

Growth And Results of Some Microgreens of Order *Caryophyllales* on Different Plant Media

Lanna Reni Gustianty, Cik Zulia, Muhammad Yoga
Agrotechnology, Universitas Asahan

ABSTRACT

The research was conducted at the Tissue Culture Laboratory, Faculty of Agriculture, Asahan University, from March 2022 to April 2023. The aim of this study was to determine the growth and yield of several microgreens of the order *Caryophyllales* on different planting media. The design used was a factorial Completely Randomized Design (CRD), with 1 treatment factor: the first factor was: Growing Media (M) (M) consisted of M1 = rockwool, M2 = cocopeat, M3 = vermiculite. The observed variables consisted of: percentage of live seeds, number of seed germinations, plant height, number of leaves, fresh weight. The results showed that the treatment of several microgreens of the order (*O*) *caryophyllales* where the red spinach (*O2*) treatment gave the highest percentage of survival could have a real effect on the percentage of live seeds 0.82%, the number of seed germinations 13.89%, plant height 1.48% , number of leaves 1.51%, and the treatment of basil plants was not significantly different at 0.56% fresh weight. The treatment of different planting media (M) where the treatment of vermiculite growing media gave the highest percentage of survival could have a significant effect on the percentage of live seeds 0.79%, the number of seed germinations 11.22%, plant height 1.44%, number of leaves 1.45% , and the treatment of cocopeat plant media was not significantly different at 0.52% fresh weight. The interaction of several microgreens of the order *Caryophyllales* and different growing media had no significant effect on the percentage of live seeds, the number of seed germinations, plant height, number of leaves, fresh weight.

Keywords: *Growth* , *Microgreens*, *orders*, *media*

Corresponding author

Name: Lanna Reni Gustianty

Email: lanna.reni08@gmail.com

INTRODUCTION

Indonesia is an agricultural country where the livelihood of the majority of the population is farmers. Indonesia has a lot of land and most of the land is used for agricultural production processes. At present, Indonesia is experiencing a shortage of agricultural land due to the conversion of land used for industrial development such as the construction of housing, shopping centers, crowds and for widening lanes and construction of toll roads (La

Sarido and Junia, 2017). The concept of land use in urban zones for agriculture is known as urban farming or urban agriculture (Budy et al., 2018).

One of the cases in agricultural cultivation, especially horticultural cultivation, is the limited land which continues to decrease every year. Limited land has implications for limited growing media for plants which can result in plant production which will not be optimal and will not have lasting value. Limited planting media can be overcome through the use of organic matter which can reduce the use of soil in cultivation activities. Therefore, one option for limited land use is the microgreens cultivation method (Damayanti et al., 2019).

Microgreens are functional, nutrient-dense plants that are eaten fresh. These microgreens have a short growing span and do not require a lot of input to support growth and have great nutrition in the growing media. The plant has a large seed to biomass ratio and is microbiologically comfortable when grown in a controlled indoor environment. (Dalal et al., 2020).

Research (Kyriacou et al., 2016) entitled "Production of microgreens" shows that microgreens have great potential to adapt the production of leafy vegetables to the microscale, to increase nutritional value in human diet and to influence gastronomic trends. Advances in the description of preharvest factors affecting production and quality, as well as postharvest factors ensuring shelf life have been investigated in the current review along with the challenges encountered.

The basil plant (*Ocimum americanum*) is a plant that grows a lot in this tropical region depicting a large upright herb 0.3 - 1.5 meters. Basil has chemical compounds including tannins, flavonoids, alkaloids, terpenoids, saponins and essential oils (Sarah, 2015). Previous research has shown that the flavonoid content of basil leaves (*Ocimum americanum* L.) can provide strong antibacterial effects with an extract concentration of 10% against *staphylococcus aureus*, *staphylococcus epidermidis*, *propionibacterium acnes* and *pseudomonas aeruginosa* bacteria (Syamsul, 2015). The research also showed that a mixture of two basil leaf flavonoid compounds, namely orientin and visenin, has a synergistic antibacterial effect.

Vermiculite growing media has a higher cation exchange capacity, especially when solid and wet. Vermiculite can reduce specific gravity and increase water absorption (Suryani, 2015). Cocopeat planting media easily absorbs water, has a pore space characteristic of 95% with a water holding capacity of 80% and does not contain disease-causing pathogens (Nurifah & Fajarfika, 2020).

In a study (Valupi et al., 2021) "Growth and Yield of Microgreens of Several Pakcoy (*Brassica rapa*. L) Varieties in Different Growing Media" showed that the treatment of cocopeat growing media has the ability to store water properly resulting in water availability being maintained so that it influences significant effect on the growth of pakcoy plants. As

stated by Istomo and Valentino (2012) that cocopeat media basically has a very strong ability to bind and store water, cocopeat is a medium that has a fairly high water holding capacity. Cocopeat media has micro pores that are able to absorb greater water movement, resulting in higher water availability.

Microgreens are young vegetables with an average harvest of between 10 and 14 days from seeding. Microgreens measure between 1 and 3 inches. Microgreens have three parts: a central stem, leaf or leaf cotyledons, and a pair of true young leaves. However, not all young vegetables are considered green vegetables. Microgreens can be harvested as soon as young leaves appear and harvested without roots. Microgreens are also known by their various colors. Therefore, microgreens are often used to decorate salads, soups, dishes and sandwiches (Choe et al. 2018).

The basil plant (*Ocimum americanum* L.) is a plant that is easy to obtain, the basil plant is a type of hermaphrodite plant that grows in the tropics, this plant belongs to the lamiaceae family which grows a lot in Indonesia. Along with the increase in science and technology, people have used basil plants as natural products which have high economic value, usually people make basil leaves as a complement to dishes or as fresh vegetables (Safwan, et al. 2016).

Spinach (*Amaranthus* spp.) is an annual plant originating from tropical America. In Indonesia, only two types of cultivated spinach are known, namely pulled spinach (*Amaranthus tricolor*) and snapper spinach (*Amaranthus hybridus*). Snapper spinach is also known as year spinach, turus spinach or bathok spinach, and is grown as picking spinach. Pulled spinach consists of two varieties, one of which is red spinach (Saparinto and Maya, 2014).

The ruku-ruku plant (*Ocimum tenuiflorum*) is a herb plant that belongs to the lamiaceae family and originates from parts of India and Southeast Asia. For the territory of Indonesia itself, this plant can be found in Sumatra, Sumbawa and its surroundings. This plant is still closely related, and has a shape and aroma similar to basil leaves. This ruku-ruku plant is usually used for Minangkabau dishes in the form of fresh vegetables and curry and is believed to be efficacious for high blood pressure and heart disease (Ramadani, 2021).

Rockwool is the medium used for control. Rockwool planting media contains the nutrients phosphorus (P) and potassium (K). In addition, rockwool planting media is also able to store more water compared to other planting media, so that the planting media is kept moist and the water needs in the process of photosynthesis in plants (Minju Shin et al. 2022).

Cocopeat is one of the growing media produced from the process of destroying coconut coir, the process of destroying coir produces fiber or fiber. Cocopeat has high water absorption and the ability to bind and store water well. Cocopeat also contains essential nutrient elements, such as calcium (Ca), magnesium (Mg), potassium (K), sodium (N), and

phosphorus (P) which are needed by plants, and are also useful for loosening the soil (Sisriana, 2021).

Vermiculite was the best medium for variable wet weight of microgreens. Vermiculite growing media has a higher cation exchange capacity, especially when solid and wet. Vermiculite can reduce specific gravity and increase water absorption. So that the planting media which has these advantages can absorb more nutrients when the media is immersed in water with a nutrient solution of AB mix and nutrient reserves stored in the media can be more easily absorbed by plant roots to support plant growth (Sisriana, 2021). The main content of vermiculite is SiO₂ (34.46%), MgO (20.96%), Al₂O₃ (12.79%), Fe₂O₃ (8.98%), TiO₂ (1.59%), CaO (0.54 %), K₂O (0.29%), P₂O₃ (0.29%), Na₂O (0.07%), Mn₃O₄ (0.15%), carbon (0.03%), fluorine (0.44%) , and several other ingredients whose percentage is less than 0.05% (Hendry, 2014) in Syahril and Lindang (2021).

METHODS

This research was conducted at the Tissue Culture Laboratory, Faculty of Agriculture, Asahan University. This research was conducted from March 2023 to April 2023

The research design used in this study was a completely randomized design (CRD) with 2 treatment factors, namely:

1. Treatment of Various Ordo *caryophyllales* (O) consists of 3 levels, namely:
 - O₁ = Basil (*Ocimum americanum*)
 - O₂ = Red Spinach (*Amaranthus tricolor*)
 - O₃ = Ruku-ruku (*Ocimum tenuiflorum*)
2. Treatment of Various Kinds of Planting Media (M) consists of 3 levels, namely:
 - M₁ = Rockwool
 - M₂ = Cocopeat
 - M₃ = Vermiculite

The number of treatment combinations is 3 x 3 = 9 treatment combinations consisting of:

O1M1 ___	O2M1 ___	O3M1 ___
O1M2 ___	O2M2 ___	O3M2 ___
O1M3 ___	O2M3 ___	O3M3 ___

Based on the description above, this research treatment combination can be carried out using the following formula:

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

$$(9 - 1) (n - 1) \geq 15$$

$$8 (n - 1) \geq 15$$

$$8n - 8 \geq 15$$

$$8n \geq 15 + 8$$

$$8n \geq 23$$

$$n \geq 23/8$$

$$n \geq 2.8 \text{ (3 repetitions)}$$

With the following criteria:

Number of repetitions = 3 repetitions

The number of treatment combinations = 9 combinations

Number of plants per plot = 16 plants

Number of Sample Plants per Plot = 4 plants

The number of sample plant seeds = 108 seeds

The total number of seeds = 432 seeds

$$Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \varepsilon_{ijk}$$

Information :

Y_{ijk} = TBA value of dangke ke-k which obtained a combination of treatments of various genera of *caryophyllales* i-th various growing media j

μ = Average actual TBA value;

α_i = Effect of treatment of various genera of *ocimum* i

β_j = Effect of treatment of various growing media j

$(\alpha\beta)_{ij}$ = The interaction effect of the ith and jth treatments

ε_{ijk} = The effect of the ith and jth treatment errors on the kth experimental unit

The data obtained were analyzed by F test at the 5% level. If there is a significant difference from the mean, a further test is carried out using the DMRT (*Duncan Multiple Range Test*) at the 5% level.

CONCLUSION

Based on the results of the analysis of variance, it was shown that several planting media were different where the growing media was vermiculite very significant effect on the observed parameters of the percentage of live seeds at the age of 7 days after sowing, the number of seed germinations at the age of 14 days after sowing, plant height, number of leaves. However, the parameter of fresh weight of cocopeat growing media had a significant effect on 14 days after sowing.

Based on the results of the analysis of variance, the treatment of vermiculite growing media had a significant effect, this was because the main content of vermiculite was SiO₂ (34.46%), MgO (20.96%), Al₂O₃ (12.79%), Fe₂O₃ (8.98%) , TiO₂ (1.59%), CaO (0.54%), K₂O (0.29%), P₂O₃ (0.29%), Na₂O (0.07%), Mn₃O₄ (0.15%), carbon (0.03%), fluorine (0.44%) other ingredients whose percentage is less than 0.05%. Vermiculite exhibits extraordinary ion exchange characteristics, which can be used to prepare materials needed to extract heavy metal salts from water (Rashad, 2016 in Syahril, 2021).

This is in accordance with the opinion of Muliawan (2009) *in* Valupi, *et al* . (2021) that cocopeat is a type of planting medium that has the characteristics of being able to bind and store water strongly, and contains essential nutrients, such as calcium (Ca), magnesium (Mg), potassium (K), sodium (N), and phosphorus (P). Cocopeat media has the requirements desired by plants, both in terms of NPK, C/N, CEC, pH and its loose nature so that oxygen and light can easily reach deep into the plant roots. Loose media will accelerate the growth of new roots in a plant (Agustin, 2010 *in* Silvina, 2017) .

This is due to the use of media which is very closely related to plant growth, one of which is rockwool. This rockwool growing media has advantages that not many other growing media have, especially in terms of the ratio of the composition of water and air that can be stored by rockwool growing media.

According to Nurdiana, *et al* (2013) *in* Valupi, *et al* . (2021) Rockwool has environmentally friendly properties because it is made from a combination of rocks, such as basalt, coal, and limestone which are heated at 1,600o C until they melt like 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.

This is also supported by the results of Novizan's research (2005) *in* Valupi, *et al* . (2021) that the availability of nutrients that can be absorbed by plants is one of the factors that can affect the growth and development rate of plants. If a plant lacks these nutrients, it will interfere with plant metabolic activities so that the process of forming leaves, in this case new cells, will be hampered. Meanwhile, leaf width is according to (Putri *et al*, 2013) *in* (Valupi, *et al* . 2021). The use of planting media with a composition suitable for a type of plant will provide a good response and influence on plant growth and can increase the percentage of successful seedlings and can encourage an increase in plant productivity.

Based on the results of the analysis of variance, it was shown that the effect of growth and yield of various types of microgreens of the order Caryophyllales where red spinach plants had a very significant effect on the parameters of the percentage of live seeds, the number of seed germinations, plant height, and number of leaves. However, the fresh weight of basil plants significantly affected the parameters of fresh weight.

Red spinach is a red leaf vegetable. Red spinach was originally an ornamental plant, however, many people have used red spinach as a food source which contains lots of protein, vitamins A, B and C, and contains mineral salts such as calcium, phosphorus and iron (Nirmalayanti, 2017).

Basil is a vegetable that has a distinctive aroma. Basil plants are known as fresh vegetables. This fragrant plant can be used as a freshener for bad breath and body odor. Basil plants are called wild plants because they can grow in a place or land that is open or slightly shady and is not strong when it is dry. Can grow approximately 300 m at sea level. Basil includes both upright and shrub herbs, the crown is rounded, branched a lot, the stem is woody, has green fur and is very fragrant with a height of 0.3 – 1.5 m. The main stem is

green, often purplish. Single leaf opposite and arranged from bottom to top. The fruit has a box shape, dark brown, upright and depressed with the tip forming a circular hook. Taproot and dirty white color (Rona, 2020).

The ruku-ruku plant contains flavonoids, triterpenoids, essential oils, alkaloids, tannins and saponins (Shafqatullah et al., 2013) so that almost all parts of this plant such as the leaves have medicinal properties. Based on its chemical content, ruku-ruku leaves contain many terpenoids, alkaloids, flavonoids, and phenolics (Wahyuni et al., 2008) which are known to have antibacterial and antifungal potential (Tansil et al., 2016 in Andalia and Fitri, 2021).

Based on the analysis of variance, it was shown that the interaction of different planting media treatments on growth and yield had no significant effect on all observed parameters. Sometimes the combination that is done will encourage, inhibit, or not give a good response to plant growth at all.

REFERENCES

- Andalia, R., Fitri, W. 2021. Efektivitas Ekstrak Etanol Daun Ruku-Ruku (*Ocimum Tenuiflorum* L) Terhadap Daya Hambat Bakteri *Escherichia Coli*. *Jurnal Sains dan Aplikasi* Volume IX, No.1, April 2021.
- Andalia, R., Fitri, W. 2021. Efektivitas Ekstrak Etanol Daun Ruku-Ruku (*Ocimum Tenuiflorum* L) Terhadap Daya Hambat Bakteri *Escherichia Coli*. *Jurnal Sains dan Aplikasi* Volume IX, No.1, April 2021.
- Azmi, S. Z. 2016. Sistem Penghitung pH Air pada Tambak Ikan Berbasis Mikrokontroler. *Jurnal Ilmiah Saintikom (Sains dan Komputer)*, 15(2). [Online]. prpm.trigunadharma.ac.id [Diakses pada 16 Februari 2021].
- BPS Statistik Indonesia. (2018). Statistics of seasonal vegetable and fruit plants. Statistik Tanaman Sayuran Dan Buah-Buahan Semusim Indonesia.
- Budy F., Ahmad T., dan Riki K.F. 2018. Evaluasi Variasi Nilai Electrical Conductivity Terhadap Pertumbuhan Tanaman Selada (*Lactuca sativa* L.) Pada Sistem NFT. *Jurnal Agro*, Vol. 5(2).
- Choe, M., Yu, L. L., Wang, T. T. 2018. Sains di balik Microgreens sebagai Makanan Baru yang Menyenangkan untuk Abad ke-21. *Journal of Agricultural and Food Chemistry*. Departemen Nutrisi dan Ilmu Pangan, University of Maryland, College Park, Maryland 20742, Amerika Serikat.
- Damayanti N.S., D.W. Widjajanto, dan Sutarno. 2019. Pertumbuhan dan produksi tanaman sawi Pakcoy (*Brassica rapa* l.) akibat dibudidayakan pada berbagai media tanam dan dosis pupuk organik. *Jurnal Agro Complex*, Vol. 3(3):142- 150.
- Hidayah, L., N. 2022. Aplikasi Konsentrasi Air Cucian Beras Putih Dan Pupuk Daun Pada Tanaman Basil (*Ocimum basilicum* L.). SKRIPSI. Program Studi Agroteknologi Fakultas Pertanian Universitas Islam Batik Surakarta.

- Iqbal, M. 2016. *Simpel Hidroponik*. Lily Publisher. Yogyakarta.
- Istomo, Valentino., N. 2012. Pengaruh Perlakuan Kombinasi Media terhadap Pertumbuhan Anakan Tumih (*Combretocarpus rotundatus* Miq.Danser). *Jurnal Silvikultur Tropika*. 3(2):81-84.
- Kyriacou, M. C., Roupheal, Y., Di Gioia, F., Kyrtzis, A., Serio, F., Renna, M., De Pascale, S., Santamaria, P. 2016. Micro-scale Vegetable Production and the rise of Microgreens. *Trends Food Sci. Technol.* 57, 103–115. doi:10.1016/j.tifs.2016.09.005.
- Kyriacou, M. C., Roupheal, Y., Di Gioia, F., Kyrtzis, A., Serio, F., Renna, M., De Pascale, S., Santamaria, P. 2016. Micro-scale Vegetable Production and the rise of Microgreens. *Trends Food Sci. Technol.* 57, 103–115. doi:10.1016/j.tifs.2016.09.005.
- Larasati, Rona.P. 2020. *Formulasi Gel Antiseptik Minyak Atsiri Kemangi (Ocimum basilicum) Dan Uji Aktivitas Antibakteri Terhadap Staphyococcus aureus*. Skripsi. Yogyakarta: Universitas Islam Indonesia.
- Nurifah, G., & Fajarfika, R. (2020). Pengaruh Media Tanam Hidroponik Terhadap Pertumbuhan dan Hasil Tanaman Kailan (*Brassica Oleracea L.*). *Jagros: Jurnal Ilmu Agroteknologi*, 4 (2), 281-291.
- Prismawan, N. 2022. Pengaruh Dosis Pupuk Urea Terhadap Pertumbuhan Dan Hasil Dua Jenis Kemangi (*Ocimum americanum L.*). SKRIPSI. Fakultas Pertanian-Peternakan. Universitas Muhammadiyah Malang.
- Ramadani, P. 2021. *Penentuan Kandungan Antioksidan Dan Fenolik Total Dari Infusa Daun Tanaman Famili Lamiaceae Secara Spektrofotometri*. SKRIPSI. Jurusan Kimia. Fakultas Matematika Dan Ilmu Pengetahuan Alam Universitas Andalas.
- Safwan, dkk. 2016. Pengaruh Ekstrak Daun Kemangi (*Ocimum sanctum L.*) Terhadap Motilitas dan Konsentrasi Spermatozoa Mencit Jantan (*Mus musculus*). *Jurnal Ilmiah Ibnu Sina*, 1(2), p. 173-181 .
- Sari, K. R., Hadie, J., & Nisa, C. (2016). Pengaruh Media Tanam pada Berbagai Konsentrasi Nutrisi Terhadap Pertumbuhan dan Hasil Seledri dengan Sistem Tanam Hidroponik NFT. *Jurnal Daun*, 3, 7–14.
- Sarido, L dan Junia. 2017. Uji Pertumbuhan dan Hasil Tanaman Pakcoy (*Brassica 47 rapa L.*) Dengan Pemberian POC Pada System Hidroponik. *Jurnal AGRIFOR*, Vol. 16 (1).
- Shin, M., Jeong, H., Young, M., Kim, J, H., Song, K, J. (2022). Respon Pertumbuhan dan Hasil Tanaman *Perilla* yang Ditumbuhkan Berbeda-beda Substrat dalam Sistem Hidroponik. Departemen Ilmu Hortikultura, Universitas Nasional Jeju, Jeju 63243, Korea. *Jurnal Pengendalian Bio-Lingkungan*, Vol.31.4:292-299.
- Silvina. 2017. *Pertumbuhan Bibit Kelapa Sawit (Elaeis Guineensis Jacq) Di Pre-Nursery Yang Di Beri Cocopeat Pada Ultisol*. Skripsi. Program Studi Agroekoteknologi. Jurusan Budidaya Perkebunan. Fakultas Pertanian Kampus Iii Unand Dharmasraya.

- Sisriana, S., Suryani, & M. Sholihah, S. (2021). Pengaruh Berbagai Media Tanam Terhadap Pertumbuhan dan Kadar Pigmen Microgreens Selada. In *Jurnal Ilmiah Respati* (Vol. 12, Issue Desember). <http://ejournal.urindo.ac.id/index.php/pertanian>.
- Statistik, B. S.-J. (ID): B. P. (2018). *Statistik Tanaman Sayuran dan Buah-buahan Semusim Indonesia 2018*. Jakarta: Badan Pusat Statistik.
- Suryani, R. 2015. *Hidroponik Budidaya Tanama Tanpa Tanah*. Arcitra. Yogyakarta.
- Syahril, Lintang D.A. 2021. *Kajian Pengaruh Penambahan Vermikulit Terhadap Beton Segar*. Magister Terapan Rekayasa Infrastruktur, Teknik Sipil, Politeknik Negeri Bandung. Vol. 23, No. 1, April 2021.
- Tanuja P. Gurav . Bhushan B. Dholakia . Ashok P. Giri. 2021. Sekilas tentang kemodiversitas Okimumspesies: Tren, implikasi, dan strategi untuk peningkatan kualitas dan hasil minyak atsiri. *Phytochem Rev* (2022) 21:879–913 <https://doi.org/10.1007/s11101-021-09767-z>.
- Valupi, H., Rosmaiti, & Iswahyudi. (2021). Pertumbuhan dan Hasil Microgreens Beberapa Varietas Pakcoy (*Brassica rapa*. L) pada Media Tanam yang BerbedaVI Langsa.