Journal Techno, Vol. 9, No.2, 2023, pp. 067 - 076
ISSN. 2461-1484

GROWTH RESPONSE AND YIELD OF PURPLE EGGPLANT ON VARIOUS PLANTING MEDIA AND LIQUID ORGANIC FERTILIZER

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ABSTRACT

Purple eggplant is a seasonal vegetable that contains a lot of fiber and few calories and is rich in manganese, folate, potassium, vitamins K and C, small amounts of niacin, magnesium and copper. The research aims to determine the composition of various planting media compositions and liquid organic fertilizers that are best for the growth and yield of purple eggplant plants. The research was carried out at the Experimental Garden of the Faculty of Agriculture, National Development University "Veteran" Yogyakarta. This research used a factorial design arranged in a completely randomized design. The first factor is the composition of the planting medium, soil, sand, and manure with volume ratios of (2:1:1), (1:1:2), (1:2:1), and (1:2:2). The second factor is the type of liquid organic fertilizer consisting of rabbit urine, cow urine, rice washing water and liquid smoke. The research results showed that the composition of the planting media and the application of liquid organic fertilizer from rabbit urine, cow urine, rice washing water and liquid smoke had no significant effect on all parameters, except for the diameter of purple eggplant stems per plant.

Keywords*: Planting media, liquid organic fertilizer, purple eggplant*

INTRODUCTION

Purple eggplant (*Solanum melongena* L.) is a type of seasonal vegetable that contains lots of vitamins, minerals, fiber and several calories. Purple eggplant plants are widely cultivated by humans for consumption and health purposes, for example in the treatment of high blood pressure. Based on data from the Central Statistics Agency and the Directorate General of Horticulture, it is known that there has been an increase in eggplant productivity of 5.74%. Eggplant productivity in 2015 was 11.20 tons/ha, 2016 was 11.37 tons/ha, 2017 was 12.20 tons/ha, 2018 was 12.38 tons/ha, and 2019 was 13.09 tons/ha.

The large-scale use of chemical fertilizers in plant cultivation is widely carried out because of its practicality and is widely sold on the market. This excessive use has a negative impact on the environment, land, plants and humans who consume the food produced by these plants. The negative effects of using chemical fertilizers can be prevented by paying attention to the type and

composition of planting media and the application of organic fertilizer in fertilization.

The composition of the planting media is a collection of materials or substrates where seeds are planted, while liquid organic fertilizer is a type of fertilizer derived from dead plants and animals and other organic waste that has gone through an engineering process in liquid form. Planting media supports plant life because plants use roots to reach and absorb nutrients in the planting media. Liquid organic fertilizer is a solution resulting from the decomposition of organic materials originating from plant residues, animal and human waste which contains more than one nutrient element (Pratiwi et al., 2019). The better the properties of the planting medium, the more optimal the absorption of nutrients by plants will be, so that more photosynthate will be produced by photosynthesis. The growth of plant roots is also influenced by the condition of the air in the soil, the physical and environmental conditions of the soil.

According to Annisa and Leni (2016), planting media is the main component when cultivating crops. The planting medium that will be used must be adjusted to the type of plant you want to plant. A good planting medium must have physical, chemical and biological properties that suit the needs of the plant. In general, a good planting medium must have the following requirements: (a) Able to provide growth space for plant roots, while also being able to support plants. The planting medium must be loose so that the plant roots can grow well and perfectly, and still be solid enough to hold the roots and support the stem so that it does not collapse. If the media is too loose, root growth will be free, but the plant will be uprooted too easily. On the other hand, if it is too dense, the roots will have difficulty growing. (b) It has good porosity, meaning it can store water while also having good drainage and aeration. The planting medium must maintain soil moisture, but must be able to remove excess water. Porous planting media has empty spaces between the materials, which can be permeable to water so that water does not stagnate in pots or polybags. However, on the other hand, these cavities must be able to absorb water (hygroscopic) to be stored as reserves and retain moisture, (c) Provide sufficient nutrients, both macro and micro. Nutrients are very important for plant growth. These nutrients can be provided from fertilizer or the activity of microorganisms contained in the planting medium. (d) The planting medium does not contain disease germs and must be clean from pests and diseases. Pests and diseases contained in the planting medium can attack plants and cause plant death. The planting medium does not have to be sterile because there are many soil microorganisms which are actually very beneficial for plants, but it must be hygienic from disease seeds, (e) The planting medium must supply sufficient oxygen, because the roots need respiration to get energy which is ultimately used for absorbing sunlight, the media It must also supply sufficient water. Water in the planting medium facilitates nutrients being dissolved in the soil solution and can be taken up by plants. The planting medium must be able to supply sufficient nutrients for plant growth.

Mineral soil functions as an ideal growing medium, materially composed of 4 components, namely solid materials in the form of mineral materials and organic

materials, water and air. Based on its volume, soil consists of 50% solids in the form of 45% mineral material, 5% organic material, 50% pore space containing 25% water and 25% air. Air (O2, CO2, N2 and others) functions as a storehouse and source of gas. Good air circulation (aeration) will enable the exchange of these gases with O2 from the atmosphere, so that autotrophic microbial activity which plays a vital role in providing nutrients is guaranteed and the toxicity of these gases is neutralized (Zuhaida and Kurniawan, 2018). Sand has a large number of macro pores so it gets wet easily and dries quickly, but can produce good air circulation for plant roots. Manure contains macro and micro nutrients. Each manure has different nutrient content, because each animal has its own unique properties which are determined by the type of feed and age of the animal (Nurjanah et al., 2020). The application of organic material causes improvements in soil structure, in sandy soil it causes the soil's binding capacity to increase, while in clayey soil the water holding capacity increases, the soil's binding capacity for nutrients increases, and soil drainage and air conditioning can be improved. Good soil air management with sufficient water content will cause stable soil temperatures and better soil water and air flow (Rosniawaty et al., 2015). Determining the right and standard planting medium for plant types in different native habitats is difficult. This is because each region has different air humidity and wind speed (Radha, et al., 2018). In general, the planting medium must maintain humidity in the area around the roots, provide enough air, and be able to withstand the availability of nutrients. The type of planting media in each region is not always the same (Haryanto et al., 2019).

Fertilization itself has a close relationship with plant growing media, the quality of which has basic indicators of the presence of nutrients. Liquid organic fertilizer can be a source of nutrients that come from externally to the plant body and meet plant needs if intake from the soil is lacking. Liquid organic fertilizer comes from rabbit urine, cow urine, rice washing water and liquid smoke. The aim of the research is to determine the composition of planting media and liquid organic fertilizer that provides the highest growth and yield in purple eggplant plants.

LITERATURE REVIEW

Environmental factors, especially planting media, play a very important role in the process of plant growth and development. A good planting medium usually uses a mixture of sand, soil and manure (Hayati et al., 2012). Soil functions as an ideal growing medium materially. Sand for planting is due to the weight of the sand being quite heavy so it can support plants upright, but there are a large number of macro-sized pores so it gets wet easily and dries quickly. Manure can improve soil structure and in sandy soil causes soil binding capacity to increase.

Using liquid organic fertilizer can increase fertilization efficiency while reducing the use of existing chemical fertilizers. Liquid fertilizer is more easily absorbed by plants because the elements in it have been decomposed. Liquid organic fertilizer has weaknesses such as less nutrient content compared to artificial fertilizer in terms of quantity and tends to have a more pungent odor.

Good planting media will cause better root growth and development so that the function of the roots in absorbing water and nutrients will increase. Apart from that, the nutrient content from adding liquid organic fertilizer will increase the availability of nutrients needed by plants, so that the macro nutrients that are essential for vegetative growth are sufficient for cell division and enlargement and provide energy for plant metabolism.

According to Santoso and Djarwatiningsih (2013) show that there is an interaction between various eggplant plant varieties and various planting media compositions on plant height, number of leaves, number and weight of fruit with a composition of (2:1:1) compared to a composition of (1:1:1), (1 :1:2), and (1:2:1). The research results of Azisah et al., (2017), also stated that the use of liquid organic fertilizer from cow urine had a good effect on plants and was able to support vegetative growth, especially at a dose of 300 ml compared to the control treatment, 100 ml and 200 ml. Biourine liquid fertilizer can quickly overcome nutrient deficiencies, the amount of nitrogen, phosphorus, potassium and water is higher than solid cow dung (Pratiwi et al., 2019). In planting media, the best composition of planting media is soil, sand and drum fertilizer with a ratio (v/v/v) of (2:1:1). According to Santoso and Djarwatingsih (2013), this is because the composition contains good environmental conditions so that it can support plant growth and roots well. The composition of the planting media also has good soil physical properties, namely high water absorption and retention capacity. Aeration or drainage in the soil at this composition ratio can also work well, because the soil is not thick and not too crumbly. Research by Panggua and Amarullah (2019) shows that the composition of the planting medium: soil: sand: manure (2:1:1) gives the best average results for each observation parameter because the presence and adequacy of soil as the main medium for plants has a positive influence on plant growth. such as increasing leaf length and plant height. The best treatment for various liquid organic fertilizers is liquid organic fertilizer from cow urine. This is because several studies show that cow urine has a real effect on the growth and yield of eggplant plants. Puspitorini's research (2017) showed that giving organic cow urine fertilizer had a significant effect on the variables of plant height, number of leaves, fruit weight, fruit length, number of fruit per plant.

Research shows that the use of organic rabbit urine fertilizer can affect the number of fruit and fruit weight in the first harvest. Satriawi et al., (2020) also said that there is fertilizer from other livestock, namely rabbits, which is able to provide a fairly high nitrogen supply for plants. According to Lulan (2020), organic fertilizer made from rice washing water shows that the influence of the pH of soil treated with rice washing water shows a real influence on the growth of land kale plants (Ipomoea reptans) on stem height, leaf length and leaf width at age. 2 and 3 weeks after planting with an average pH of 6.0 to 6.3. This is because there is vitamin B1 which can convert carbohydrates into energy to drive activities in plants. Household waste such as rice washing water contains 2.245% organic matter, C/N ratio 81.38%, total P2O5 0.073% and total K2O 0.052%. According to Murniati et al., (2020) said that liquid smoke can support increased plant production because liquid smoke contains chemical components such as acetic acid, methanol and phenol which

provide resistance to plants from pest attacks and can stimulate growth so that plants grow and produce well.

RESEARCH METHODS

The research was carried out in February 2022-June 2022. This research was carried out at the Experimental Garden of the Faculty of Agriculture, National Development University "Veteran" Yogyakarta, Wedomartani Village, Kapenawon Ngemplak, Sleman Regency, Yogyakarta Special Region 55584. The soil type is regosol, the altitude is 154 m above sea level.

The materials used are Yuvita F1 purple eggplant seeds, soil, sand, cow manure, cow urine liquid organic fertilizer, rabbit urine, rice washing water and liquid smoke. The tools used are 6 x 7 cm plastic seedbeds, 40 x 40 cm polybags, buckets, buckets, hoes, small shovels, sprayers, scales, calipers, rulers or meters, label boards, cameras and stationery.

This research was carried out using polybags with a Factorial Design arranged in a Completely Randomized Design (CRD) consisting of two factors. The first factor is the composition of the planting medium with a volume ratio consisting of 4 types, namely soil: sand: cow manure (2:1:1) (M1), (1:1:2) (M2), (1:2:1) (M3), and (1:2:2) (M4). The second factor is the type of liquid organic fertilizer, namely rabbit urine (P1), cow urine (P2), rice washing water (P3), and liquid smoke (P4).

The research implementation included preparing planting media in the nursery using soil, sand and drum fertilizer in the ratio (1:1:1) (v/v/v). All media are mixed until evenly distributed and placed in a plastic nursery. Seed selection begins by soaking the seeds in water for 10 minutes. Floating seeds are discarded and sunken seeds are used as seeds. Then the seeds are sown in 6 cm x 7 cm plastic for 3 weeks. One seed for one plant hole. The planting media used is according to the treatment with a volume ratio of soil: sand: manure (2:1:1), (1:1:2), (1:2:1), and (1:2:2). Transplanting plants already have 4 leaves. Polybag planting distance 50 x 60 cm. Liquid organic fertilizer was given 3 times during the research, namely when the plants were 14, 28 and 42 days after planting. The concentration of liquid organic fertilizer given is 22.5 ml/liter. The dosage of liquid organic fertilizer when the plants are 14 days old is 300 ml/plant, 600 ml/plant at 28 days and 900 ml/plant at 42 days. How to apply liquid organic fertilizer by spraying directly onto plants, especially the leaves and stems. Plant maintenance includes watering in the morning, controlling pests and diseases, especially the appearance of yellowing leaves, as well as harvesting the eggplant which is carried out when the purple eggplant has the characteristics of being ready to harvest purple eggplant, including the color of the fruit being shiny and the fruit looking full. Harvesting is done once a week and consists of 5 harvests.

Plant growth observation data includes plant height, stem diameter, number of leaves, leaf length and leaf width per plant, while plant yields are fruit length, fruit diameter, number of fruit, fresh fruit weight per plant and harvest index. The data that was obtained was then analyzed using analysis of variance (ANOVA), then continued with the Duncan Multiple Range Test (DMRT) at the 5% level.

RESULTS AND DISCUSSION

The results of analysis of observational data on the growth of purple eggplant plants in the treatment of planting media composition and type of liquid organic fertilizer are shown in Tables 1 and 2 as follows:

Table 1. Response of purple eggplant plant growth to the composition of the planting medium and type of fertilizer liquid organic.

Treatment	Plant height per plant (cm) 64 DAP	Stem diameter per plant (mm) 64 DAP	Number of leaves per plant (pieces) 64 DAP	Length of leaves per plant (cm) 64 DAP	Width of leaves per plant (cm) 64 DAP
Composition of soil: sand: manure (v/v/v)					
M1=(2 : 1 : 1)	39,20 a	6,51 b	8,26 a	9,95 a	5,28 a
M2=(1 : 1 : 2)	41,24 a	6,70 b	8,18 a	9,94 a	5,38 a
M3=(1 : 2 : 1)	39,29 a	6,75 b	8,49 a	9,71 a	5,01 a
M4=(1 : 2 : 2)	41,35 a	7,68 a	8,91 a	10,40 a	5,43 a
Liquid organic fertilizer					
P1=Rabbit urine	40,70 p	6,95 p	8,86 p	10,20 p	5,34 p
P2=Cow urine	41,20 p	6,95 p	8,35 p	10,11 p	5,26 p
P3=Washing water rice	39,64 p	6,83 p	8,69 p	9,99 p	5,31 p
P4=Liquid smoke	39,54 p	6,91 p	7,94 p	9,71 p	5,18 p
Interaction	(-)	(-)	(-)	(-)	(-)

Note: Numbers followed by the same letter indicate there is no significant difference based on DMRT level = 5%.
The sign (-) indicates no interaction.

Table 1 shows that plant height, number of leaves, leaf length and leaf width per plant when they were 64 days old showed no significant difference in the composition of the soil media: sand: manure with a composition of (1:2:2), (2:1:1), (1:1:2) and (1:2:1). This is due to the balanced composition of soil and sand as well as drum fertilizer, so that it can support the vegetative growth of plants. Plant growth is largely determined by the availability of nutrients, both macro and micro nutrients contained in the planting medium or soil. The presence of sand makes the porosity of the planting medium greater and the application of organic fertilizer is able to restore soil fertility lost due to erosion and the application of chemical fertilizers (Setiawan, 2011). The need for nutrients increases as the plant ages and can be met by the soil in which it grows, so that by providing organic materials such as manure, it can increase the availability of nutrients, especially nitrogen (N), which is needed for plant vegetative growth (Safei et al., 2014). The Phosphorus (P) element in manure serves to accelerate root growth. The potassium content functions to help

root development and help the process of protein formation (Widiarta et al., 2021). The use of liquid organic fertilizer from rabbit urine, cow urine, rice washing water and liquid smoke also had no significant effect on plant height, stem diameter, number of leaves, leaf length and leaf width per plant at 64 days after planting. In other words, the use of rabbit urine, cow urine, rice washing water and liquid smoke has the same effect on plant height, stem diameter, number of leaves, leaf length and leaf width per plant.

The composition of the planting media, sand and manure in a ratio of (1:2:2), had a significantly better effect than (2:1:1), (1:1:2) and (1:2:1) on the stem diameter of purple eggplant per plant. This is because the planting media treatment has a larger volume of sand so that the planting media has a more porous nature and has good aeration. As Tyas and Hartini (2019) said, media aeration and drainage have an effect on root growth and development. Porous media will make it easier for roots to grow and develop. Better root growth will ensure nutrient and water absorption.

Table 2. Response of purple eggplant yields to the composition of the planting media and type of liquid organic fertilizer.

Treatment	Fruit length per plant (cm)	Fruit diameter per plant (mm)	Number of fruit per plant (fruit)	Fresh fruit weight per plant (g)	Harvest index
Composition of soil: sand: manure (v/v/v)					
M1=(2 : 1 : 1)	11,85 a	23,88 a	0,65 a	65,46 a	0,24 a
M2=(1 : 1 : 2)	9,65 a	17,21 a	0,56 a	48,71 a	0,18 a
M3=(1 : 2 : 1)	7,80 a	16,29 a	0,48 a	45,03 a	0,25 a
M4=(1 : 2 : 2)	12,19 a	22,04 a	0,61 a	72,30 a	0,22 a
Liquid organic fertilizer					
P1=Rabbit urine	8,14 p	16,48 p	0,49 p	40,81 p	0,21 p
P2=Cow urine	12,74 p	25,06 p	0,68 p	76,98 p	0,26 p
P3=Washing water rice	11,23 p	21,16 p	0,61 p	62,08 p	0,22 p
P4=Liquid smoke	9,38 p	16,71 p	0,53 p	51,64 p	0,22 p
Interaction	(-)	(-)	(-)	(-)	(-)

Note: Numbers followed by the same letter indicate there is no significant difference based on DMRT level = 5%.
The sign (-) indicates no interaction.

Table 2 shows that the composition of the planting medium has no significant effect on fruit length, fruit diameter, number of fruits and fresh weight of purple eggplant fruit per plant. This means that the use of planting media composition has the same influence on fruit length, fruit diameter, number of fruits and fresh weight of purple eggplant fruit per plant, whether used as a planting medium of soil, sand and cow manure (v/v/v) with composition ratio (2:1:1), (1:1:2), (1:2:1) and (1:2:2).

Likewise, applying liquid organic fertilizer did not have a significant effect on fruit length, fruit diameter, number of fruits and fresh weight of purple eggplant fruit

per plant. This is due to nutrient loss due to leaching of nutrients. Nutrient leaching is more influenced by the soil's ability to hold nutrients, soil texture, soil moisture and the high and low levels of the rainy season. Soil with a sandy texture will wash nutrients more intensively or faster than soil with a clay texture (Watrianthos, 2021). Apart from that, this research purely used liquid organic fertilizer from rabbit urine, cow urine, large washing water and liquid smoke without using additional fertilizer in the form of NPK fertilizer. Thus, if you only rely on liquid organic fertilizer, even though it contains complete amounts of both macro and micro nutrients, the amount is not as expected, as a result the purple eggplant yield will not be optimal. Based on research by Larasati et al., (2019), the dose of NPK fertilizer needed for eggplant plants is 5 g/plant. With a dose of NPK fertilizer of 5 g/plant, it had a significant effect on the variables number of leaves, plant fresh weight, plant dry weight, fruit length, fruit diameter, number of fruit per sample and fruit weight per plant. Firmansyah et al., (2017) argue that the function of macro nutrients is as a primary element N to support vegetative growth and chlorophyll formation. P nutrients for plant maturation and root growth. K nutrient is an element that builds cell walls, regulates the opening and closing of guard cells in leaf stomata, the strength of plant stalks and stems and resistance to pests and plant stem diseases.

The harvest index is the ability of plants to distribute assimilate which describes the efficiency of using photosynthesis results for human benefit. The harvest index value increases with more parts of the plant that can be utilized. Table 2 shows that the composition of the planting medium and the type of liquid organic fertilizer do not have a significant effect, which means the effect is the same. The harvest index for the composition of the planting media is 0.18 – 0.25 for the type of organic fertilizer, the harvest index is 0.21 – 0.26. All values are below one, which means a situation that reflects humans' inefficiency in utilizing purple eggplant plants.

From the several tables above, it can be seen that the interaction between the composition of the planting media and the type of liquid organic fertilizer on the growth and yield of purple eggplant also does not show any significant differences. Interaction is the tendency of a factor to have a different influence on various levels of other factors (Sutjihno, 1992).

CONCLUSION & SUGGESTION

CONCLUSION

1. The interaction between the composition of the planting media and the application of liquid organic fertilizer did not have a significant effect on all observed parameters of purple eggplant.
2. The composition of the planting media and the application of liquid organic fertilizer from rabbit urine, cow urine, rice washing water and liquid smoke had no significant effect on all parameters, except for the diameter of purple eggplant stems per plant.

3. This research purely uses liquid organic fertilizer from rabbit urine, cow urine, large washing water and liquid smoke without using additional fertilizer in the form of NPK fertilizer.

SUGGESTION

Based on this research, it is recommended that if you plant purple eggplant using liquid organic fertilizer from rabbit urine, cow urine, rice washing water and liquid smoke, it would be better if you also use NPK chemical fertilizer to get the expected results.

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