JPPIPA 9(5) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

The Effectiveness Test of Using Various Planting Media by Giving Coconut Water as Nutrient to the Growth of Microgreen Sunflower Plants *(Helianthus annuus L.)*

Ade Fipriani Lubis[1*], Armaniar[2], Dian Handayani[3]

[1,3]Agrotechnology Study Program, Faculty of Agriculture, Universitas Asahan
[2]Agrotechnology Study Program, Faculty of Agriculture, Universitas Pembangunan Panca Budi

Received: March 13, 2023
Revised: May 24, 2023
Accepted: May 28, 2023
Published: May 31, 2023

Corresponding Author:
Ade Fipriani Lubis
adefipriani@gmail.com

DOI: 10.29303/jppipa.v9i5.3415

© 2023 The Authors. This open access article is distributed under a (CC-BY License)

Abstract: The research was conducted at the Tissue Culture Laboratory, Faculty of Agriculture, University of Asahan, from December 2022 to January 2023. This study aims to determine the effectiveness of planting media and coconut water on the growth of microgreen sunflower plants. The design used is a factorial Randomised Complete Design (CRD), with 2 treatment factors, the first factor is: Planting Media (M), consisting of soil (M0), cocopeat (M1), rockwool (M2), husk charcoal (M3). The second factor is: Coconut Water (K), consisting of (K0) 0%, (K1) 25%, (K2) 50%, (K3) 75%, (K4) 100%. Observed variables: seed germination potential, number of seed germination and chlorophyll rf (retention/retardation factor) value. The results showed that the planting media had a very significant effect on all observed parameters. Giving coconut water has a very significant effect on chlorophyll rf. There is an interaction between planting media and coconut water on chlorophyll rf.

Keywords: Coconut Water; Effectiveness Test; Planting Media; Sunflower Plants

Introduction

Along with the increasing need for land, causing the use of agricultural land to switch to non-agricultural uses, this has become a serious problem for Indonesia. If the problem continues, agricultural commodities will drop dramatically as the land changes (Febriani et al., 2017). One of the gardening activities that does not require a large area of land and is very suitable for urban areas is microgreen (Samiarsih et al., 2022; B. Singh, 2023). Microgreen is a new vegetable product that is gaining popularity over time (Eliseeva et al., 2021). Microgreen is an edible plant seedling that is harvested when the first real leaves appear, which is 7-14 days after planting. Microgreen is suitable for indoor production and is part of the global movement towards the development of a Controlled Environment Agriculture (CEA) model (Maulidiyah et al., 2022).

There are several plants that can be used as microgreen, one of which is sunflower (Poudel et al., 2023). Sunflower (Helianthus annuus L.) is a native introduced plant originating from the United States. Since most people use sunflower as an ornamental plant, processed foods derived from commercially available sunflower plants are still rare (Bila et al., 2023; Hassama et al., 2022).

There are several factors that affect plant growth in cultivation, one of which is the planting medium. Planting media determines the good and bad growth of plants, which in turn will affect production (Buana et al., 2019). In addition to planting media, nutrition is also an important factor for plant growth. Plant nutrition refers to how plants obtain, disperse and use nutrients in various processes and reactions that occur in plants for plant growth and development (Febrilla, 2021; Munawar, 2018).

How to Cite:
Lubis, A.F., Armaniar, A., & Handayani, D. (2023). The Effectiveness Test of Using Various Planting Media by Giving Coconut Water as Nutrient to the Growth of Microgreen Sunflower Plants (Helianthus annuus L.). *Jurnal Penelitian Pendidikan IPA*, *9*(5), 2720–2725. https://doi.org/10.29303/jppipa.v9i5.3415

Current undernutrition statistics are high and exacerbated by contemporary agricultural practices that damage the environment on which the production of nutritious food depends. As the world's population grows at an unprecedented rate, food systems must be revised to provide adequate nutrition while minimizing environmental impact (Weber, 2017). To improve mineral malnutrition, nutrient enhancement and land malfunction, one of the things that can be done is to microgreen (Ampim et al., 2022; Gupta et al., 2023; N. Singh et al., 2020).

Method

The research was conducted at the Tissue Culture Laboratory, Faculty of Agriculture, University of Asahan, from December 2022 to January 2023.

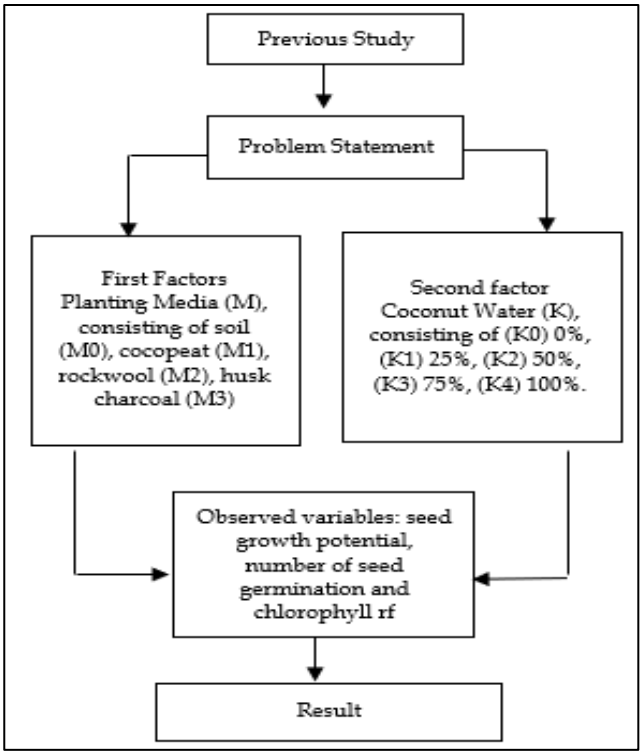

Figure 1. Schema of Research

Based on Figure 1, it can be explained that the first is a literature study, namely previous studies that are similar to the direction of this research. From this reading, a novelty emerges that ultimately underlies the formulation of the problem.

The design used is a factorial Completely Randomized Design (CRD), with 2 treatment factors, the first factor is: Planting Media (M), consisting of soil (M0), cocopeat (M1), rockwool (M2), husk charcoal (M3). The second factor is: Coconut Water (K), consisting of (K0) 0%, (K1) 25%, (K2) 50%, (K3) 75%, (K4) 100%. Observed variables: seed growth potential, number of seed germination and chlorophyll rf (retention/retardation factor) value.

Result and Discussion

The use of cocopeat planting media (M1) obtained the highest growth potential of 85.60% while the lowest growth potential was found in the husk charcoal planting media (M3) at 50.60%. The results of the independent t-test of the mean response to the treatment of planting media types and the provision of coconut water nutrients to the number of seed germination.

Table 1. T-test results of the mean difference in response to the treatment of planting media types and coconut water nutrition on seed germination potential.

M/K	K0	K1	K2	K3	K4	Average
M0	79.00	83.00	83.00	83.00	83.00	82.20abc
M1	83.00	79.00	83.00	100.00	83.00	85.60 a
M2	91.00	70.50	79.00	87.00	95.50	84.60 ab
M3	54.00	50.00	45.50	45.50	58.00	50.60 d
Average	76.75a	70.63a	72.63a	78.88a	79.88a	KK = 3.01%

Note: numbers followed by the same letter in the column and row show no significant difference at the 5% level of the BNJ test.

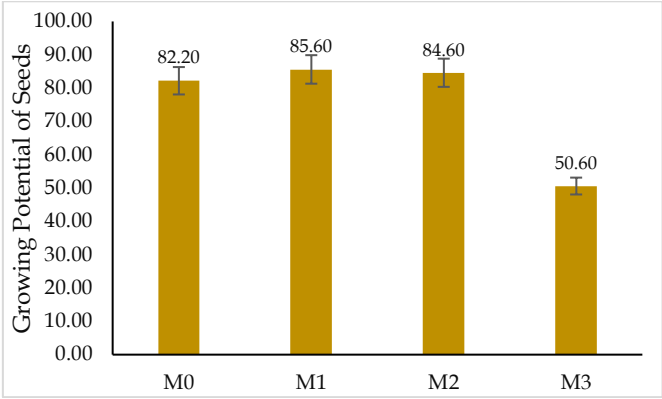

Figure 2. Graph of the effect of using the type of planting media on the growth potential of seeds at the age of 14 day after plant.

Table 2. Types of planting media on the amount of germination

M/K	K0	K1	K2	K3	K4	Average
M0	9.50	10.00	10.00	10.00	10.00	9.90 abc
M1	10.00	9.50	10.00	12.00	10.00	10.30 a
M2	11.00	8.50	9.50	10.50	11.50	10.20 ab
M3	6.50	6.00	5.50	5.50	7.00	6.10 d
Average	9.25 a	8.50 a	8.75 a	9.50 a	9.63 a	KK = 10.79%

Note: numbers followed by the same letter in the column and row show no significant difference at the 5% level of the BNT test.

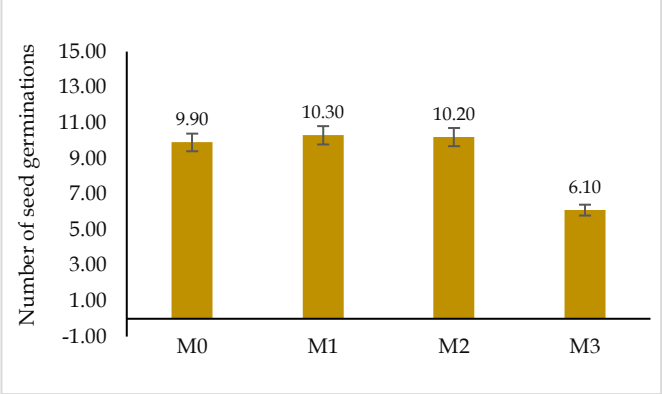

Figure 3. Graph of the effect of using the type of planting media amount of germination at the age of 14 day after plant.

The use of cocopeat planting media (M1) obtained the highest number of sprouts at 10.30 while the lowest number of sprouts was found in the husk charcoal planting media (M3) with the number of sprouts at 6.10.

Table 3. The results of the independent t-test of the mean response to the treatment of planting media types and the provision of coconut water nutrients to the rf value of chlorophyll.

M/K	K0	K1	K2	K3	K4	Average
M0	0.56	0.51	0.46	0.46	0.57	0.51 a
M1	0.39	0.52	0.51	0.48	0.42	0.46 c
M2	0.38	0.39	0.47	0.05	0.59	0.37 d
M3	0.47	0.45	0.61	0.41	0.50	0.49 b
Average	0.45 d	0.47 c	0.51 ab	0.35 e	0.52 a	KK = 39.18%

Note: numbers followed by the same letter in the column and row show no significant difference at the 5% level of the DMRT test.

The use of soil planting media (M0) obtained the highest rf value of 0.51 cm while the lowest rf value was found in rockwool planting media (M2) which was 0.37 cm.

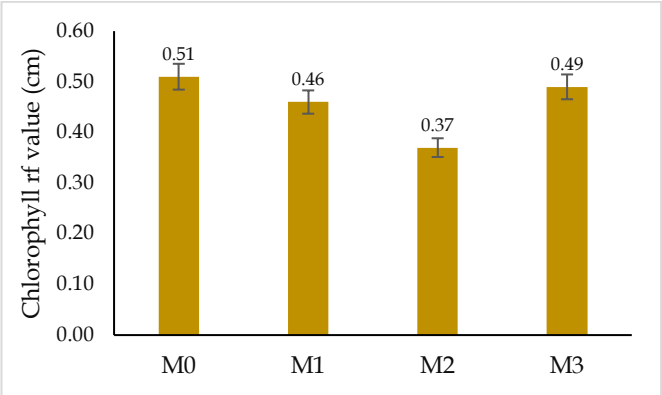

Figure 4. Graph of the effect of the use of planting media types on the rf value of chlorophyll at the age of 14 day after plant.

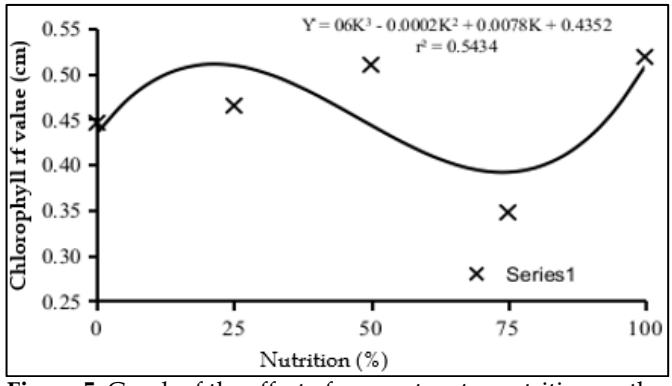

Figure 5. Graph of the effect of coconut water nutrition on the rf value of chlorophyll at the age of 14 day after plant.

The provision of coconut water with the highest rf value is at 100% concentration (K4) with a value of 0.52 cm, while the lowest rf value is at 75% concentration (K3) with a value of 0.35 cm.

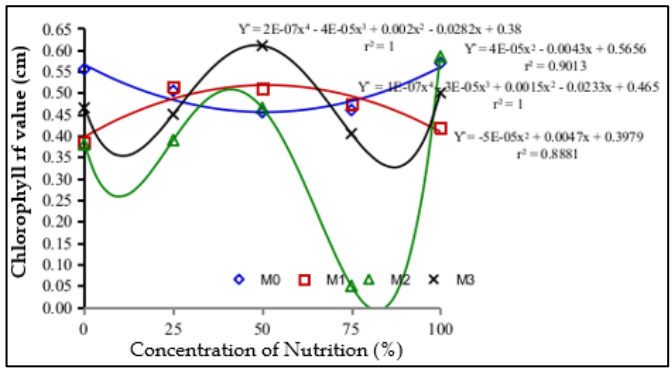

Figure 6. Interaction graph of the use of planting media types and coconut water nutrition on the rf value of chlorophyll at the age of 14 day after plant.

The results showed that the use of the type of planting media had a very significant effect on seed growth potential, the number of seed germination and rf chlorophyll. The best response was found in cocopeat planting media followed by rockwool, soil and husk charcoal on seed survival potential and number of seed germination (Pal et al., 2019). In chlorophyll rf, the best response was found in soil planting media followed by husk charcoal, cocopeat and rockwool. Soil planting media has the best response at rf chlorophyll because this planting media is a top surface soil that contains high nutrients, weathering products and metabolic products of various organisms. Fertile topsoil also contains potassium, phosphorus, and iron (Maluin et al., 2021; Rizki & Novi, 2017)

The application of coconut water had no significant effect on seed germination potential and the number of seed germinations but had a very significant effect on chlorophyll rf (Borgohain et al., 2020). Giving coconut water with a concentration of 100% has the best response compared to giving it with a concentration of 75%, 50%, and 25% on chlorophyll rf. The unreal effect of coconut

water on growth potential and number of germinations, according to Manullang et al. (2019), is because after the absorption of water by the seeds, the seeds experience a slow absorption phase, where metabolic activity takes place in this phase (El-Maarouf-Bouteau, 2022; Sarkar et al., 2019). In this phase the seeds move stored food reserves such as protein, starch and metabolic enzymes become active. Then the seeds enter the first cell elongation and mitosis while producing the protrusion of the root, then the epicotyl, hypocotyl and cotyledon appear (Mangena & Mokwala, 2019).

The interaction between the use of planting media and the application of coconut water had no significant effect on seed germination potential and the number of germinated seeds but had a very significant effect on chlorophyll rf . The absence of interaction between planting media and coconut water on seed growth potential and number of seed germination, indicates that each treatment and the elements in it have a function that does not support each other (Mukarlina et al., 2010).

The interaction between planting media and coconut water on chlorophyll rf indicates that the two treatments support each other. Planting media and its ability to bind water affect the absorption of nutrients (Du et al., 2022; Eswaranpillai et al., 2023). The provision of coconut water is able to be absorbed well by the planting media used so that nutrients and ingredients contained in coconut water can be absorbed well by plants. These two treatments influence and support each other so that there is an interaction between the two on chlorophyll rf, where the elements contained become a factor in chlorophyll formation. According to (Setiowati & Furqonita, 2007), elements of magnesium, iron and nitrogen are forming elements and catalysts in chlorophyll synthesis.

Conclusion

The treatment of planting media has a very significant effect on all observed parameters. The treatment of coconut water concentration did not significantly affect all observed parameters except chlorophyll rf. There is no interaction between the type of planting media and the application of coconut water concentration on all observed parameters except chlorophyll rf. Planting media with the best response on the parameters of seed growth potential and the number of seed germination is found in cocopeat (M1), namely (85.60% seed growth potential) and (10.30 number of seed germination). Whereas in the rf of chlorophyll, the best response is found in soil planting media (M0) which is 0.51 cm. Seeing the results of using the type of planting media that gives a very real effect, the authors suggest using more types of other planting media so that a more varied comparison is obtained.

Acknowledgments

Our gratitude goes to God Almighty for allowing this research to be completed. The research team would like to thank the leadership of the Faculty of Agriculture, University of Asahan and especially the lab assistants who technically assisted this research.

Author Contributions

In this research, our collaboration places equal roles and positions based on the assignment agreement that we always discuss, even from the idea until the research report is made, and also until this publication.

Funding

This research is independent research, where the source of funds needed comes from the contributions of the research team itself. This is a kind of collective task to produce collaborative research as one of the duties of an academic, namely research.

Conflicts of Interest

There is no conflict of interest in this research, with any party. The research team is completely independent in determining the research theme, preparation of proposals to the implementation, reporting and publication of the research results. Every step taken, is definitely through discussion by the team.

References

Ampim, P. A. Y., Obeng, E., & Olvera-Gonzalez, E. (2022). Indoor Vegetable Production: An Alternative Approach to Increasing Cultivation. *Plants*, *11*(21), 2843. https://doi.org/10.3390/plants11212843

Bila, R. S., Mardiyani, S. A., & Murwani, I. (2023). Pengaruh Media Tanam Dan Aplikasi Pupuk Terhadap Pertumbuhan Pada Microgreen Bunga Matahari (Helianthus Annuus L.). *AGRONISMA*, *11*(1). Retrieved from http://jim.unisma.ac.id/index.php/AGRNM/article/view/20249

Borgohain, L., Borgohain, H., Konwar, B., Dutta, A. K., & Panging, U. (2020). Panchagavya: A Multidimensional Review Article through the Lens of an Agriculture Scholar. *Asian Soil Research Journal*, *3*(4), 32–38. Retrieved from http://scholareprints.uk/id/eprint/1432/

Buana, Z., Candra, O., & Elfizon, E. (2019). Sistem pemantauan tanaman sayur dengan media tanam hidroponik menggunakan arduino. *JTEV (Jurnal Teknik Elektro Dan Vokasional)*, *5*(1), 74–80. https://doi.org/10.24036/jtev.v5i1.105169

Du, M., Xiao, Z., & Luo, Y. (2022). Advances and emerging trends in cultivation substrates for growing sprouts and microgreens toward safe and sustainable agriculture. *Current Opinion in Food Science*, *46*, 100863. https://doi.org/10.1016/j.cofs.2022.100863

El-Maarouf-Bouteau, H. (2022). The Seed and the metabolism regulation. *Biology*, *11*(2), 168. https://doi.org/10.3390/biology11020168

Eliseeva, L. G., Simina, D. V, & others. (2021). Microgreens: a newly merging product, aspects, prospectives, and disadvantages. *Вестник Воронежского Государственного Университета Инженерных Технологий*, *83*(1(87)), 102–107. Retrieved from https://cyberleninka.ru/article/n/microgreens-a-newly-merging-product-aspects-prospectives-and-disadvantages

Eswaranpillai, U., Murugesan, P., & Karuppiah, P. (2023). Assess the impact of cultivation substrates for growing sprouts and microgreens of selected four legumes and two grains and evaluation of its nutritional properties. *Plant Science Today*, *10*(2), 160–169. https://doi.org/10.14719/pst.2058

Febriani, V., Nasrika, E., Munasari, T., Permatasari, Y., & Widiatningrum, T. (2017). Analisis Produksi Microgreens Brassica oleracea Berinovasi Urban Gardening Untuk Peningkatan Mutu Pangan Nasional. *Journal of Creativity Student*, *2*(2), 58–66. https://doi.org/10.15294/jcs.v2i2.19840

Febrilla, D. (2021). *Respon Tanaman Selada (Lactuca sativa L.) terhadap berbagai Kombinasi Media Tanam dengan Teknologi Irigasi Tetes (Ro Drip)*. Universitas Hasanuddin. Retrieved from http://repository.unhas.ac.id/id/eprint/17366/

Gupta, A., Sharma, T., Singh, S. P., Bhardwaj, A., Srivastava, D., & Kumar, R. (2023). Prospects of microgreens as budding living functional food: Breeding and biofortification through OMICS and other approaches for nutritional security. *Frontiers in Genetics*, *14*. https://doi.org/10.3389/fgene.2023.1053810

Hassama, P., Sirinupong, M., & Ruangrak, E. (2022). Comparing Sources of Nitrogen Fertilizer on Growth in Sunflower Microgreens. *Journal of Food Science and Agricultural Technology (JFAT)*, *6*(1), 52–58. Retrieved from http://rs.mfu.ac.th/ojs/index.php/jfat/article/view/385

Maluin, F. N., Hussein, M. Z., Nik Ibrahim, N. N. L., Wayayok, A., & Hashim, N. (2021). Some emerging opportunities of nanotechnology development for soilless and microgreen farming. *Agronomy*, *11*(6), 1213. https://doi.org/10.3390/agronomy11061213

Mangena, P., & Mokwala, P. W. (2019). The influence of seed viability on the germination and in vitro multiple shoot regeneration of soybean (Glycine max L.). *Agriculture*, *9*(2), 35. https://doi.org/10.3390/agriculture9020035

Manullang, I. F., Hasibuan, S., & CH, R. M. (2019). Pengaruh Nutrisi Mix Dan Media Tanam Berbeda Terhadap Pertumbuhan Dan Produksi Tanaman SeladA (Lactuca sativa) Secara Hidroponikvdengan Sistem Wick. *Bernas: Jurnal Penelitian Pertanian*, *15*(1), 82–90. Retrieved from http://jurnal.una.ac.id/index.php/jb/article/view/471

Maulidiyah, I., Lestari, M. W., & Mardiyani, S. A. (2022). Pengaruh aplikasi perendaman berbagai jenis media tanam dengan beberapa pupuk cair terhadap kualitas dan tingkat kesukaan konsumen microgreen Wheatgrass (Triticum aestivum L). *Folium: Jurnal Ilmu Pertanian*, *6*(2), 118–126. https://doi.org/10.33474/folium.v6i2.16653

Mukarlina, M., Lisstyawati, A., & Mulyani, S. R. I. (2010). The effect of coconut water and naphthalene acetic acid (NAA) application on the in vitro growth of Paraphalaeonopsis serpentilingua from West Kalimantan. *Nusantara Bioscience*, *2*(2). Retrieved from https://www.smujo.id/nb/article/view/967

Munawar, A. (2018). *Kesuburan tanah dan nutrisi tanaman*. PT Penerbit IPB Press.

Pal, R., Meena, N. K., Pant, R. P., & Dayamma, M. (2019). Cymbidium: botany, production, and uses. *Orchids Phytochemistry, Biology and Horticulture: Fundamentals and Applications*, 1–37. https://doi.org/10.1007/978-3-030-38392-3

Poudel, P., Di Gioia, F., Lambert, J. D., & Connolly, E. L. (2023). Zinc biofortification through seed nutri-priming using alternative zinc sources and concentration levels in pea and sunflower microgreens. *Frontiers in Plant Science*, *14*. https://doi.org/10.3389/fpls.2023.1177844

Rizki, R., & Novi, N. (2017). Respon pertumbuhan bibit mangrove Rhizophora apiculata B1 pada media tanah topsoil. *Jurnal Bioconcetta*, *3*(2), 41–54. https://doi.org/10.22202/bc.2017.v3i2.2769

Samiarsih, S., Herawati, W., Juwarno, J., Sukarsa, S., & Budisantoso, I. (2022). Pelatihan Budidaya Sayuran Microgreen Selama Pandemi Covid 19 Di Griya Satria Mandalatama Karanglewas Lor, Purwokerto Barat. *Prosiding Seminar Nasional LPPM Unsoed*, *11*(1). Retrieved from http://www.jurnal.lppm.unsoed.ac.id/ojs/index.php/Prosiding/article/view/1922/0

Sarkar, R. K., Mukherjee, A. K., & Chakraborty, K. (2019). Seed priming alleviates stress tolerance in rice (Oryza sativa L.). *Priming and Pretreatment of Seeds and Seedlings: Implication in Plant Stress Tolerance and Enhancing Productivity in Crop Plants*, 181-204. https://doi.org/10.1007/978-981-13-8625-1_9

Setiowati, T., & Furqonita, D. (2007). Biologi Interaktif. In *Jakarta Timur. Azka Press. h* (Vol. 18). Azka Press.

Singh, B. (2023). New Systems of Vegetable Production: Protected Cultivation, Hydroponics, Aeroponics, Vertical, Organic, Microgreens. In *Vegetables for*

Nutrition and Entrepreneurship, 31–56. https://doi.org/10.1007/978-981-19-9016-8_2

Singh, N., Aditika, Rani, S., & Chaurasia, O. P. (2020). Vegetable microgreens farming in high-altitude region of Trans-Himalayas to maintain nutritional diet of Indian troops. *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences*, *90*, 743–752. https://doi.org/10.1007/s40011-019-01147-0

Weber, C. F. (2017). Broccoli microgreens: A mineral-rich crop that can diversify food systems. *Frontiers in Nutrition*, *4*, 7. https://doi.org/10.3389/fnut.2017.00007