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RESPONSE TO THE GROWTH AND RESULTS OF MICROGREENS BROCOLY PLANTED HYDROPONICALLY WITH VARIOUS PLANTING MEDIA AND ADDITION OF COCONUT WATER SOURCES OF NUTRITION AND HORMONE

RESPON PERTUMBUHAN DAN HASIL MICROGREENS BROKOLI YANG DITANAM SECARA HIDROPONIK DENGAN BERBAGAI MEDIA TANAM DAN PENAMBAHAN AIR KELAPA SEBAGAI SUMBER NUTRISI DAN HORMON

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INTISARI

Penelitian ini bertujuan untuk: (1) mengetahui jenis media tanam yang paling sesuai untuk pertumbuhan dan hasil microgreens brokoli, (2) mengetahui pengaruh air kelapa bagi pertumbuhan dan hasil microgreens brokoli. Percobaan disusun menurut Rancangan Acak Lengkap (RAL) Faktorial dengan uji lanjut BNJ 5%, dengan faktor I : Media tanam terdiri atas 4 level (M1 : Media tanam rockwool, M2: Media tanam cocopeat, M3: Media tanam arang sekam, M4: Media tanam pasir. Faktor II: Pemberian air kelapa terdiri atas 2 level (S1: Penyemprotan air biasa, S2: Penyemprotan air kelapa konsentrasi 100%). Berdasarkan dua faktor tersebut maka diperoleh 8 kombinasi perlakuan dengan 3 kali ulangan. Hasil penelitian menunjukkan: (1) Media tanam cocopeat ditambah air kelapa memberikan respon yang paling baik pada pertumbuhan dan hasil microgreen brokoli yang dikulturkan secara hidroponik dibandingkan dengan media tanam rockwool, arang sekam, maupun pasir, (2) Penambahan air kelapa sebagai nutrisi dan hormon mampu meningkatkan pertumbuhan dan hasil microgreen brokoli pada semua jenis media tanam yang diujikan. Pada percobaan ini, penambahan air kelapa pada media tanam cocopeat dalam kultur hidroponik mampu meningkatkan pertumbuhan tinggi microgreen mencapai 12,20 cm dengan berat basah mencapai 340.20 gram. Untuk mencapai pertumbuhan dan hasil microgreen lebih optimal, perlu dilakukan penelitian lebih lanjut dengan menggunakan media tanam campuran antara cocopeat dan media tanam lain untuk mengatasi kelemahan yang terdapat pada cocopeat.

Kata kunci : microgreen, hidroponik, air kelapa

ABSTRACT

This study aims to: (1) determine the type of planting medium that is most suitable for the growth and yield of broccoli microgreens, (2) to determine the effect of coconut water on the growth and yield of broccoli microgreens. Experiments were arranged according to Factorial Completely Randomized Design (CRD) with further 5% BNJ test, with factor I: Media for planting consisted of 4 levels (M1: Media for rockwool planting, M2: Media for planting cocopeat, M3: Media for planting husk charcoal, M4: Media Sand planting Factor II: Coconut water application consists of 2 levels (S1: Spraying ordinary water, S2: Spraying coconut water with 100% concentration). Based on these two factors, 8 treatment combinations were obtained with 3 repetitions. The results showed: (1) The planting medium of cocopeat added with coconut water gave the best response to the growth and yield of microgreen broccoli cultured hydroponically compared to the planting medium of rockwool, husk charcoal, and sand, (2) The addition of coconut water as a nutrient and hormone able to increase the growth and yield of broccoli microgreen in all types of planting media tested. In this experiment, the addition of coconut water to the cocopeat growing medium in hydroponic culture was able to increase the growth of microgreen height to 12.20 cm with a wet weight of 340.20 grams. To achieve optimal microgreen growth and yields, further research is needed using a mixed planting medium of cocopeat and other growing media to overcome the weaknesses in cocopeat.

Key words: microgreen, hydroponics, coconut water

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PREFACE

Background. Broccoli is a cool, sun-loving winter crop and is best planted in spring or fall. Broccoli is also nicknamed "the crown jewel of nutrition" because it is rich in vitamins and minerals, and is a good source of Vitamin A, potassium, folic acid, iron, and fiber (Boeckmann, 2019). Public interest in broccoli products continues to increase along with the development of a healthy lifestyle by consuming high quality vegetables such as broccoli. In addition to broccoli, which is harvested in mature green form, now people are also starting to recognize and consume vegetables in the form of very young products called microgreens.

Microgreens are vegetables that are harvested at a very young age, which is when the cotyledons have opened up wide and the first pair of young leaves have appeared. In contrast to sprouts harvested when the cotyledons have not opened (around three to 10 days of age), microgreens are harvested at seven to 14 days of age (Eric, 2018). The results showed that the nutritional content of microgreens was much higher than that of adult vegetables. Current consumption of microgreens has increased due to higher concentrations of bioactive components such as vitamins, minerals and antioxidants than green mature ones, which are important for human health (Nivedha, V & Lakshmy, P. S, 2018).

The growing media used for cultivating microgreens varies, it can be soil or non-soil. Cultivation of non-soil microgreens, among others, uses a hydroponic system with growing media for rockwool, cocopeat, hydroton, and others. Hydroponic cultivation of microgreens is widely practiced because they look clean and tidy. Growing microgreens requires water and nutrients, which is different from sprouts. The sprouts only need water because the nutrients are taken from the breakdown of organic matter in the cotyledons. Meanwhile, for the growth of microgreens, nutrients from outside are needed for leaf development. The application of coconut water to the planting medium is expected to provide nutrients for the growth of microgreens because coconut water contains various minerals, such as K, Ca, Na, Mg, Fe, Cu, S, sugars, proteins, and natural hormones, namely auxins and cytokinins that play a role. as a supporter of cell division (Suryanto, E.2009; Bhargav, R, 2017; Carlisle, K, 2019; Wall, J. & Gupta, A, 2016). From the literature search and previous research results, it is known that the effect of coconut water on the growth of microgreens has never been studied, so a reference to this is not yet available. On the basis of this, this research is important to do.

Formulation of the problem. (1) It is not known what type of planting medium is most suitable for the growth and yield of broccoli microgreens, (2) The effect of coconut water on the growth and yield of broccoli microgreens is not yet known.

Research purposes. (1) To determine the type of planting medium that is most suitable for the growth and yield of broccoli microgreens, (2) To determine the effect of coconut water on the growth and yield of broccoli microgreens.

RESEARCH METHODS

The research was conducted from July to November 2020 at the Microgreens Nursery located in Jetis Hamlet, Wedomartani Village, Sleman Regency. Experiments were arranged according to a completely randomized design (CRD) factorial with further test Honest Significant Difference (HSD) 5%. There are two treatment factors in this study, namely the treatment of the type of growing media and the treatment of watering with coconut water.

The first factor is: the type of growing media which consists of 4 levels, namely:

M1: Rockwool growing media
M2: Cocopeat planting medium
M3: The media for planting husk charcoal
M4: Media for planting sand.

The second factor is watering, consisting of two levels, namely:

S1: Spraying with plain water
S2: Spraying with coconut water (100% concentration).

Based on these two factors, 8 treatment combinations were obtained with 3 replications. The eight treatment combinations are:

M1 S1: Media for planting rockwool + plain water
M2 S1: Cocopeat + plain water planting medium
M3 S1: Media for planting husk charcoal + ordinary water
M4 S1: Media for planting sand + ordinary water
M1 S2: Media for planting rockwool + coconut water
M2 S2: Media for planting cocopeat + coconut water
M3 S2: Media for planting husk charcoal + coconut water
M4 S2: Media for planting sand + coconut water

The tools used are plastic tubs or plastic containers 17x13x4 cm in size, cutters, nails, spray bottles, scissors, rulers, plastic labels, cameras, scales, and stationery. The materials used are broccoli seeds, rockwool, cocopeat, husk charcoal, sand, plain water, and coconut water.

Planting broccoli microgreens was carried out in 17x13x4 cm plastic trays. The seeds needed for each plastic tub are 50 seeds, after the seeds are planted then the plastic tray is placed on a shelf made of mild steel with a plastic zinc lid and watered using plain water and coconut water volume of 100 ml / plastic tray according to the treatment combination. . The frequency of watering is carried out every day or adjusted to the condition of the growing media, that is, watering is done when the media has reduced its moisture. Thus the planting medium is maintained moisture. Spraying ordinary water or coconut water is done using a hand sprayer.

Harvesting is done when the broccoli microgreen has reached the harvest criteria. The criteria for harvesting broccoli plant microgreens are if the first true cotyledons and leaves have grown, or what is commonly referred to as the first true leaves, 5-10 cm high. The way to harvest broccoli plant microgreens is to cut the broccoli microgreens one centimeter above the medium using a pair of scissors or a cutter. The results of the harvest were then weighed for each tray and recording of the wet weight of microgreen broccoli for each tray according to the treatment label attached to the tray. Furthermore, tabulation and data analysis were carried out. The variables observed were plant height and wet weight of broccoli microgreen.

Observation of the height of microgreen plants is carried out by measuring the height of the plant using a

ruler or ruler that has a size of up to millimeters. Microgreen samples measured for height were taken from each tray of 5 plants. Samples were determined randomly, namely by selecting 4 microgreens located in the corner and 1 microgreen located in the middle of each planting tray. Plant height observations were carried out when the microgreens were 15 DAP (days after planting), 16 DAP, 17 DAP, 18 DAP, and 20 DAP. However, the height data analyzed were microgreen height data at harvest age (20 DAP). Growth data (plant height) were analyzed using 5% DMRT analysis.

The microgreen wet weight measurement is done by weighing all the plants in each tray. Harvesting is carried out according to the harvest criteria as described above. The part of the plant that is harvested is all the parts of the plant that are located on the planting medium. So the plant roots are not weighed. Microgreen wet weight is measured in grams. Weighing is done using digital scales.

RESULTS AND DISCUSSION

The growth and yield of microgreen broccoli in this study showed an increase after being watered with coconut water. Increased growth and yield of broccoli microgreen occurred in all types of growing media used in this study, both rockwool, cocopeat, husk charcoal, and sand.

For plant height parameters, the addition of coconut water to the growing media resulted in an increase in the height of microgreen broccoli on all types of growing media compared to watering the planting medium with water alone.

In this study, microgreen broccoli was harvested when it met the harvest criteria, namely having a pair of cotyledon leaves that opened wide and one true leaf.

Observation of Plant Height. The results of observations and high variance of broccoli microgreen in all types of planting media treatments and coconut water and ordinary water sprinkling are presented in Table 1.From Table 1, it can be seen that watering treatment with coconut water gave a positive response to the height of microgreen broccoli in all types of planting media . The cocopeat growing medium gave the best response, followed by rockwool, sand, and husk charcoal growing media. The coconut water sprinkling treatment on broccoli microgreen grown in the cocopeat growing medium was able to increase the microgreen height which was significantly different from the treatment of other growing media.

The highest average microgreen broccoli height was found in the watering treatment with coconut water on a tray with cocopeat planting media, reaching 320.20 grams. According to Seswita (2010), coconut water is a natural material that can be used as a substitute for GRS. Coconut water contains amino acids, organic acids, nucleic acids, purines, sugars, vitamins and minerals (Netty 2002; Ma et al. 2008). Coconut water is an organic compound containing 1,3 diphenylurea, zeatin, zeatin glucoside, zeatin riboside, high levels of K and Cl, sucrose, fructose, glucose, protein, carbohydrates, minerals, vitamins, less fat, Ca and P (Yong et al. 2009) and kinetin (Barciszewski et al. 2007).

Zeatin, zeatin glucoside, zeatin riboside are GRS which can increase cell division and cell extension. Amino acids, sugars and vitamins can increase cellular metabolism and act as energy, enzymes and co-factors. Kinetin plays an important role in increasing the chlorophyll content in leaves so as to spur photosynthetic activity and increase plant growth and production

(Gore and Sreenivasa 2011). Apart from vitamins and minerals, coconut water also contains auxin and cytokinin hormones. Both types of hormones are useful in supporting cell division, thus helping the formation of shoots and elongation of stems (Lawalata 2011). Auxins help cell division to divide faster which in turn encourages the development of shoots and stems. Coconut water also contains nutrients needed in the process of plant growth (Pamungkas et al. 2009).

Actually coconut water is coconut fruit endosperm liquid which contains active biological compounds with a unique chemical composition, consisting of minerals, vitamins, sugars, amino acids, and phytohormones which are important in spurring plant growth (Winarto et al. 2015: 304). It was reported that the use of coconut water in tissue culture can increase callus initiation and root development, this is because coconut water contains Growth Regulating Substances (GRS) (Agampodi & Jawawardena 2009: 280). Young coconut water is known to contain the hormone gibberellin (0.460 ppm GA3, 0.255 ppm GA5, 0.053 ppm GA7), cytokinins (0.441 ppm kinetin, 0.247 ppm zeatin), and auxin (0.237 ppm IAA) (Savitri (2005, in Djamhuri, 2011: 5) Coconut water also contains potassium with levels of 14.11 mg per 100 ml, calcium 24.67 mg per 100 ml, and nitrogen 43.00 mg per 100 ml of young coconut water (Kristina & Syahid 2012: 126).

According to Ramda (2008), coconut water is thought to contain nutrients needed by plants so that it can increase growth, this is based on experiments on Dendrobium orchids which are given coconut water and alternative fertilizers, it turns out that their growth can be increased. Suhardiman (1992) argues that coconut water can also be used for watering (because coconut water in addition to containing calories, protein and minerals also contains cytokinins that can growing dormant buds in certain plants, so it is concluded that coconut water is a good material to be given to plants).

Furthermore (Suryanto, 2009) states that as a plant product, coconut water can be used to encourage plant growth by watering it. This is because coconut water is rich in potassium, besides that it also contains minerals such as Calcium (Ca), Sodium (Na), Magnesium (Mg), Ferum (Fe), Cuprum (Cu), Sulfur (S), and also contain sugar and protein. Coconut water also contains natural hormones, namely auxins and cytokinins which act as support for cell division.

Table 1. Average Height of Broccoli Microgreen in All Treatments

Treatment	**Broccoli Microgreen Height (cm)**	
	S1	**S2**
M1	9,4 a	10,4 b
M2	10,9 b	12,2 d
M3	8,4 c	9,1 a
M4	9,3 a	10,2 b
HSD 5 %	0,30	

Note: the numbers followed by the same letter show that they are not significantly different.

Young coconut is a plant product that can be used as a natural growth regulator. Young coconut water contains diphenyl urea which has activities as cytokinins, potassium, sugar and protein which can stimulate plant growth and production. Yusnida (2006) states that coconut water contains growth regulators such as cytokinins 5.8 mg L-1, auxin 0.07 mg L-1 and very little gibberellin and other compounds that can stimulate germination and plant growth. The results of Metusala's (2012) research show that coconut water is rich in potassium (potassium) up to 17%, also contains sugar between 1.7 to 2.6% and protein from 0.07 to 0.55%.

Cocopeat is a hydroponic growing media that is organic in nature, because it is made from coconut fiber powder. One of the benefits of using Cocopeat as a hydroponic growing medium is that it can hold water and has quite a lot of chemical elements. Cocopeat has a Ph between 5.0 and 6.8 so it is very good for the growth of any plant. Cocopeat is easy to absorb and store water. It also has pores, which facilitate air exchange, and the entry of sunlight. The content of Trichoderma molds, a type of enzyme from fungi, can reduce disease in the soil. Thus, cocopeat can keep the soil loose and fertile (https://diskapang.ntbprov.go.id/detailpost/cocopeat-sebagai-media-tanam)

As an organic growing medium, Cocopeat has several advantages or advantages over other growing media. The advantages of Cocopeat include:

• The texture is similar to soil
The shape and texture of Cocopeat resembles the soil and its fine grains allow the plant to adapt as well as when planted in soil. The difference between Cocopeat and soil growing media is only in its nutritional content, where Cocopeat does not contain nutrients such as soil. Therefore, to grow plants with Cocopeat, plants are not only splashed with water but also with nutrient solutions.

• Can absorb water well
Cocopeat is a planting medium that has a high water absorption and can store more water than is stored in the soil. Cocopeat can store and retain water 10 times better than soil and this is very good of course for plants that grow with hydroponic systems. Because it can maintain water well, plant roots do not dry out easily and can be well hydrated.

• Environmentally friendly
Because it is made from organic materials, Cocopeat is very environmentally friendly and can degrade well in the soil when it is not used. In addition, Cocopeat can also be recycled back into new planting media, of course, with certain processes.

• More pest resistant
Some types of pests such as soil pests do not like to be in Cocopeat and this can certainly better protect the plant and protect it from pests.

• Easier for beginners
Growing plants with Cocopeat is highly recommended for those who are just starting to learn to grow plants hydroponically. Cocopeat is easy to use the first time you plant it because of its earth-like shape and texture.
(https://diskapang.ntbprov.go.id/detailpost/cocopeat-sebagai-media-tanam)

Cocopeat is a planting medium that has many advantages for hydroponic growing media. The advantages of cocopeat compared to other conventional media are that it is able to hold water and hold it almost 10 times, the tough but lightweight fiber is also resistant to the elements. The composition of cocopeat consists of 75% carbohydrates, and 25% lignin. Carbohydrates are a complex polysaccharide cellulose group. With high reserves of cellulose and lignin, cocopeat can be a good food source and breeding ground for beneficial microorganisms. Some of the beneficial microorganisms in the roots that can reproduce well in cocopeat media are rhizobacteria and several types of mycorrhizae. Cocopeat contains high potassium (K) and phosphorus (P), besides that it also contains nitrogen (N), calcium (Ca), magnesium (Mg), boron (B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), and zinc (Zn). These nutrients are nutrients that are needed by plants to support their needs. Cocopeat is also reuse, meaning that it can be reused for further crops, but with a note that after harvest, you must add enzyme solutions and wash cocopeat to remove residual salt and sterilization.
(https://www.kampustani.com/benefits-cocopeat-for-pertanian/).

Observation of Plant Wet Weight. The results of observations and responses to the variable responses of the wet weight of microgreen broccoli in all types of planting media and watering with coconut water and regular water are presented in Table 2.Based on Table 2, it can be seen that watering the planting medium with coconut water has a significant effect on the wet weight of microgreen broccoli. on all types of growing media. The cocopeat growing medium gave the best response, followed by rockwool, sand, and husk charcoal growing media. However, watering coconut water on the microgreen broccoli with rockwool, husk charcoal, and sand growing media showed that the average wet weight was not significantly different. The coconut water sprinkling treatment on microgreen broccoli planted in cocopeat growing media was able to increase the wet weight of microgreen broccoli which was significantly different from the treatment of other growing media.

The highest average wet weight of microgreen broccoli was found in the watering treatment with coconut water on a tray with cocopeat planting media, reaching 320.20 grams. These data indicate that the results are microgreen broccoli can be achieved well when cultivated with a hydroponic system

Table 2. Average Wet Weight of Broccoli Microgreen in All Treatments

Treatment	**Broccoli Microgreen Wet Weight per Tray (g)**	
	S1	S2
M1	226,80 a	255,15 b
M2	266,22 b	340,20 d
M3	197,67 c	222,70 a
M4	224,56 a	248,77 b
HSD 5 %	0,30	

Note: the numbers followed by the same letter show that they are not significantly different

using cocopeat growing media and doused with coconut water. This is because the nutritional content in coconut water is able to boost the growth rate and in turn affect crop yields.

As stated by Ramda (2008), coconut water contains nutrients needed by plants so that it can increase growth, this is based on experiments on Dendrobium orchids which are given coconut water and alternative fertilizers, it turns out that their growth can be increased. Suhardiman (1992) argues that coconut water can also be used for watering, because coconut water in addition to containing calories, protein and minerals also contains cytokinins which can grow dormant buds in certain plants, so it is concluded that coconut water is a good material. to give to plants. Yusnida (2006) states that coconut water contains growth regulators such as cytokinins 5.8 mg L-1, auxin 0.07 mg L-1 and very little gibberellin and other compounds that can stimulate germination and plant growth. The results of Metusala's research (2012) show that coconut water is rich in potassium (potassium) up to 17%, also contains sugar between 1.7 to 2.6% and protein from 0.07 to 0.55%.

Meanwhile, the growing medium for cocopeat was proven to be able to encourage the growth and yield of hydroponically grown microgreens. This is because cocopeat is a planting medium that has many advantages for hydroponic growing media. The advantages of cocopeat compared to other conventional media are that it is able to hold water and hold it almost 10 times, the tough but lightweight fiber is also resistant to the elements. The composition of cocopeat consists of 75% carbohydrates, and 25% lignin. Carbohydrates are a complex polysaccharide cellulose group. With high reserves of cellulose and lignin, cocopeat can be a good food source and breeding ground for beneficial microorganisms. Some of the beneficial microorganisms in the roots that can reproduce well in cocopeat media are rhizobacteria (PGPR) and several types of mycorrhizae. Cocopeat contains high potassium (K) and phosphorus (P), besides that it also contains nitrogen (N), calcium (Ca), magnesium (Mg), boron (B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo) and zinc (Zn). These nutrients are nutrients that are needed by plants to support their needs. Cocopeat is also reuse, meaning that it can be reused for further crops, but with a note that after harvest, you must add enzyme solutions and wash cocopeat to remove residual salt and sterilization.
(https://www.kampustani.com/benefits-cocopeat-for-pertanian/).).

Hydroponic technology with proper nutrition and cocoeat growing media has been shown to provide more microgreen broccoli yields than other treatments. This is because hydroponic technology has advantages over planting technology on the ground. These advantages are: (1) Does not require soil media, (2) Use of fertilizers is more efficient, (3) Use of water is more efficient, (4) The water used can continue to circulate so that it can be used for other purposes such as being circulated into the aquarium, (5) Control and provision of nutrition is easier and more efficient, (6) Does not cause pollution to the environment, (7) Provides more crop yields, (8) Sterile and clean, (9) Crop yields are easy to harvest, (10) Nutrients and pH are better preserved, (11) Does not require large

areas of land, (12) Does not require a lot of labor, (13) Free from pests and diseases, (14) Media can be used for years, and (15) Growth and faster plant development (https://bibitbunga.com/kelelu-kekurang-serta-benefits-hydroponik/).

CONCLUSIONS AND SUGGESTIONS

Conclusion

(1) The planting medium of cocopeat plus coconut water gave the best response to the growth and yield of hydroponically cultured microgreen broccoli compared to the growing media for rockwool, husk charcoal, and sand. (2) The addition of coconut water as a nutrient and hormone was able to increase the growth and yield of microgreen broccoli on all tested planting media types. In this experiment, the addition of coconut water to the cocopeat growing medium in hydroponic culture was able to increase the growth of microgreen height to 12.20 cm with a wet weight of 340.20 grams.

Suggestions

To achieve optimal microgreen growth and yield, further research is needed using a mixed planting medium of cocopeat and other growing media to overcome the weaknesses in cocopeat.

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