



## Response to Mung Bean Growth and Production (*Vigna Radiata L.*) with Organic Liquid Fertilizer and Biochar Applications

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### ABSTRACT

The study aimed to determine the effect of biochar and Organic Liquid Fertilizer in various concentrations on the growth and productivity of mung beans (*Vigna radiata, L.*). The research was conducted on private land located in Watuompak, Mojoagung, Prambon, Nganjuk, East Java with an altitude of 95 meters above sea level, with rainfall in the planting month of 219 mm. This study used a 3 x 4 factorial Complete Random Design (CRD) that repeated 4 times a total of 48 plants. The difference in the concentration of Nasa (P) Organic Liquid Fertilizer with 4 levels, namely: P1 = 100 ml / 1 liter of water; P2= 300 ml/ 1 liter of water; P3= 500 ml / 1 liter of water. The composition factor of biochar addition media from 3 levels, namely control M0 = control / Soil; M1 = Biochar 50% + Soil = 50%; M2 = Biochar = 25% + Soil = 75%; M3 = Biochar = 10% + Soil = 90%. Observations were made 4 times on 21 Days, 35 Days, 49 Days, and 63 Days. The results showed that composition of media had a single significantly different effect on the number of leaves 63 Days after planting, the best influence was given by the M1 treatment (14.33 leaves). The combination of media treatment and organic liquid fertilizer had a very significant effect on the number of pods 49 Days after planting. Uniform organic liquid fertilizer treatment provided more pod counts than other treatments P3M1(10.75), P2M1(10.5),P2M2(10.25). Variables of plant height, fresh weight, weight of 100 seeds were not found to have a real effect both a combination of treatment and a single treatment carried out.

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## **INTRODUCTION**

Agriculture is a sector that occupies a vital role in needs of a country, especially Indonesia which is categorized as agrarian country, where the population has a livelihood as farmers. Agriculture supports the food availability for the community. The strategy to fulfill the food needs are by intensifying agricultural sector which includes the development of technology and science, increasing the variety of commodities, and increasing agricultural production.

One of the important elements in food fulfillment is protein. Commodities cultivated in protein consumption include mung beans. Mung beans are plant based protein. The protein content of mung beans as a vegetable protein ranks third after soybeans and peanuts with a value of 22%. Green beans have a relatively short cultivation time (55-65 Days).

The need for mung beans will increase in line with the increase in population and the development of the food and feed industry. On the other hand, the production of mung beans has not been able to meet these needs (Mustakim, 2012). This is due to the increasing conversion of agricultural land, the destruction of agricultural land, and the degradation of land fertility. The number of mung bean imports is still relatively high compared to other commodities with an import value of 114.44 thousand tons of mung beans worth US\$ 132.86 million, corn imports with a volume of 8.99 thousand tons worth US\$ 6 thousand, and sweet potatoes weighing 38 thousand kg with a value of US\$ 93.56 thousand. A new innovation is needed in the cultivation of mung bean plants.

Strategy to increase mung bean production sustainability needs to be made. One way to increase production is by improving cultivation techniques such as the use of fertilizers to support a sustainable agricultural system. In this activity, environmental friendly methods are needed and in case reduce damage of the soil lithosphere, one of the method is by use of organic farming with organic fertilizers instead of chemical fertilizers.

Organic fertilizers are fertilizers made from organic materials such plants and animals that are processed through engineering processes such as composting (Irianto, 2014). This organic fertilizer is divided into two based on its form, solid and liquid. Liquid organic fertilizer is a solution from the decay of organic materials derived from plant residues, animal and human manure whose nutrient content is more than one element. The advantage of this organic fertilizer compared to other fertilizers, that it is able to overcome nutrient deficiencies quickly, without problems in nutrient leaching, provides nutrients precisely, spurs plant growth, increases microorganisms that support plant growth, easily absorbed by plants and improves soil loosening properties. When compared to inorganic fertilizers, liquid organic fertilizers generally do not damage the soil and plants even though they have been used frequently. In addition, this fertilizer also has a binding agent so that the fertilizer solution given to the soil surface can be directly used by plants. (Hadisuwito, 2012).

The technology for increasing agricultural production is as old as the history of agriculture itself. Compost and manure technology has started in 2300 BC (Fitzpatrick et al., 2005). Likewise, the use of smoke for seed preparation, prescribed burning for land preparation (Kulkarni et al., 2011), and the use of biochar in the traditional agricultural system in the Amazon Valley so that terra preta black soil is formed to increase agricultural potential in less fertile soil (Barrow, 2012). Anthropogenic black soils are also found in the Baltic region of Germany (Thiele, Bruhn et al. 2014), in Sub-Saharan Africa (Solomon et al., 2016) and possibly in East Kalimantan (Sheil et al., 2012). The terra preta black soil formation is anthropogenic (human activity) thousands of years ago, which is thought to have originated from the burning of household waste and vegetation that accumulates with residential organic waste (Kern et al., 2017)

The use of biochar for agriculture is a local wisdom of farmers in Sub-Saharan Africa. Agriculture in these areas uses the addition of several types of waste such as ash and charcoal residues from kitchen products, by waste from palm oil processing and the manufacture of processed household soaps, animal-based organic inputs such as bones from food preparation, as well as crop residues and household waste based on plant biomass (Solomon et al., 2016). The application of biochar to farmland as a result of intentional pyrolysis of wood or as a byproduct of cooking, has had a history of more than 150 years in the Western World (Schmidt et al., 2021). Thus, the application of Organic Liquid Fertilizer combined with the addition of biochar to the planting medium is considered the right effort to implement a sustainable agricultural system with high productivity

## LITERATURE REVIEW

### Mung Bean

Mung bean (*Vigna radiata*, L.) is a green plant that originated in India and spread to Indonesia around the beginning of the 17th century. This plant is a shrub that grows upright and has resistance to dry air and can grow in less fertile soil conditions, besides that the cultivation of this plant is also quite easy, resistant to pest and disease attacks. This plant is also a type of palawija and belongs to the legume tribe (Fabaceae) which is widely known in the Tropics and has many benefits in daily life, Mung Beans have a fairly high nutritional content, including carbohydrates 62.90 g, protein 22.00 g, fat 1.20 g, also contains Vitamin A 1.57g, Vitamin B1 0.64 g, Vitamin C 6.00 g and mineral Ca, P, Fe and contains 345 calories (Mustakim, 2013).

Mung bean plants are short-lived annuals (60 Days). A close relative of mung beans is a type of cultivated and palawija plant that is widely known in the tropics. This plant, which belongs to the family of legumes (Fabaceae), has many benefits in daily life as a source of food with high vegetable protein (Rukmana, 2006).

Taksonomi tanaman kacang hijau (*Vigna radiata* L.)Rukmana (2006) as following:

Kingdom : Plantae  
Devisiion : Spermatophyta  
Subdivision : Angiospremae  
Class : Dicotylodenae  
Ordo : Polypetalae  
Familia : Papilionacaea  
Genus : Vigna  
Species : *Vigna radiata* L. (Wilczek)

### **Mung Beans Morphology**

Mung bean plants have straight up stems. The stem of the mung bean varies in height, between 30-60 cm depending on the variety. The lateral branches of mung beans on the main stem are round and hairy, the color of the stem, the branches are green and purple, the seeds of mung beans are smaller than the seeds of other beans. Mung bean seeds consist of three main parts, namely the seed shell (10%), cotyledons (88%) and institutions (2%). The shell of mung bean seeds contains minerals including phosphorus (P), calcium (Ca), and iron (Fe). Cotyledons contain a lot of starch and fiber, while the institution is a source of protein and fat (Purwono & Hartono, 2010). The mung bean plant is tap-rooted with branched roots on the surface and yellow mung bean flowers arranged in bunches, coming out on branches and stems and can pollinate themselves (Tjitrosoepomo, 2000).

### **Growth Requirement of Mung Beans**

#### 1. Climate

Mung beans to be able to grow and develop require optimal rainfall of 50-200 mm/month with a temperature of 25 oC-27oC, air humidity ranging from 50%-80% and enough sunlight. Green beans are tropical plants that want a hot atmosphere during their life. This plant can be planted in lowlands up to 500 m above sea level (above sea level), mung bean plants can live in low rainfall areas by utilizing the moisture remnants of fully irrigated plants, for example rice, mung beans can grow in all kinds of soil types, but the best growth is in clay soils with high organic matter (Rukmana, 2006)

#### 2. Soil

The suitable soil for mung bean plants is loamy clay, well-drained soil and sufficient nutrients N, P, K, Cadan microelements, soil that is too fertile with a high content of total N-(0.51% - 0.75%) and K-available (0.61-1.00 Cmol, kg-1) which is not good for mung beans because it will result in excessive vegetative growth and reduced pod formation (Sumarno, 2016). The optimum soil acidity level for mung bean growth is between pH 6.5 (Andrianto and Indarto, 2004). Mung beans can grow on all types of soil as long as there is sufficient moisture and nutrients. The land that will be used must be prepared as well as possible. Rice fields after rice harvesting, there is no need to cultivate the soil. According to Sunantara (2000), the provision of land in the form of cutting rice straw is suitable for mung bean cultivation after rice plants. Meanwhile, in rice fields that have not been planted for a long time, it is necessary to carry out perfect soil management, to avoid waterlogging in the rainy season and it is necessary to

make drainage channels with a width and depth of 20-30 cm and a maximum distance between channels of 4 m (Atman, 2007).

Dry land is land with a very low level of fertility and productivity and especially on unpaved or undulating land with considerable soil erosion potential. Seran (2013) stated that farming on dry land is still faced with various problems such as irrigation water problems, soil fertility levels, and low land productivity, so it is necessary to strive to increase the productivity of dry land through fertilization of both inorganic and organic fertilizers.

The problems in the management of mung bean plants in dry land are still low yield productivity, low nutrients in dry land and very little available water, drought is one of the important factors that affect the low and unstable mung bean plant, the availability of very limited groundwater results in stunted growth of seedlings and can cause low crop yields, Severe drought caused by low rainfall and uneven distribution in dry climate areas causes groundwater content to fluctuate, due to inhibition of plant growth (Sukarman et al., 2012). The critical period of plants is the period at which plants are very sensitive to environmental factors, and outside of this period it is relatively influential on plant growth and yield (Moenandir, 2010). Adisarwanto (2014) stated that in the critical stadia there is a lack of water will affect the yield and end of the plant, the critical stadia in mung bean plants are: (1) germination, (2) flowering, (3) pod formation, (4) seed filling.

### 3. Biochar

The technology for increasing agricultural production is very old even as old as the history of agriculture itself. Compost and manure technology has started in 2300 BC (Fitzpatrick et al., 2005). Likewise, the use of smoke for seed preparation, prescribed burning for land preparation (Kulkarni et al., 2011), and the use of biochar in the traditional agricultural system in the Amazone Valley so that terra preta black soil is formed to increase agricultural potential in less fertile soil (Barrow, 2012). Anthropogenic black soils are also found in the Baltic region of Germany (Bruhn et.al, 2014), in Sub-Saharan Africa (Solomon et al., 2016) and possibly in East Kalimantan (Sheil et al., 2012). Terra preta black soil formations are anthropogenic (human activity) thousands of years ago, which is suspected to have originated from the burning of household waste and vegetation that accumulates with sewage.organic settlements (Kern et al., 2017).

The use of biochar for agriculture is a local wisdom of farmers in Sub-Saharan Africa. For farming, they add several types of waste such as ash and charcoal residues from kitchen products, by-products from palm oil processing and the manufacture of processed household soaps, animal-based organic inputs such as bones from food preparation, as well as crop residues and household waste based on plant biomass (Solomon et al., 2016). The application of biochar to farmland as a result of intentional pyrolysis of wood or as a byproduct of cooking, has had a history of more than 150 years in the Western World (Schmidt et al., 2021).

Biochar or better known as charcoal is a solid material formed from the carbonization of biomass. Biochar can be added to the soil with the aim of improving soil function and reducing emissions from biomass that naturally decomposes into greenhouse gases. Biochar also has the function of binding carbon quite large (Brassard et al., 2019). Biochar can be made from a variety of organic materials, such as sawdust, rice husks and others.

According to Bambang (2012), the raw materials for making biochar are generally agricultural or forestry biomass residues, including wood chips, coconut shells, oil palm bunches, corn cobs, rice husks or nut shells, barks, wood business residues, as well as organic matter derived from paper waste, municipal waste and animal manure. If the waste is burned in a state of low or no oxygen, 3 substances will be produced, namely Methane and Hydrogen which can be used as fuel, renewable bio-oil, and biochar which has stable and carbon-rich properties (>50%).

The practice of utilizing agricultural biochar continues to develop rapidly both from the manufacturing method and the formulation. Many studies have reported the effect of biochar application on soil properties and plant agronomy (Schmidt et al., 2021). The application of biochar into soil has many benefits such as its effect on physical properties (increasing porosity, water-holding capacity, soil aggregation), chemistry (increasing pH, cation exchange capacity, soil organic carbon, nutrient retention and availability), and soil biology (microbes and earthworms). The improvement of soil properties then affects the agronomic appearance of plants, namely growth and production (Hussain et al., 2017). The results showed that the addition of biochar to the soil resulted in an increase in above-ground productivity, crop yield, soil microbial biomass, rhizobia nodulation, plant K tissue concentration, soil phosphorus (P), soil potassium (K), total soil nitrogen (N), total soil carbon (C), and soil pH compared to control conditions (Biederman & Harpole, 2013).

Biochar formulations from widely available local materials are practically needed by farmers, not only to improve land fertility in the long term, but at the same time to be able to increase production in the current year. Rice husk biochar is an organic medium that contains a lot of potassium and carbon which is useful for plant growth and development. Biochar is a pyrolysis product produced from the process of burning certain raw materials at a temperature of 300oC - 600oC with limited oxygen supply or no oxygen at all. Biochar plays a role in improving the physical, chemical and biological properties of soil (Oksilia, 2023). Rice husk biochar is porous and able to store water well, and can absorb pollutants such as heavy metals, minerals including nutrients in the soil whose nutrient binding capacity is low and the development of long bean plants compared to no treatment and 5 tons/ha for the parameters of plant height, plant fresh weight, and fruit weight per plot. According to Risa (2016), the application of rice husk biochar at a dose of 5 tons/ha provides the best growth and yield for mung bean plants compared to no treatment and a dose of 10 tons/ha.

## Liquid Organic Fertilizer

Organic fertilizers are fertilizers made from organic materials such as plants and animals that are processed through engineering processes such as composting. (Irianto & Mukhsin, 2014). This organic fertilizer is divided into two based on its form, namely solid and liquid. Liquid organic fertilizer is a solution from the decay of organic materials derived from plant residues, animal and human manure whose nutrient content is more than one element. The advantages of this organic fertilizer compared to other fertilizers are that it is able to overcome nutrient deficiencies quickly, has no problems in nutrient leaching, provides nutrients appropriately, spurs plant growth, increases microorganisms that help plant growth, are easily absorbed by plants and improve soil loosening properties. When compared to inorganic fertilizers, liquid organic fertilizers generally do not damage the soil and plants even though they have been used frequently. In addition, this fertilizer also has a binding agent so that the fertilizer solution given to the soil surface can be directly used by plants (Hadisuwito, 2012).

Along with the development of agricultural technology, natural organic fertilizers have been developed that can be used to help overcome obstacles in agricultural production. Nasa liquid organic fertilizer (organic liquid fertilizer) is a 100% natural organic fertilizer from extracts of organic matter from livestock and poultry waste, certain plant wastes and other natural substances processed based on environmentally sound technology. Nasa organic liquid fertilizer is able to accelerate plant growth, can reduce the rate of pest attacks, does not have side effects that are detrimental to plants and the environment, and is safe for humans (Natural Nusantara, 2015). Meanwhile, from the results of Karida's research, (2019) for the need for Nasa Liquid Organic fertilizer showed an insignificant effect on plant height of all plant ages and had a real effect on the observation of the number of planting pods, the number of pods containing plants, crop production and the weight of 100 seeds per plot, with the best treatment (10 ml/liter of water/plot) on mung bean plants.

Nasa Liquid Organic Fertilizer can reduce the use of chemical fertilizers by 12%-25%, Other benefits of Nasa Liquid Organic Fertilizer are spurring the growth of plants and roots, stimulating growth, flowering and fertilization and reducing flower and fruit loss (containing hormones or Growth Regulators such as auxin, cytokinin and giberllin), helping the development of microorganisms and soil organisms that are beneficial to plants, and increase plant resistance to pests and diseases (Ramadan et al., 2016).

At the age of 30 Days, the highest IKK of 2.4 40g/plant was obtained by fertilizing 300 kg of Phonska/ha, while the highest CPI at the age of 40 DAYS was obtained by fertilizing 300 kg of Phonska/ha and 5000 kg of manure/ha. This indicates that the ability to supply N from 5000 kg of manure/ha is equivalent to 300 kg of Phonska/ha (Lestari & Kunstyastuti, 2016). Cow manure has a nutrient content of C 24.57%, N 1.63%, P 0.26%, and K 2.80% (Sudarsono et al. 2013). The effect of organic fertilizer application, NPK fertilization, and ZA in increasing plant chlorophyll content (Maschner, 2011). Thus, the fertilization

dose is measured according to the treatment formulated with the aim of full use of organic fertilizers in mung bean planting.

### **Pant Disease of Mung Beans**

In tropical regions such as Indonesia, there are more diseases caused by fungal infections than viruses and bacteria. For example, in soybean plants as close relatives of mung bean plants there are 16 types, namely: *Macrophomina phaseolina*, *Fusarium oxysporum*, *Aspergillus flavus*, *A. niger*, *Phoma* sp., *Sclerotinia sclerotiorum*, *Cercospora kikuchii*, *Peronospora manshurica*, *Microsphaera diffusa*, *Alternaria* spp., *Cladosporium* sp., *Verticillium* spp., *Pythium* sp., *Phytophthora* sp., *Curvularia lunata*, *Penicillium* spp. Pada kacang tanah sebanyak 19 jenis yaitu: *Rhizoctonia* spp., *Fusarium* spp., *Pythium* spp., *Rhizopus* spp., *Penicillium* spp., *Alternaria* spp., *Botrytis cinerea*, *Mucor* spp., *Curvularia* sp., *Cladosporium* sp., *Botryodiplodia theobromae*, *A. flavus*, *A. niger*, *Sclerotium rolfsii*, *Sclerotium bataticola*, *Rhizoctonia solani*, *Verticillium* sp., *Mucor* sp., *Rhizopus* sp.. Pada kacang hijau sebanyak 7 jenis yaitu *Alternaria* sp., *Fusarium* spp., *Myrothecium roridum*, *Drechslera* sp., *A.s flavus*, *A. niger*, *Macrophomina phaseolina* (Rahayu, 2016). Mung bean diseases that are often identified in the field include the following:

#### 1. Powdery Mildew

One of the main diseases in green beans is powdery mildew. Although it has been known for a long time, it is rarely controlled due to the limited knowledge of farmers about the disease. Powdery mildew is widespread throughout mung bean production center countries, including India, Pakistan, Thailand, China, Myanmar, and Indonesia (Nair et al., 2014). The decrease in mung bean yield due to powdery mildew disease in Thailand reached 26.2% (Tantanapornkul et al., 2005). Farmers rarely control powdery mildew, and if it is still controlled using fungicides that are not environmentally friendly.

#### 2. Leaf Spot

Leaf spot is one of the main diseases of green beans. Not only in Indonesia, but also in Asia such as the Philippines, Malaysia, Thailand, India, Bangladesh, and Pakistan. In Indonesia, this disease is known in all mung bean production centers. *C. canescens* infection in mung beans causes yield loss of 46-61% in the field (Sompong et al., 2011).

#### 3. Wilt Disease

Symptoms of wilt disease are in the form of rashes on infected parts, such as the influence of waterlogging. The part of the rash is light brown and develops into a dark brown. The infected plant will then become rotten and eventually die. White mycelia will be found around the symptoms, and in advanced symptoms a number of sclerosia will be found on the roots (Jin Hyeuk, 2017) and leaves near the ground level. In addition to wilting symptoms, this fungal infection also causes root and pod rot, as well as bud collapse (damping off) (Akram et al., 2007). Infection of the plant can occur in the early stadia before the seeds germinate to the final generative phase. However, the initial phase of plant growth is a vulnerable phase of this fungal infection.

## METHODOLOGY

The research began with the preparation of land for planting sites in the form of green houses by clearing the land from disturbing organisms and possible threats to plants. Then the mixture of media in the form of soil with a mixture of biochar made from rice husk charcoal was carried out. Then the prepared media is inserted according to the treatment on each polybag with 50% Biochar treatment; 25%; and 10% of the planting volume, then it is combined with the application of fertilization with Nasa Organic Liquid Fertilizer which is carried out on the planting medium. Then a repeat is made three times and embroidered plants are provided.

This study was conducted using a 3 x 4 factorial Complete Random Design (RAL) which was repeated 3 times so that 36 plants were found. Then the first factor is the difference in the concentration of liquid fertilizer given, the Nasa organic liquid fertilizer (P) Giving Factor with 4 levels, namely: P1 = 100 ml / 1 liter of water; P2= 300 ml/ 1 liter of water; P3= 500 ml / 1 liter of water. The second factor is the composition of biochar addition media from 3 levels, namely control M0 = control / Soil; M1 = Biochar 50% + Soil = 50%; M2 = Biochar = 25% + Soil = 75%; M3 = Biochar = 10% + Soil = 90%.

Grouped as such:

Fertilizer factors

P1 : 100ml/ 1 liter water

P2 : 300ml/ 1 liter water

P3 : 500ml/ 1 liter water

The second factor is the addition of biochar:

M0 = kontrol / Soil;

M1 = Biochar = 50% + Soil = 50%;

M2 = Biochar = 25% + Soil = 75%;

M3 = Biochar = 10% + Soil =90%.

Then a combination is carried out:

Table 1. Combinstion is Carried

P1M0	P1M1	P1M2	P1M3
P2M0	P2M1	P2M2	P2M3
P3M0	P3M1	P3M2	P3M3

## **Riset Conduction**

The steps taken in this study include:

### **1. Media Mixing**

The media prepared is in the form of soil and rice husk charcoal biochar. After the media is prepared, the media is mixed according to the ratio that has been set on the treatment. The media that has been mixed is then put into a polybag and recorded and labeled according to the treatment. Then the media is placed as in the research planning map.

### **2. Plantation**

Planting is carried out by placing 2 plant seeds in each polybag then thinning is carried out when it is 1 week after planting into 1 plant per polybag. For each treatment, embroidery is prepared in the form of 1 polybag containing several plants. Green beans are planted with a distance of 40cm between polybags and given a distance of 50cm between replicates.

### **3. Maintenance**

Maintenance carried out includes watering, thinning, squeezing and embroidery. Watering is done daily in the morning or evening using a padlock. Watering is carried out to meet the water needs of plants provided by the planting medium in a flexible level. Thinning is carried out by leaving 1 plant in each planting hole when the plant is 1 mst. Embroidery is done when the plant grows poorly or dies. Embroidery is carried out when the plant is 1 mst old until it enters a critical period. If an attack from pests is found, then pesticide spraying is carried out in contact with the Decis trademark.

### **4. Fertilizer Addition**

Fertilization begins 2 weeks after planting with fertilizer application intervals every 2 weeks. With a dose of 300ml/plant each stock solution from the treatment. The treatment provided includes the difference in the concentration of liquid fertilizer given, the Nasa organic liquid fertilizer (P) Giving Factor with 3 levels, namely: P1 = 100 ml / 1 liter of water; P2= 300 ml/ 1 liter of water; P3= 500 ml / 1 liter of water.

### **5. Obervation**

Observations were made by measuring the observed variables. This variable is divided into two stages, the vegetative stage and the productive stage of the plant. For the vegetative stage of the plant, observation is made of stem height, and number of leaves. The productive stages of plants are measured on wet weight, dry weight, and the number of pods in the plant. This observation was carried out 21 Days after planting, 35 Days after planting, 49 Days after planting, and 63 Days after planting, then from the data processed by statistical methods.

### **6. Harvesting**

Harvesting is carried out when the plant is 56 Days old after planting by pulling out the plant so that all parts are lifted, including the roots. After harvesting, wet weight, number of leaves, and number of pods are measured.

## RESULTS AND DISCUSSION

### Vegetatif Observation

#### A.Plant Height (cm)

Plant height data analyzed by the variegated fingerprint method or ANOVA showed that there was an unreal effect on the height of Mung Bean plants of the Vima-5 variety in observations made at each replicate at 21 Days, 35 Days, 49 Days, and 60 Days, either in the single treatment of organic liquid fertilizer concentration factor or single treatment of biochar composition. The results of data analysis did not find any interaction between organic liquid fertilizer concentration treatment and biochar media composition. This is possible because the nutrient needs for plant growth have been met, accompanied by superior plant gene expression.

Tabel 2. Height of Mung Beans Plant

Treatment	Plant Height (cm)			
	21 Days	35 Days	49 Days	63 Days
P1	22.28	51.06	53.94	56.81
P2	22.48	49.63	52.38	56.06
P3	21.75	49.01	51.34	54.31
LSD 5%	tn	tn	tn	tn
M1	20.60	49.59	52.04	55.50
M2	21.79	50.72	53.00	56.33
M3	24.08	49.88	52.58	55.58
M0	22.21	49.42	52.58	55.50
LSD 5%	tn	tn	tn	tn

Description : F-count value lower than F-table 5% so it stated as Not significance different(TN)

The average observation of the height size of mung bean plants in the study that has been carried out shows that the value close to the description of the Vima-5 mung bean variety of 62.4 cm with the highest value in the observation obtained at 56.81 cm. The variable of plant height is influenced by several factors, especially the nitrogen availability factor explained by Kurniawan and Febrianingsih (2009) that nitrogen is beneficial for plant vegetative growth, namely the formation of new cells such as leaves, branches, and replacing damaged cells with a lack of nitrogen will cause inhibition of plant growth so that the plant is dwarfed, Meanwhile, excess nitrogen can cause plants to collapse or have unstable stems. According to Table 2. It was shown that the analysis of various fingerprints was carried out at 21 Days, 35 Days, 49 Days, and 63 Days by comparing F calculation with F table at 5% and 1% degrees. The F calculation obtained from the analysis of plant height data did not exceed the F table with a degree of 5%, thus it was stated that there was no real effect of single treatment or interaction between organic liquid fertilizer and biochar treatment on the observed growth at 21 Days, 35 Days, 49 Days, and 63 Days. According to Setyamidjaja (1986) stated that if the plant lacks element N, the plant will show stunted growth. The application of fertilizer and the comparison of the composition of the media with biochar in each treatment have met the nutrient

needs for the vegetative growth of mung bean plants, so that no real influence is detected on the growth of mung bean plants.

#### B. Number of Leaf

Table 3. The average number of leaves showed that there was no interaction between Organic Liquid Fertilizer concentration treatments and composition of the media. The single treatment of the composition of the planting medium generally had no real effect, but at the age of 63 Days the analysis showed a significant difference with the smallest value of the influence of M0 media composition with no biochar application. This is because at the age of plants above 35 Days plant growth is directed towards production or generative phase, so that the increase in the number of leaves can be observed clearly showing a real difference in the results of a single treatment of planting media. Through the observations that have been made, Table 3. showed that the treatment of fertilizer application with the dose symbol P2 had the highest number of leaves, and the treatment with the P1 dose combined with M0 found the lowest value. This is suspected because the concentration of liquid organic fertilizer with P1 treatment has a high dose of fertilizer but the treatment on the planting medium with M0 is not added biochar at all so that the soil aggregate is denser, causing more limited nutrient absorption, this is accordance with the statement of Risa (2016) Rice husk biochar is porous and able to store water well, and can absorb pollutants such as heavy metals, minerals including nutrients in the soil with low nutrient binding capacity. The addition of biochar has an effect on looser soil aggregates, so that the roots are able to grow more freely and efficiently in nutrient absorption.

Table 3. Number of Mung Beans Leaf

Treatment	Number of leaf (pieces)			
	21 Days	35 Days	49 Days	63 Days
P1	2.50	5.44	8.44	12.88
P2	2.81	5.44	9.63	13.44
P3	2.69	5.44	9.44	12.69
LSD 5%	tn	tn	tn	tn
M1	2.58	5.33	9.75	14.33
M2	2.67	5.58	9.42	13.17
M3	2.67	5.33	8.67	12.67
M0	2.75	5.50	8.83	11.83

Description : F-calculation value under the F-table 5% sebesar 2,87, stated as non significance (tn)

The results showed that there was no real effect on the treatment of differences in organic liquid fertilizer concentrations due to the number of leaves affected by the hormone auxin and nitrogen content in the formation of the apical meristem of a plant. A plant's need for nitrogen is limited based on the phenotypic potential of the genes possessed by the plant. If the nitrogen requirement has been met, then the number of leaves growing can reach or approach the maximum potential that has been listed in the variety description

(Appendix 1.). Leaves that have an important role in photosynthesis and with stomata facilitate energy overhaul in plants, it can be assumed that the greater the number of leaves, the more the plant produces on the generative variable or the yield of the mung bean plant. Another factor that influences the formation of the number of leaves is the availability of water during the growth period, especially the critical periods of the plant. Kurniawan and Febrianingsih (2009) explained that nitrogen is beneficial for plant vegetative growth, namely the formation of new cells such as leaves, branches, and replacing damaged cells.

### C. Fresh Weight of Plant

The results of the analysis from the observation of the fresh weight of the plants did not show any significant difference in the treatments given and there was no interaction between the two treatments. This incident is caused by the dosage range that may not be far and the presence of locust pest attacks in the time before the crop harvest.

Tabel 4. Fresh Weight of Mung Beans Plant

Treatment	Fresh Weight <u>Of</u> Plant
P1	35.06
P2	35.31
P3	29.50
LSD 5%	tn
M1	37.08
M2	33.83
M3	31.08
M0	31.17
LSD 5%	tn

Description : All the f-calculation value of treatment bare under F-table of 5%, it categorized as non-significance (tn)

Suriadikarta (2006) stated that the application of liquid organic fertilizer must pay attention to the dosage in applying it to plants in order to provide good results. The application of liquid organic fertilizer in addition to adding nutrients also improves soil aggregates, so that the soil becomes loose and can facilitate plant roots to penetrate the soil and absorb nutrients in meeting their needs (Sopyan et al., 2020) It can be seen from the results of the study (Table 4.), namely plants are given a medium dose of P2 which has a fertilizer concentration of 30% with M1 media treatment which has a ratio of 50:50 biochar composition: soil has the greatest yield.



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