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Impact of Growing Media and Nutrition on Growth and Yield of Broccoli Microgreens (*Brassica oleracea*)

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Abstract *—Microgreens are a new class of vegetables that are harvested within 7-21 days after sowing, have a lot of nutritional potential and are a new trend in the food industry. One type of microgreens that is grown commercially is broccoli. The nutrients in broccoli microgreens are 4-6 times more than mature plants, contain good vitamin C, and contain antioxidants that can help protect the body from the harmful effects of free radicals. Cultivating microgreens requires the right planting medium and nutrients to support plant growth. The research objective was to obtain the interaction between the types of growing media and the nutrients used to increase the growth and yield of broccoli microgreens. This research was carried out from October to November 2022 at the Greenhouse of the Faculty of Agriculture, Andalas University. The study* was a two-factorial experiment in a completely randomized design (CRD) *with 3 replications. The first factor is several types of planting media, namely soil, cocopeat, and rock wool. The second factor consisted of several types of nutrition, namely AB mix and young coconut water. Observational data were analyzed using statistical analysis of variance test F. If F Count treatment is greater than F Table 5% then it will be continued with the DNMRT test at 5% level. The results showed that there was an interaction between the type of growing media and the nutrition given to the growth of broccoli microgreens. The use of rock wool growing media and AB mix nutrition gave the best response for the observed parameters of seedling height, number of leaves, fresh weight, and chlorophyll content. The results of the antioxidant analysis carried out when harvesting broccoli microgreens gave a red color change when given HCl, whereas if NaOH was added drop by drop there was no blue color change. So it can be concluded that broccoli microgreens contain betacyanin.*

Keywords *—**Microgreens, Broccoli, Cocopeat, Rockwool, Nutrition.***

I. INTRODUCTION

Microgreens are vegetables that are harvested at a young age, harvesting is done when the cotyledon leaves and a pair of young leaves have appeared. Microgreens are a new class of vegetables that are harvested within 7-21 days after sowing, have a lot of nutritional potential and are a new trend in the food industry (Kyriacou et al., 2016). Nutrients in microgreens are 4-6 times more than mature plants, contain good vitamin C, and contain antioxidants that can help protect the body from the harmful effects of free radicals (Xiao et al., 2012).

There are many types of microgreens that aregrown commercially around the world, one of which is broccoli. The product from the broccoli plant that we know so far and is often sold in the market isonly the end product in the form of broccoli vegetables. The length of time it takes to harvest broccoli encourages farmers to carry out various innovations, one of the innovations made is by planting broccoli microgreens (Widiwurjani, 2019).

According to Sriwahyuni (2021), topsoil-growing media can be used in the cultivation of microgreens. However, the use of topsoil still has some drawbacks such as high organic matter content little and lack of availability of certain nutrients for plants, so certain nutrients are needed for plants to increase the availability of nutrients, one of which is organic matter. Several types of organic materials that can be used as planting media include

cocopeat and rockwool. Cocopeat is obtained from the extraction ofcoco fiber which has the advantage of being a plantingmedium, namely the ability to bind water (Pratiwi et al., 2017). Based on previous research (Ramadhan, 2018) the use of 25% and 50% cocopeat combined with soil as a planting medium is the best composition for the growth of ground merbau seedlings.

Besides that, rock wool planting media also has advantages that not many other planting media have, especially in terms of the ratio of the composition of water and air that can be stored by rockwool growing media. Additional nutrients are also needed to increase the production of broccoli microgreens. In meeting these needs, one alternative that can be done is to add AB Mix and young coconut water as nutrients for the growth of broccoli microgreens. AB Mix nutrients are nutrients that are commonly used in plant growth. The results of Hidayanti's research (2019), explained that the treatment of giving AB Mix nutrition had a significant effect on plant height, number of leaves, and fresh weight of red spinach.

The young coconut water given to the plants as a nutrient is expected to increase the growth and yield of broccoli microgreens. According to Amsar in Sari (2021), the hormones contained in coconut water are auxinns an cytokinins. Both of these hormones functon as plant growth stimulants, auxin can affect stem elongation and root branching. Meanwhile, cytokinins can influence growth and differentiation, encourge cell division and promote germination. Based on this, its is necessary to conduct research to further study the effects of Several Kinds of Growing Media and Different Nutrients in the Growth and Yield of Broccoli Microgreens (*Brassic oleracea*).

II. MATERIALS AND METHODS

This research was carried out in October 2022 which is located in the Greenhouse and Seed Technology Laboratory, Faculty of Agriculture, Andalas University. The materials used are broccoli seeds, water, soil, tissue, cocopeat, rockwool, AB Mix nutrition and young coconut water. Tools that used include plastic seedling trays, meters, digital scales, microscopes, calipers, color charts, scissors, sprayers, documentation tools, and stationery, millimeter blocks, chlorophyll meters.

The experiment was carried out using a completely randomized design with 2-factor factors and consisted of 3 replications. The first factor consisted of several types of planting media, namely soil, cocopeat, and rockwool. The second factor consisted of several types of nutrition, namely AB Mix and young coconut water. Observational data were analyzed using the analysis of variance F test. If F calculated treatment is greater than F table 5% then it will be continued with the DNMRT test at 5% level.

The implementation study started with a selection of broccoli microgreens seeds, preparation of planting media, planting, treatment, maintenance, observation, and harvesting. The parameters observed consisted of sprout height, number of leaves, fresh weight, chlorophyll content, and antioxidant content.

III. RESULTS AND DISCUSSION

3.1 Sprout Height

The results of variance showed that in the sprout height variable, there was an interaction between the planting medium and the nutrition given to the broccoli microgreens.

Table 1. Height of Broccoli Microgreens Sprouts at 21HST treated with different types of growing media and nutrients.

Growing Media (M)	Nutrition (N)	
	AB Mix	Coconut Water
---------- cm ----------		
Land	4,6133 a A	3,2033 b B
Cocopeat	3,1567 b A	3,0567 b A
Rockwool	4,7133 a A	3,7400 a B
KK = 7,34%		

Note: Numbers followed by different lowercase letters in the same column and numbers followed by different uppercase letters in the same row are significantly different according to DNMRT at a level of 5%.

Treatment of rockwool growing media and AB mix nutrients can increase the height growth of broccoli microgreens sprouts, this is because the nutrients from AB Mix received by plants contain macro elements Nitrogen (N) and Phosphate (P), microelements Boron (B) and Zinc Zn) which can help plant growth. Zhang et al. (2020) explained that the hypocotyl is one of the main parts of sprouts and green vegetables, it is located below the

cotyledons and just above the roots. Hypocotyl development is an important character for prospective plants because it will then develop into plant stems.

In addition, rockwool's growing media is media that is able to absorb and transmit water well so that it has a high water-holding capacity. With these advantages, Rockwool planting media can optimize the role of nutrients to be absorbed by plants in meeting their needs and supporting plant growth and development (Miranda, 2017).

3.2 Number of Leaves

The results of variance on the number of leaves variable for broccoli microgreens showed that therewas an interaction between the growing media and the nutrition given to the broccoli microgreens.

Table 2. Number of Broccoli Microgreens Leaves atAge 21 HST treated with different types of growing media and nutrients

Growing Media (M)	Nutrition (N)	
	AB Mix	Coconut Water
---------- sheet----------		
Land	3,20 a A	2,00 b B
Cocopeat	2,30 b A	2,00 b B
Rockwool	3,20 a A	2,30 a B
KK = 3,85%		

Note: Numbers followed by different lowercase letters in the same column and numbers followed by different uppercase letters in the same row are significantly different according to DNMRT at a level of 5%.

At the age of 21 HST, the treatment of rockwool growing media with AB mix nutrients and soil planting media with AB mix nutrients had the highest number of leaves, and the lowest number of leaves was found in soil growing media with young coconut water nutrients and cocopeat growing media with young coconut water nutrients.

Rockwool planting media has environmentally friendly properties because it is made from a combination of rocks, such as basalt, coal, and limestone which are heated at 16000C until they melt to resemble lava which then turns into fibers. After it cools, the fiber bundle will be cut according to the needs and the rockwool also has sufficient nutrient availability (Nurdiana et al, 2013). This is supported by the results of a study (Valupi, 2021) concerning the effect of using rockwool growing media on pakcoy microgreens showing the highest number of leaves found in rockwool growing media.

3.3 Fresh Weight

The fresh weight of broccoli microgreens at 21 HST depends on the use of different growing media and nutrients. This can be seen in table 3, there is an interaction between the treatments given.

Table 3. Fresh Weight of Broccoli Microgreens at Age21 HST treated with different types of growing media and nutrients.

Growing Media (M)	Nutrition (N)	
	AB Mix	Coconut Water
---------- g ----------		
Land	8,9371 b A	6,2563 b B
Cocopeat	7,7665 b A	7,2901 b A
Rockwool	15,0277 a A	10,3625 a B
KK = 10,38%		

Note: Numbers followed by different lowercase letters in the same column and numbers followed by different uppercase letters in the same row are significantly different according to DNMRT at a level of 5%.

Based on Table 3, it can be seen that the treatment of rockwool growing media with AB mix nutrition gave the highest fresh weight yield of broccoli microgreens with a value of 15.0277 g. Broccoli microgreens grown using rockwool growing media have a heavier weight presumably because the rockwool media is able to absorb

water well so that the absorption of macro and micronutrients needed by plants can run optimally. Fresh weight is the result of plant metabolism. Fresh weight is influenced by the state of nutrients that can be absorbed by the roots (Maharani, 2021).

Treatment media plant and nutrition have a very significant effect on the chlorophyll content of broccoli microgreens based on Table 4. The type of rockwool growing media with AB mix nutrition produced the highest chlorophyll content value of 0.3253 compared to other treatments. As for the lowest chlorophyll content, it was found in the treatment of soil planting media with young coconut water nutrition, which was 0.2403.

3.4 Chlorophyll Levels

Table 4. Microgreens Broccoli Chlorophyll Levels atAge 21 HST treated with different types of growing media and nutrients.

Growing Media (M)	Nutrition (N)	
	AB Mix	Coconut Water
Land	0,2807 b A	0,2403 c B
Cocopeat	0,2620 c B	0,2757 a A
Rockwool	0,3253 a A	0,2643 b B
KK = 1,38%		

Note: Numbers followed by different lowercase letters in the same column and numbers followed by different uppercase letters in the same row are significantly different according to DNMRT at a level of 5%.

The content of chlorophyll in is one of vegetables the important criteria for determining the content of nutrients. Chlorophyll is known acts as an antioxidant for the body. The high availabilityof chlorophyll in nature and its biological properties are an opportunity to be developed as a food supplement or functional food ingredient (Rahmawati, 2007).

One of the factors that affect the production of chlorophyll pigment is nutrients. Cocopeat has a high water absorption capacity, capable of storing water properly, contains the nutrients needed by plants, and loosens the soil.

3.5 Antioxidant Analysis

Antioxidant analysis was carried out 1 time at harvest, when the plants were 21 HST and the following results were obtained:

Table 5. Antioxidant Analysis of Broccoli Microgreens at 21 HST treated with several types of growing mediaand different nutrients.

Sample	HCl (a red color change occurs)	NaOH (appear blue green)	Conclusion
Land + AB Mix	+	-	Betacyanin
Land + Coconut Water	+	-	Betacyanin
Cocopeat + AB Mix	+	-	Betacyanin
Cocopeat + Coconut Water	+	-	Betacyanin
Rockwool + AB Mix	+	-	Betacyanin
Rockwool + Coconut Water	+	-	Betacyanin

In Table 5 the qualitative test results for the antioxidant content show that the broccoli microgreensget a red color change when given HCl, whereas if NaOH is added drop by drop there is no blue color change. So it can be concluded that broccoli microgreens contain betacyanin.

Betacyanin is a pigment that can be used as a natural dye and can be extracted from plants. Betacyanin has the property of being easily soluble in water solvents, so Betacyanin is very well developedas a natural dye. In plants, betacyanin is found in flowers, fruits and leaves which have a purplish-red color (Strack, et.al., 2003).

IV. CONCLUSION

1. The interaction between growing media and nutrients has influenced this research for the parameters of

observation of sprout height, number of leaves, fresh weight, and chlorophyll content.

2. The results of the qualitative test for the antioxidant content showed that the broccoli microgreens had a red color change when given HCl, whereas if NaOH was added drop by drop there was no blue color change. So it can be concluded that broccoli microgreens contain betacyanin.

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