PENGARUH PEMBERIAN BIOCHAR DARI BERBAGAI SUMBER DAN PUPUK KANDANG SAPI TERHADAP PERTUMBUHAN VEGETATIF TANAMAN PADI BERAS HITAM *(Oryza sativa L.)*

SKRIPSI

OLEH :

ROKKI NAIBAHO
14.821.0143

PROGRAM STUDI AGROTEKNOLOGI
FAKULTAS PERTANIAN
UNIVERSITAS MEDAN AREA
MEDAN
2019

ABSTRACT

Rokki Naibaho 148210143 Effect of Biochar Giving from Various Sources and cow manure toward Vegetative Growth of Black Rice (*Oryza sativa L.*) in Vegetative Phase. This thesis guided by Prof. Dr. Ir. A. Rafiqi Tantawi, MS as the supervisor and Dr. Ir. Sumihar Hutapea, MS as a member of the supervisor. The aim of this research to determine the level of black rice plants growth in the vegetative phase about biochar giving from various sources and cow manure, which carry out in Desa Sampali, kecamatan Percut Sei Tuan, kabupaten Deli Serdang. This research was conducted starting from September 2018 to January 2019.

The design used in this research are Factorial randomized block design consisting of 2 treatment factors, 1 factor of biochar administration from various sources consisted of 4 levels of treatment, namely A0 = control (without treatment), A1 = Using corn cob biochar dose of 10 tons / ha (1 kg / plot); A2 = Using rice husk biochar with a dose of 10 tons / ha (1 kg / plot); A3 = Use pecan shell Biochar with a dose of 10 tons / ha (1 kg / plot). Factor 2, giving cow manure consisting of 4 levels of treatment, namely B0 = control (without treatment) B1 = using cow manure dose of 5 tons / ha (0.5 kg / plot); B2 = using cow manure with a dose of 10 tons / ha (1 kg / plot); B3 = using cow doses of 15 tons / ha (1.5 kg / plot). This research was carried out with 2 replications.

The parameters observed in this research are plant height (cm), number of tillers (stems), identification of pests found in rice plants, number of pest populations found in rice plants, percentage of perplot pest attacks, percentage of pest attack, identification of diseases on rice plants, the number of disease populations found in rice plants, the percentage of perplot disease attacks, the percentage of attacks on perumpot disease. The results obtained from this research are that the administration of biochar from various sources has no significant effect on plant height and number of tillers but the administration of cow manure has a very significant effect on plant height and number of tillers.

Keywords: Black rice, biochar, cow manure

CHAPTER I

INTRODUCTION

1.1. Background of Study

Rice (Oryza Sativa L.) is an important food crop because it has become the staple food of more than half the world's population. In Indonesia, rice is the main commodity in supporting people's daily food consumption. Indonesia, as a country with a large population, is facing challenges in meeting food needs (Anggraini et al. 2013).

The production of rice in North Sumatra in 2014 was 3.63 tons/ha of milled dry grain, and it decreased by 96.210 tons compared to rice production in 2013. The decrease in rice production was due to a decrease in the harvested area of 25.650 hectares or 3.45%. The decline in rice production in 2014 was 96,210 tons (2.58%) between May to August as much as 89,305 tons (7.93%) while between May to August, the rice production was as much as 89.305 tons (7.93%) and between January to April, the rice production increased by 18.313 tons (1.22%) (BPS, 2015).

There are two ways to cultivate rice, namely lowland rice cultivation, and upland rice cultivation. The lowland rice cultivation system requires a lot of water and the rice field must be filled with a lot of water. Another type of rice cultivation is called upland rice cultivation which is carried out on dry land (Arie, 2015). The black rice plant is a type of rice in the world besides white rice, red rice, and brown rice (Sa'adah, 2013).

Black rice has gained popularity and has been consumed as a functional food because of its health benefits. Black rice is beneficial in increasing the body's resistance to disease, repairing liver cell damage (hepatitis and cirrhosis), preventing kidney function disorders, preventing

cancer and tumors, slowing the aging process, preventing anemia, reducing cholesterol in the blood, and functioning as an antioxidant (Suardi and Ridwan, 2009). In addition, the calories contained in Black rice are the lowest compared to any other types of rice which are only 362 Kcal per 100 grams of Black rice. Therefore, black rice is suitable for diet and safe for people who have diabetes and obesity (Suardi and Ridwan, 2009).

Black Rice contains three times more iron (Fe) compared to the iron in white rice. The Fe is needed to deal with deficiencies. Black rice is also rich in amino acids, potassium, magnesium, calcium, and flavonoids which are five times higher than white rice (Suhartini and Suardi, 2010).

Currently, black rice cultivation is still relatively rare due to a small number of farmers who want to grow black rice. Cultivating black rice brings various obstacles, one of which is pests and disease, especially leafhoppers and leaf spot disease. Pests and diseases are great challenges to farmers because they can reduce the production of rice by 10 – 30% even pests and diseases can cause crops not to produce well (Idris, 2008).

Pests and diseases are indeed the enemies of farmers and they can attack crops at any time. Pest control is carried out by an environmentally friendly approach. Pest control can be done using technical, mechanical, physical, genetic, and biological techniques (Thomas, 1999). One of the most common and safest ways to suppress pest populations in black rice cultivation is by using traps.

Apart from pests and diseases, farmers are also less interested in growing black rice because of its long age and low yield production (Kristiamtini, 2010). This causes the existence of genetic resources of this local type of rice to be increasingly rare, even almost extinct. Therefore, there should be an effort to preserve black rice seeds properly. Efforts that can be

taken to improve the productivity of black rice plants are such as, by creating an optimal growing environment for each phase of plant growth and development (Lita, et al. 2013). A strategy to improve the soil quality is by using raw materials classified as a soil amendment. To improve the quality of the physical, chemical, and biological properties of the soil, natural materials should be selected to increase soil fertility and to let the soil become resistant to decomposition, and one of the ways is by using Biochar. Biochar is a wood charcoal substance that is porous without low oxygen at <700°C. Biochar is derived from the agricultural, plantation, livestock, and forestry residues (Hutapea, 2015).

Cow Manure Fertilizer is one of the organic fertilizers which contains a nutrient that can improve soil fertility and the growth of microorganisms in the soil. Cow Manure Fertilizer is given to increase the nutrients, support the growth of microorganisms, and improve soil structure (Mayadewi, 2007). Based on this explanation, the researcher is interested in conducting a study entitled "The Effect Of Biochar From Different Sources And Cow Manure Fertilizer On Vegetative Growth Of Black Rice (Oryza Sativa L.)"

1.2. Formulation of Study

There are a small number of farmers who grow black rice plants because farmers are not familiar with the benefits of black rice plants. Besides, the production of black rice plants is low, and the number of pests attacking black rice plants is high. Thus, it is necessary to carry out activities that can increase the production of black rice plants.

1.3. Objective of the Study

1) To know the attack level of the invading organism disturbing black rice plants in the vegetative phase on the application of Biochar from various sources

2) To know the attack level of the invading organism disturbing black rice plants in the vegetative phase on the application of Cow Manure Fertilizer
3) To know the attack level of the invading organisms disturbing black rice plants in the vegetative phase on the combination of Biochar from various sources and Cow Manure Fertilizer.

1.4. Hypothesis of Study

1) The application of Biochar from various sources will have a real impact on increasing the vegetative growth of black rice and suppressing the attack of pest organisms in black rice cultivation
2) The application of Cow Manure Fertilizer will have a real impact on increasing the vegetative growth of black rice cultivation and suppressing the attack of pest organisms in black rice cultivation.
3) The combination of applying Biochar from different sources and Cow Manure Fertilizer will have a significant impact on increasing the vegetative growth of black rice plants and suppressing the attack of pest organisms in black rice cultivation

1.5. Significance of Study

1) This study can be used as a reference in writing a thesis to fulfill the requirement for obtaining a bachelor's degree in the Agrotechnology program at the Faculty of Agriculture at the Universitas Medan Area.
2) This study can be used to provide information to farmers, especially farmers who grow black rice in that the application of Biochar from different sources and Cow Manure Fertilizer will affect the vegetative growth of black rice plants.

CHAPTER II

LITERATURE REVIEW

2.1 Rice plants

The Rice plant is known as "palawija" plant that produces rice which is the staple food for most of the Indonesian population. Rice can meet 63% of the total energy and 27% protein. The nutrition contained in rice makes rice commodities important for food needs, so it becomes a concern in Indonesia to meet the needs rice (Norsalis, 2011).

2.2 The Taxonomy of Rice plants

The classification of rice plants according to Utama (2015) is classified into Division: Spermatophyta, Subdivision: Angiospermae, Class: Monocotyledoneae, Order: Poales, Family: Graminae, Genus: Oryza Linn, Species: Oryza Sativa L. In Indonesia, initially, rice plants were cultivated on dry land with a field system, the system develops and rice plants were grown by stabilizing yields by irrigating areas that have less rain. Rice plants that can grow well in the tropical area are called Indica, and rice which is mostly cultivated in sub-tropical areas is called Japonica (Norsalis, 2011).

Rice (Oryza Sativa L) belongs to the Graminae group with segments in its stem, and the segments consist of empty roofs covered by books and the length of each segment is different. The short segment is at the base of the stem, and the second segment and next segments are longer than the lowest segments. On the bottom of the segment grows a midrib that wraps the segment up to the top of the knuckle. Right at the top of the book, the tip of the midrib shows branching in which the shortest branch becomes the leaf Ligue and the longest and largest one

becomes the leaf blades. The leaves of rice plants are divided into two sides, the right one and the left one, which is called the auricular.

2.3 The Conditions of Growing Rice Plants

2.3.1 Temperature

The suitable temperature for growing rice plants is 20-35oC. Low temperature and high humidity during the flowering phase will interfere with the process of fertilization and seed formation (Samyuni et al., 2015). Black rice is a type of rice plant that can only produce well when planted in dry areas or on unflooded land with water at a temperature of 22 – 27 oC (Syurainsah, et al. 2013).

2.3.2 Sunlight

The relatively low intensity of sunlight is one of the causes of low productivity. Low light intensity results in disruption of the rate of photosynthesis and carbohydrate synthesis and results in decreased plant growth rate and productivity. The intensity of the Sunlight during the grain filling period can increase biomass production which results in the height of ripe grains which will then increase rice yields (Sasmita, et al. 2006). Black Rice requires full sunlight without shade. Radiation is needed for the photosynthesis process to take place and especially during the flowering phase.

2.3.3 Wind

The wind has an important role in the growth of rice plants in that it can help the process of pollination and fertilization. However, the win also has a negative impact because many diseases in rice plants are often transmitted by the wind. In addition, the wind also causes the

fruits of rice plants to become empty, and the wind can cause collapsed rice plants too (Mubaroq, 2013).

2.3.4 Season

The growth of rice plants is strongly influenced by the seasons in Indonesia. Indonesia has two seasons, namely the rainy season and the dry season. Growing rice during the rainy and dry seasons has a large impact on the quantity and quality of rice crops. Rice planting will be better in the dry season than in the rainy season with good irrigation (Samyuni et al., 2015).

The process of pollination and fertilization of rice plans in the dry season will not be disturbed by rain so more rice can be produced. However, rice planted in the rainy season can be interrupted by rain during the process of pollination and fertilization. As a result, many rice seeds are empty (Mubaroq, 2013).

2.4 The Morphology of Rice Plants

Different colors of rice are genetically regulated due to different genes that regulate aleurone color, endospermic color, and starch composition in the endosperm. Rice is black because of aleurone and endosperm producing anthocyanins with high intensity so it causes a deep purple color close to black in rice (Kristamtini, et.al., 2014).

2.4.1 The Roots of Rice Plants

Rice plants are classified as Gramineae plants which have fiber rooting. During germination, primary roots appear together with another root called the seminal root. Furthermore, the seminal root will be replaced by adventitious roots that grow from the bottom

of the stem. The fiber roots are located at a soil depth of 20-30 cm (Utama, 2015). The roots of black rice plants are the same as the roots found in other types of rice plants.

2.4.2 The Stem of Rice Plants

The stem of the rice plants is composed of a series of segments, every segment was separated from one another by a book. The extension of several stems occurs when rice plants enter the reproductive phase. The stem segment of rice plants is hollow and round. From top to bottom, the stem segment is getting shorter. The shortest segments can be found at the bottom of the stem, and these segments are practically indistinguishable from the standing segments themselves (Herawati, 2012).

2.4.3 The Leaves of Rice Plants

Rice plants have lanceolate-shaped leaves with parallel veins covered by fine short fibers. At the top of the stem, there is a flag leaf that is wider than the lower part leave. Many leaves and the large formed between the flag leaves with panicles, depending on the varieties of rice planted (Makarim and Suhartatik, 2007). The leaves of the rice plants have a leave length of 60 cm (Kristamtini and H. Purwaningsih, 2013).

2.4.4 The Flowers of Rice Plants

The flowers of rice plants consist of 6 stamens which are short and thin, and the large anthers, and two powder bags. There are two pistil stalks with two pistils in the form of a panicle, generally white or purple. The opening of the flowers is followed by the rupture of the pollen sac which then shed the pollen (Prastini and Damanhuri, 2017).

The flowering process of black rice plants begins with the pollen being shed from the powder bladder, and it causes the lemma and palea to close. The transfer of pollen to the pistil completes the pollination process. Then, this fertilization process produces the institution and endosperm. The endosperm is important as a reserve food source for newly grown plants (Herawati, 2012).

2.5 Organisms Attacking Rice Plants

Black rice is a plant that is very susceptible to being attacked by pests and diseases. Pests that are often found in black rice plants can be seen as follows:

2.5.1 Rice Pests

The pests attacking black rice plants are as follows:

1) White pests (Nymphula Depunctalis) with symptoms: attacking the seedling leaves, damaging in the form of dots that extend parallel to the leaf bone, the caterpillar rolling up the rice leaves.
2) Rice trip (Trips oryzae) with symptoms: the leaves are curled and turn yellow to redness, stunted seedling growth, no grains found.
3) Army caterpillar (Psuedaletia unipuncta, gray Spodoptera) with symptoms: leaves are eaten by caterpillars; the leaves of rice plants are gone, just leaving the stems.
4) Walang Sangit (Leptocoriza Acuta) with symptoms: causing empty fruits or low-quality rice, such as wrinkled, brown, and unpleasant things on the leaves, and there are sucking marks and black speckled found on the rice seeds.
5) Green Ladybug (Nezara viridula) with symptoms: puncture marks are found on the stem of the rice plants, sucking stains are found and disturbed.

6) Rats (Rattus Argentiventer) with symptoms: collapsed rice plants found on the rice field, there is no rice plant found in the middle of the rice field.
7) Birds (Palceus manyar manyar), the birds attack before harvesting the rice plants, broken fruit stalks, and scattered seeds.

2.5.2 The Diseases of Black Rice Plants

Common diseases attacking black rice include the followings (Irsan, 2015):

1) Tungro and green leafhopper diseases which do not directly damage the rice plants but can be infectious. This kind of disease can be controlled by choosing the right planting time and the rotation of varieties. Virus-resistant for varieties of Tungro or insect-resistant for green leafhoppers should be used. Green leafhopper resistant varieties determine >70% success in controlling Tungro.
2) Hawar Daun Bakteri (English: Bacterial Leaf Blight [BLB]) Xanthomonas Oryzae pv Ooryzae can attack through water, wind, and seeds. This infection occurs through wounds/natural openings (stomata). The damage in the plant should be observed, and if the severity of the disease exceeds 20%, Agrep bactericide should be used.

2.6 Biochar (Activated Charcoal)

Biochar is a term used to describe charcoal porous materials made from organic waste added to the soil. Biochar is produced through the pyrolysis process of biomass. This pyrolysis process is carried out by exposing biomass to high temperatures in the absence of oxygen. This process produces two types of fuel (sygas or synthetic gas and bio-oil or vegetable oil) and charcoal (Biochar) as by-products (Nabihaty, 2010).

Biochar is a type of charcoal that can absorb anions, cations, and molecules in the form of organic or inorganic compounds, solutions, or gases. Biochar is a chemical that is widely used in using absorption and purification processes (Azis et al. 2012). Biochar technology can improve some chemical properties in the soil, such as pH, CEC, and several compounds such as C-organics, N-total, and can reduce the activity of Fe and AI compounds that have an impact on increasing available P (Sudjana, 2014).

Biochar's characteristics include a large surface, large volume, micropores, bulk density, macropores, and high water-binding capacity. These characteristics make Biochar capable of supplying carbon. Biochar can also reduce CO2 from the atmosphere by binding it to the soil (Hutapea, et al. 2015).

Biochar comes from agricultural, plantation, and livestock residues. Some benefits of Biochar can be seen as follows:

1) It functions as ameliorating material in the soil, and it can increase the total organic carbon.
2) It improves the circulation of water and air in the soil.
3) It stimulates root growth, and can improve the physical, chemical, and biological properties of the soil.
4) It helps reduce clay hardness and enhances the ability of binding groundwater so that it affects the increase in the activity of soil microorganisms.
5) Biochar acts as a shelter or house for microorganisms.
6) It can increase the pH value (if the soil is acidic) and lowers pH (if the soil is alkaline), it can increase the soil CEC, and increase the population of pollutant-degrading microbes.

Biochar was created through the carbonation process of raw materials and the activation process resulting from the carbonization process at high temperatures. The carbonation process is the process of decomposition of cellulose into carbon elements and the release of other non-carbon elements which take place at a temperature of 600 - 700°C. Besides Biochar which can improve soil fertility, providing Cow Manure Fertilizer to the soil, can also provide good benefits for the growth and crop production (Hutapea et al., 2015).

Studies related to finding alternative energy sources continue to be developed, especially from biomass (corn cobs, rice husks, and candlenut shells). Corn cobs are one of the solid wastes that can be used as biomass (Widarti et al. 2016). Agricultural waste that can be used as an energy source is such as rice husks, and corn cobs (Mangkau, 2011).

Biochar was derived from corn cobs which contain 22% crude fiber, 44% cellulose, and 33.3% lignin allowing corn cobs to be used as raw material for charcoal briquettes (Mangkau, 2011). Corn cobs contain the energy of about 3,500 – 4,500 kcal/kg and the combustion can reach a high temperature of 205 °C (Gandhi, 2010).

Biochar derived from rice husks is composed of a network of fibers cellulose containing a lot of silica in the form of hard fibers. The husk has a bulk density of 125kkg/m3 with the calorific value of 1 kg of rice husk being 3300 calories. The cellulose in the rice husk is 31.12%, lignin 22.34%, and hemicellulose 22.47% (Widarti Efrizal A., 2016).

Biochar derived from candlenut shell contains ash as much as 1.75% wherein the candlenut shell, the ask is about 60% consisting alkaline minerals such as potassium 47.50%, calcium 48.67% and magnesium 35.21%, hydrogen 5.80%, nitrogen 0.16%, oxygen 46.50% and has a charcoal pH of 10 (Lempang and Hermin, 2013).

According to Aziz (2016), based on his study entitled "Pengaruh Penggunaan Biochar Terhadap Efisiensi Pemupukan Kedelai di Lahan Sawah Kabupaten Aceh Timur", the highest soybean yield per hectare is found in the use of Biochar 10 tons/ha with recommended 100% fertilization, and this is significantly different with treatment without Biochar and fertilization but no significantly different from the treatment with 10 tons/ha of Biochar with 50% fertilization recommendation.

2.7 Cow Manure Fertilizer

Soil organic matter is a complex and dynamic system derived from the remains of plants and animals found in the soil that continuously and constantly undergoes changes influenced by biological, physical, and chemical factors in the soil (Widarti and Efrizal, 2004).

Fertile soil with lots of soil organic matter can provide optimal productivity for the growth and development of plants. One of the good organic ingredients comes from Cow Manure which is defined as all waste products from animals that can be used to add nutrients and improve the physical and biological properties of soil (Hartatik and Widowati, 2010).

Cow Manure has advantages over other kinds of manure in that it has a high fiber content such as cellulose that provides macro and micronutrients for plants, as well as improves water absorption in the soil (Hartatik and Widowati, 2010). Nutrient in every 100 g of solid Cow Manure Fertilizer is as follows: water 80%, organic matter 16%, N 0,3%, P2O5 0,2%, K2O 0,15%, CaO 0,2%, Rasi 0,2%, C/N 20-25% (Lingga, 1991).

According to Hataik (2010) in a study entitled "Pengaruh Pupuk Kandang Sapi dengan Biodekomposer dan Pupuk Anorganic Terhadap Efisiensi Serapan K dan Hasil Tanaman Padi Sawah Palur Sukoharjo", the application of 10 ton/ha fertilizer with 50% recommended dose of

inorganic fertilizer which can increase the weight of dry milled grain by 57%, which is 6.39 tons/ha.

CHAPTER III

MATERIALS AND METHODS

3.1 Place and Time of the Study

This study was carried out in Desa Sampali, at Jalan Jati Rejo Kecamatan Percut Sei Tuan, Kabupaten Deli Serdang. The plot plan of this study can be seen in appendix 1. This study was carried out from September 2018 to January 2019. The research timeline can be seen in appendix 2. Research timeline.

3.2 Materials and Tools

The materials used are the seeds of the Cempo Ireng black rice plants, Biochar made from rice husk, Biochar made from corn cob, and Biochar made from candlenut shell, EM-4, brown sugar, cow dung, 33% technical HCI 33%, NPK, KCI, TSP fertilizer, Aquadapest and 75% of alcohol.

The tool used in this study was a pyrolysis tube (a place for modified Biochar), hoe, tribe, harrow, meter, gembor, beaker glass, measuring cup, scales, buckets, stationary, bottles, cups, plastic, label paper, stationery, pest identification books, and other supporting tools.

3.3 Research Methods

3.3.1 Research Design

This study was conducted by following a randomized design factorial group (Indonesian: Rancangan Acak Kelompok Faktorial) consisting of two treatment factors, namely:

1. The application of Biochar from various sources consists of 4 levels of treatment, namely:

A0 = Control (Biochar is not used)

A1 = The application of Biochar from corncob at a dose of 10 tons/ha (1kg/plot)

A2 = The application of Biochar from rice husk at a dose of 10 tons/ha (1kg/plot)

A3 = The application of Biochar from Candlenut shell at a dose of 10 tons/ha (1kg/plot)

2. The application of Cow Manure Fertilizer consists of 4 levels of treatment, namely:

B0 = Control (Cow Manure Fertilizer is not used)

B1 = The application of Cow Manure Fertilizer at a dose of 5 tons/ha (0.5 kg/plot)

B2 = The application of Cow Manure Fertilizer at a dose of 10 tons/ha (1kg/plot)

B3 = The application of Cow Manure Fertilizer at a dose of 15 tons/ha (1.5 kg/plot)

Based on the level of treatment used, 16 combinations of treatment were found as follows:

A0B0	A1B0	A2B0	A3BO
A0B1	A1B1	A2B1	A3B1
A0B2	A1B2	A2B2	A3B2
A0B3	A1B3	A2B3	A3B3

There were 16 combinations of treatment in this study, and each treatment was repeated according to the minimum repetition calculation in the Rancangan Acak Kelompok Faktorial (English: the Factorial Randomized Block Design) which can be seen as follow.

$(t - 1)(r - 1) \geq 15$

$(16 - 1)(r - 1) \geq 15$

$15 (r - 1) \geq 15$

$15r - 15 \geq 15$

$15r \geq 15 + 15$

$15r \geq 30$

$r \geq 30/15 = 2$ r = 2 repetitions

Description:

Number of repetitions = 2 repetitions

Number of plots = 32 plots

The Size of plot = 100 cm x 100 cm

The planting distance of black rice = 20 cm x 20 cm

The number of plants per plot = 25 plants

The number of sample plants per plot = 5 plants

The total number of plants = 800 plants

The total sample of plants = 160 plants

The distance between plots = 50 cm

The distance between tests = 100 cm

3.3.2 Method of Analysis

After the research data were obtained, data analysis was carried out by using a Factorial Randomized Block Design (Rancangan Acak Kelompok Faktorial) using the following formula:

$$Yijk = \mu + \tau i + \alpha j + \beta k + (\alpha\beta)jk + \varepsilon ijk$$

Description:

Yijk **=** The results of observation in the i-th replication that received Biochar treatment from various sources at level j and Cow Manure Fertilizer at level k.

μ **=** the mean of the population

τi **=** the effect of the –*i* repetition

αj **=** The effect of Biochar from various sources at the j level

βk = The effect of Cow Manure Fertilizer at the-*k* level

(αβ)jk =The effect of the interaction of Biochar from various sources at j-level and Cow Manure Fertilizer at k-level.

εijk = the residual effect of the i-th test that received Biochar from various sources at j-level and Cow Manure at k-level.

If the results of the treatment in this study have a significant impact, further testing will be conducted using Duncan Distance Test (Indonesian: Uji Jarak Duncan) (Montgomery, 2009)

3.4 The Implementation of Study

3.4.1 Preparing the Seeds

The seeds used for this study are Cempo Ireng Black Rice. Physiologically, high-quality seeds come from a superior variety of rice that can grow well, are not mixed with other varieties, is not contained impurities, and are not infected by pests and diseases. This type of rice can be seen in appendix 3 regarding black rice seeds – Cempo Ireng. Black rice seeds were obtained from an online shop in that this type of rice was brought from Yogyakarta in as much as 1 kg.

3.4.2 Land Clearing

The land used was measured and cleared from weeds and plants by using manual tools, such as tripe machetes, hoes, and other necessary tools.

Tillage was carried out twice. The first tillage loosened the soil resulting from hoeing, and the second tilling was aimed to create a plot. We can see the documentation of this activity on page 85 discussing tillage.

3.4.3 Producing Various Biochar

Corn Cobs used to produce Biochar were brought from a village named Laut Dendang located in Percut Sei Tuan, and the corn cobs were collected in the experimental garden at the Universitas Medan Area. Then, the corn cobs were burned using a pyrolysis tube. This was done by filling the pyrolysis tube with wood charcoal to burn the corn cobs. When the wood is smoldering, the corn cobs were thrown into the pyrolysis tube until the corncobs turned into charcoal. The process of producing Biochar was taken from the process of making Biochar in the research conducted on Kendaga and Rubber Shell seeds (Hutapea et al., 2015).

Rice husks were obtained from a rice factory located in a village named Percut Pasar 9 in the Percut Sei Tuan sub-district. The process of making Biochar was started by burning the rice husks. The rice husks were stacked and given a 0.5-inch net in the middle of the pile. Charcoals were also used to burn the rice husks. After the wood charcoal burned, the rice husks until the rice husks turned into charcoal (Lintang B, Maria, 2017).

The candlenut shells were obtained from a village named Laut Dendang located in Percut Sei Tuan sub-district. The candlenuts were imported from Kuta Buluh located in Dairi district, Tanah Pinem sub-district. The process of making Biochar was taken from research conducted on Kendaga and Rubber Shell seeds (Hutapea et al., 2015) which consists of several stages:

3.4.3.1 Preparing Tools and Materials

The ingredients to create Biochar from corn cobs, rice husks, and candlenut shells were collected and dried. To reduce the water contained in the ingredients, the ingredients were dried under the sun.

3.4.3.2 Carbonation

Carbonation is a process of breaking down cellulose into carbon elements, and the release of non-carbon elements that take place at a temperature of 600 – 700 oC. The corn cobs and the dried candlenut shells were weighed individually, and each of them weighed at least 100 kg. Then, these ingredients were thrown into the composing furnace created from an old barrel. Before the carbonation process started, the base of an old barrel was applied with kerosene. When the carbonation process started, the old barrel was closed so that there was only a little oxygen there. After the carbonation process was completed, the charcoal was activated by using 33% of technical HCI which was diluted to a concentration of 10% after it was activated. After

Document Accepted 28/5/22

that, the Biochar was dried in an area that was not exposed to direct sunlight. After the drying process is complete, the Biochar from various sources was ground and filtered through a 20 mesh sieve. The documentation of this process can be seen on pages 81 – 83 describing the process of making Biochar from various sources.

3.4.4 Producing Cow Manure Fertilizer

To speed up the composting process, the process is generally carried out in aerobic conditions since it does not cause odor. However, the process of speeding up the composting was supported by effective microorganisms (EM4) which takes place anaerobically. By using this method, the odor can be removed if the process is going well.

The method of making organic Cow Manure compost is by using cow compost that has just come out for ± 1 week and is placed on an area before being doused with 500 ml of EM4 which has been mixed with brown sugar. This combination is mixed and evenly distributed by using a hoe. After that, the Cow Manure was wrapped tightly to ensure that there are no cavities in all parts. In this way, the decomposing bacteria can decompose the manure perfectly. Every week, the Cow Manure is opened and mixed again. After that, 500 ml of EM4 and brown sugar that has been dissolved in water are given to the mixture. Then, the mixture of Cow Manure is closed again tightly until the Cow Manure does not emit an odor, the color of the manure changes into blackish brown, and if you touch the Cow Manure, it does not clump. Finally, the Cow Manure Fertilizer is ready to be used.

The number of microorganisms found in the fermentation of EM4 was a lot, approximately 80 genera. These microorganisms were selected to work effectively in fermenting organic materials from a wide range of organisms. There are five groups of them, namely

photosynthetic bacteria, Lactobacillus sp, Streptomyces sp, yeast, and Actinomycetes (Indriani, 2007). This process can be seen on page 84 about the making of Cow Manure Fertilizer.

3.4.5 The Application of Basic Fertilizer

The application of basic fertilizer was carried out after analyzing the soil first. If the soil lacks nutrients, fertilizer will be applied (Urea + TSP + KCI) with half of the recommended dose where the recommendation of Urea fertilizer is 200 kg/ha, TSP is 100 kg/ha, and KCL is 75 kg/ha, and each fertilizer was given half of the recommendation when the soil is short of nutrients.

The application of basic fertilizer was carried out after the land was processed. This was given to all parts of the plant to avoid differences in growth as the result of the application of basic fertilizer.

3.4.6 The Application of Biochar from Various Sources and Cow Manure Fertilizer

The application of Biochar from various sources and Cow Manure Fertilizers was carried out according to the prescribed treatment dose. The application of Biochar from various sources and Cow Manure Fertilizer was carried out a day before the rice seeds were planted.

The application of Biochar from various sources and Cow Manure Fertilizer was done by circling the rice planting area. The distance of applying Biochar from various sources and Cow Manure Fertilizer was carried out when the soil condition was moist, and not dry, or in a flooded area. This process can be seen on page 85 describing the application of Biochar from various sources and Cow Manure Fertilizer.

3.4.7 Planting Rice Plants

Before planting the rice, seeding was carried out first. This process was done by making a bed of 1 x 1 m with a bed height of 30 cm. After the seedling bed was prepared, the watering process was carried out on the beds. The rice seeds were put in water for a day. After that, the soaking rice seeds were transferred to a damp place that is not exposed directly to sunlight until the seeds turned dots growing from the rice seeds (radicle).

Rice seeds that have shown some radicles were then seeded on a nursery bed that was prepared for an area of 1 x 1 meter, and the seeds were sown on the surface of the bed, and they were covered by rice straw to avoid birds and to maintain the soil moisture. The beds of rice seeds were watered every day, and at the age of 1 week, after they were planted, the rice straw was removed so that the rice plants could grow under the sunlight.

The nursery has reached the age of 15 – 20 days with the characteristics of seeds ready to be transferred are 5 – 6 leaves, 22 – 25 cm high, large and hard rootstock, free from pests and diseases. The seedling process was carried out by transferring the rice from the nursery by pulling the seeds and keeping the roots of the plant from being damaged. The rice was planted at a distance of 20 x 20 cm with two seeds per area. This process can be seen on page 85 describing the rice planting process.

3.4.8 Maintaining Rice Plants

3.4.8.1 Weeding and Fertilization

The maintenance of rice plants was carried out by weeding. The weeds that grow in the plot were removed to reduce the competition among plants in absorbing nutrients in the soil. Then, if rice plants were damaged, they must be replaced directly. The rice plants used to replace

the damaged rice plants were grown in another place. The replacement of new seeds should be carried out no more than 10 days after the planting process of the damaged rice plants.

3.4.8.2 Watering

Watering was done as needed. Watering was carried out every day with an interval of twice a day, namely in the morning and in the evening with a similar dose for each plot. When it rains, the watering was carried out just once a day. This process can be seen on page 86 describing the watering process of rice plants.

3.4.8.3 Pest Control

Pest control was done by using Traps. This method is commonly used to trap pests that are active on the surface of the soil. Traps are generally made of bottles and cups filled with water, alcohol, or detergent. The mixture is poured to half the height of the trap container. The top part of the trap container is made similar to the surface of the ground. The traps are set in the shape of the letter "U" and hung parallel to the height of rice plants with an observation interval of once a week during the vegetative period, namely when the rice plants aged 2 weeks after planting the rice. Insects caught in the trap container are collected to be analyzed using a pest identification book. This process can be seen on page 87 describing traps for pest control.

3.4.8.4 Harvesting

Harvesting rice can be done when the leaves are almost 90% yellow, the grain is filled, the color of the rice grain is yellow, the grain is hard, and there is reddish black rice seen. Harvesting rice plants is done by cutting the rice plants at the base of their stem, then the rice grains are separated from the rice plants.

3.5 Parameters of Observation

Before observing the parameters, the sample plants were determined first. The sample plants were assigned randomly by ignoring the furthest plant.

3.5.1 The Height of Rice Plants

The height of rice plants was measured two weeks after the rice plants were planted. The height measurement was carried out by measuring the base of the stem to the tip of the highest leaf. This measurement was carried out at intervals of 1 week until 70% emergence of flowers on rice plants per plot.

3.5.2 The Number of Tillers

The number of tillers was counted based on all stems per sample plant and was subtracted by 2 stems. The number of tillers was counted when the rice plants aged 3 weeks after planting the rice until the flower appeared on the rice plants.

3.5.3 Pests and Diseases Found

Identifying the types of pests in rice plants was carried out by observing insects (pests) found in the rice plants growing in the research area in each plot of the research. The observation was carried out at 08:00 Indonesian Western Time until it finished. The observation was made at intervals of 1 x a week.

CHAPTER V

CONCLUSION AND SUGGESTION

Based on the results of the study, the following conclusions were drawn:

5.1 Conclusion

1. The application of Biochar from various sources has no significant effect on vegetative growth on plant height and the number of tillers of black rice plants from 2 – 8 weeks after planting the rice.
2. The application of Cow Manure Fertilizer has a very significant effect on the vegetative growth of black rice plants on plant height and the number of tillers starting from the age of 2 – 8 weeks after planting the rice.
3. The combination of Biochar from various sources and Cow Manure Fertilizer has no significant effect on vegetative growth on plant height and the number of tillers of black rice plants from 2 – 8 weeks after planting the rice.

5.2 Suggestions

Black rice should be grown in agricultural areas where the majority of farmers grow rice plants to avoid pests and diseases attacking rice plants. In addition, it is necessary to have a rotating crop cultivation system to reduce the level of pest attacks on cultivated land.