 0.57

Note: Numbers followed by letters are not the same in the same column, significantly different at the 5% level. On Table 7 can be seen that the administration of banana peel mole and egg shell administration, as well as their interactions did not significantly affect the dry weight of rubber plant roots. This is the same as the occurrence of wet weight of rubber plant roots, due to hot weather, evapatranspiration becomes high so that the soil is water deficient and hardens, and this will affect root growth so that the dry weight of roots becomes low. Dwijosapoetro (2009), states that plant growth and development is influenced by genetic factors and environmental factors, genetic factors which are the appearance of pure seeds of certain species or varieties.

CONCLUSIONS AND RECOMMENDATIONS

A. Conclusion

1 The application of banana peel mole had a significant effect on the growth of rubber plant height at 8 WAP.
2 Giving egg shells did not significantly affect all the parameters observed.
3 The interaction of giving banana peel mole and egg shell had no significant effect on all observation parameters.

B. Suggestion

It is recommended to conduct further research on the effect of giving mol banana peels and egg shells on rubber plants to obtain doses right.

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