International Journal of Agriculture and Environmental Analytics (IJAEA)
Vol.3, No.1, 2024: 13-22

Microgreen as a Minimalist Vegetable Cultivation Innovation in Supporting Food Security Family in Urban Areas

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ABSTRACT: Microgreen is a small vegetable or young edible plant with a soft texture. The purpose of this paper is to find out microgreen can be a solution in providing vegetable food in urban areas and to find out the content contained. The method used is literature review which is a reference to understand the research conducted by searching by reading various sources of books, journals, and other publications. The results of this writing microgreen does not require large areas of land for production, simple planting media. The advantages of microgreen include very easy maintenance, saving space, saving time and saving energy. The nutritional content contained in microgreen is at least 4-10 times more than that of vegetables in general.

Keywords: Cultivation, Food Security, Microgreen, Nutrition, Vegetables

Submitted: 06-01-2024; Revised: 15-01-2024; Accepted: 27-01-2024

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INTRODUCTION

The population in Indonesia continues to increase every year. Based on data from BPS (2020), there was an increase in population during 2019 and 2020 by 1.07%. The increase in population will definitely be followed by an increase in development, settlement, housing and fulfillment of food needs, which is expected to be accompanied by an increase in the population's food needs (Prasada & Rosa, 2018). The high rate of conversion of agricultural land results in an increase in the need for production and availability of food raw materials.

One of the foods needs whose fulfillment is still experiencing obstacles is the need for vegetables. The demand for vegetables in Indonesia continues to increase as the population increases but my production has not been able to meet the higher market needs. In an effort to meet these vegetable needs, Indonesia still imports many vegetables. Vegetable consumption per capita according to data from the Central Bureau of Statistics (2020), in 2020, vegetable consumption per capita in Indonesia amounted to 92.78 kg per year. Vegetable production according to data from the Ministry of Agriculture, in 2020 vegetable production in Indonesia amounted to 33.96 million tons. Vegetable imports according to data from the Ministry of Trade (2020), in 2020 Indonesia imported 270 thousand tons of vegetables with an import value of USD 219.6 million. In connection with these problems, microgreen cultivation can be developed on a household scale as a solution to fulfill vegetable food needs.

Microgreens are small vegetables or young edible plants with a soft texture. This type of small vegetable comes from the seeds of various vegetable species, aromatic herbs or wild edible species. Depending on the species grown, microgreens can generally be harvested at 7-21 days after germination when the cotyledons open and the first full leaf begins to grow. Harvesting microgreen is simply by cutting the plant just above the surface of its growth medium with a length of about 3-9 cm without roots (Salim, 2019).

Microgreen was initially introduced as a flavor enhancer and food beautifier because of its distinctive texture and taste. Nowadays, it has become a type of vegetable that is widely used in main dishes. Microgreen is claimed to have many nutrients. Research conducted by (Xiao et al., 2012) on 25 microgreens such as red cabbage, cilantro, and Garnet spinach showed that microgreens contain ascorbic acid, carotenoids, phylloquinones, and tocopherols. Based on the USDA National Nutrient Database, the concentration of nutrients in microgreens is also higher when compared to mature leaves. Research by Huang (et al., 2016), on rodentia fed a high-fat diet also showed that red cabbage microgreen can reduce LDL levels, reduce cholesterol esters in the liver, triacylglycerol levels, and expression of inflammatory cytokines in the liver.

Species/varieties that can be cultivated as microgreen include green spinach (Amaranthus gangeticus L.), red spinach (Amaranthus tricolor L.), broccoli (Brassica oleraceae var. Italic), sunflower (Helianthus annuus L.), kailan (Brassica oleraceae L var. Alboglabra), basil (Ocimum basilicum L.), cauliflower (Brassica oleraceae L. var. Botrytis), pakcoy (Brassica rapa subsp. Chinensis), purple cabbage (Brassica oleraceae var. Capitata), mung bean (Vigna radiata L.), red lettuce (Lactuca sativa L.), coriander (Coriandrum sativum L.), celery (Apium graveolens L.), parsley (Petroselinum crispum L.), Caisim (Brassica rapa L.).),

Caisim (Brassica chinensis L. var. Parachinensis), Kale (Ipomoea aquatic Forsk.), long beans (Vigna unguiculata L.), corn (Zea mays L.), Wheat (Triticum aestivum L.) (Salim, 2019). Microgreen cultivation requires nutrients for growth and increase microgreen production. If nutrients are not met, the plants will show symptoms of nutrient deficiency and result in disruption of the growth process (Sari et al., 2022).

Nutritional requirements from vegetables are essential to support a healthy body. Vegetables are rich in various nutrients that are necessary for maintaining optimal body function. Some of the important nutritional components found in vegetables and their benefits to the body include fiber that helps maintain digestive health by promoting smooth bowel movements, vitamins and minerals needed by the body for various functions, antioxidants such as vitamin C, vitamin E, and beta-carotene that help fight free radicals in the body (Ministry of Health, 2018).

THEORETICAL REVIEW

Microgreens have a much higher nutrient content than mature leaves of the same type of plant, with about four to six times more vitamins and phytochemicals. This microgreen farming method can be used for a variety of crops, even covering up to 60 different plant species (Arifiansyah et al., 2020). Microgreens are a rich source of nutrients in vitamins, minerals, and beta-carotene because in the early growth stages, the leaves of the plants still contain large amounts of vegetable oils and proteins. However, as the plant grows more mature, the content of these vegetable oils and proteins tends to decrease as they have been utilized by the plant. In general, microgreen vegetables have very small leaves and stems and are still in the young phase. The seed growth process requires exposure to sunlight in order to produce chlorophyll which is necessary in the formation of microgreen vegetables (Lutfi, 2023).

Types of Plants in Microgreen Cultivation

Some vegetable and herbal plants in Indonesia have not been utilized as microgreen, so the opportunity to develop microgreen is still wide open considering the increasing awareness of the importance of healthy food consumption. Some examples of typical Indonesian plants such as basil, red spinach, red lettuce, cauliflower, pakcoy, green beans, sunflowers, sweet sorghum, and purple cabbage have the potential to be cultivated as microgreen with higher nutritional content than the types of microgreen commonly found abroad (Adawiyah, 2020).

Many types of crops can still be grown in the form of microgreens, including cereal crops, such as oats, wheat, corn, barley, rice, and sorghum. There is also Quinoa, which is similar to cereal crops but actually belongs to the legume family, such as chickpeas, alfalfa, mung beans, fenugreek, fava beans, and lentils. Oleaginous plants, such as sunflowers, and fiber plants, such as flax, also exist. In addition, various types of aromatic plants, such as cumin, cilantro, chives, and basil, are suitable (Schramm, 2018).

Benefits of Microgreen Vegetables

Local plant species used as microgreen, antioxidant compounds consist of various bioactive substances, including alkaloids, anthocyanins, carotenoids, flavonoids, isoflavones, lignans, monoterpenes, organosulfides, phenolic acids, saponins, and many more (Candra Kusumah & Nurjasmi, 2021).

The antioxidant properties of these compounds allow microgreens to fight a wide range of diseases, including degenerative and nondegenerative ones, such as antimicrobial diseases, diabetes, hypertension, and have protective effects on the liver and heart (Adawiyah, 2020).

Planting Media

A growing medium is a substrate or material used for planting or propagating seeds. This medium can come from a variety of materials or only one type of material as long as it meets several criteria: able to hold water well, has porosity that allows air circulation without stagnation, does not contain toxic substances for plants, and especially contains nutrients needed for plant growth (Wahyu Kuncoro, 2022).

METHODOLOGY

The method used is literature review. Literature review is a work that becomes a reference to understand the research conducted by searching by reading various sources both books, journals, and other publications related to the research title to answer existing problems.

The literature sources used in this writing were traced through google scholar using the keywords microgreen cultivation and microgreen nutrient content. Journal searches are carried out with a time span from 2014 to 2022 and there are several journal sources that are more than the last 10 years which are references to several previous studies.

Preparation Steps

The steps taken in this literature review include the following:

1. Literature collection from 2014 to 2022. The material collected in the literature study is in the form of data information whose sources come from journals, official and scientific research reports and other literature that supports the making of this paper.
2. Searching for literature with the keywords microgreen, nutrient content, cultivation, and growing media through google scholar, gat research and concensus. This aims to get journal references as needed.
3. Grouping or mapping of literature based on sub topics that will be used as references in processing the literature sources to be used.
4. Analyzing the results of mapping based on each subject that has been obtained from various sources of information. At this analysis stage, conclusions are also drawn from the results of the literature review that has been carried out.

Trial

In addition to using the literature review method in taking data, the author also conducted a simple experiment without treatment in microgreen cultivation

to find out how to cultivate, techniques, and make observations on the growth of microgreen itself. The results of the experiments carried out are presented in the discussion of the growth and development of microgreen.

RESULTS

Microgreen Development

As a model for urban farming systems, the growth of microgreen has been considered as an attractive option that can become a prominent trend and alternative to overcome the challenges of farming in urban environments. Microgreens excel because they can be grown in limited space, have a quick harvest time, do not require a lot of tools and materials, and have a high nutritional content. Microgreens are small versions of nutrient-rich vegetables that are harvested at a very young age, usually 7 to 13 days after the appearance of the first leaf (Gofar et al., 2022).

Microgreen cultivation can be done in a simple way using reused materials using mineral water bottles, cans, or other containers that are no longer used with holes in the bottom is an easy way to grow microgreen. Next, the container is filled with soil or a compost mixture of husks, sawdust, or other organic materials, and watered with enough water to keep it moist. After that, the seeds are placed evenly on top of the growing medium, cover the container with plastic, and keep it in a dark room for four days to allow the seeds to germinate. After that, the container is moved to a bright place so that the plants get enough sunlight, and watered at least twice a day until the plants reach 10-14 days and are ready to be harvested.

Important aspects that need to be considered in the process of cultivating and developing microgreen are in the selection of seed types and lighting arrangements. According to research by Irma (2020), it is recommended to choose seeds that are free from the use of pesticides or other chemicals, and pay attention to variations in size, shape, and color of each type of seed. Small seeds such as broccoli and radish can be planted directly into the growing medium, while larger seeds such as capri beans and wheatgrass require soaking in warm water for about 5 hours to overnight before planting.

Microgreens require indirect exposure to sunlight, as revealed by Mardiyani (et al., 2023). The study suggested that microgreen requires about four hours daily of sunlight to support its growth and development properly. Plants that get enough light exposure will show bright colors and not look pale.

According to research by Renna & Vito (2020), microgreens are increasingly in demand as a food source with health potential due to their important micronutrient content and bioactive compounds, as well as attractive color, texture, and flavor variations. Microgreens are also considered to have higher nutrient and vitamin content than mature vegetables, with some types of microgreens containing four to six times more nutrients such as vitamin C, vitamin E, and beta-carotene (Xiao et al., 2012).

The ease of cultivation of microgreen, the development of microgreen especially in urban areas, provides promising business opportunities both

individually and commercially, due to high market demand. As mentioned by Zulkarnaen (2018), the relatively high price increases the market potential for further adoption and development of microgreen.

Microgreen Cultivation

Microgreen cultivation can use several soil media such as fine sand, sawdust, rice husk charcoal, cocopeat, vermiculite, perlite, and rockwoll. Store the seeds in a closed container to keep them safe from pest and disease contaminants. The steps for microgreen cultivation are as follows, select plant seeds that are suitable for microgreen, make sure the seeds are of high quality and free from pesticides or harmful chemicals, soak the seeds in water for several hours to speed up the germination process. Planting, prepare a sterile container or pot with holes for drainage, place the planting medium, sprinkle the seeds evenly over the planting medium, then water with clean water, cover the seeds with a thin layer of planting medium. Maintenance: place the container with seeds in direct sunlight for a few days. After 7-21 days, microgreens can be harvested by cutting with scissors or knife under the first leaf, store microgreens in the refrigerator at 1-4 degrees Celsius, microgreens can be stored for 3-5 days before consumption.

Microgreen's Relationship with Food Security

According to several limited studies, microgreen has a smooth texture, unique fresh taste, and higher content of nutrients, vitamins, minerals, and betacarotene compared to similar mature vegetables (Arifiansyah et al., 2020). Research conducted by Augustien et al. (2019) also stated that microgreen contains folate, vitamin K, vitamin C, iron, and potassium compounds. Its attractive appearance and distinctive taste is the attraction of microgreen often used to add color, flavor, and texture in various dishes such as salads, soups, sandwiches, and as a garnish on various main dishes (Treadwell et al., 2020).

Experts' research results show that for the same species, microgreens have at least ten times the phytochemical and vitamin content of mature vegetables. Microgreens contain carotenoid pigments such as zeaxanthin, lutein, and beta-carotene as well as vitamins C, E, and K. So, it is clear that microgreens have high levels of antioxidants. Consuming a few grams of microgreens is enough to fulfill your antioxidant needs. Consumption of microgreen in its raw state besides being fresh will also reduce the loss of bioactive compounds such as vitamins and pigments needed by the human body (Salim, 2019).

Table 1. Vitamin C, E and K content of some microgreen species and common vegetables

Microgreen	Vitamin Levels	Daily Requirement	Common Vegetables

	Vit C	Vit E	Vit K	Vit C	Vit E	Vit K	Vit C	Vit E	Vit K
	mg/100g BB	mg/100g BB	mg/100g BB	g	g	g	mg/100g BB	mg/100g BB	mg/100g BB
Spinach	131,6	17,1	4,1	46	76	17	0,0281	0,002	0,000483
Basil	90,8	24,0	3,2	66	54	22	0,027	0,0023	0,004829
Beets	46,4	34,5	2,0	129	38	35	0,049	0,004	0,000002
Purple Cabbage	147,0	24,1	2,8	41	54	25	0,057	0,011	0,007048
Coriander	40,6	53,0	2,5	148	25	28	0,027	0,00028	0,00031
Pepper	57,2	41,2	24	105	32	28	0,001277	0,000037	0,000074
Green peas	50,5	35,0	3,1	119	37	23	0,020	0,015	0,000025
Radish	70,7	87,4	1,9	85	15	37	0,012	0,000001	0,000001
Arugula	45,8	19,1	1,6	131	68	44	0,015	0,0043	0,001086
Celery	45,8	18,7	2,2	131	70	32	0,08	0,000001	0,00413
Corn	31,8	7,8	0,9	189	167	78	0,096	0,0037	0,000003
Yellow peas	25,1	4,9	0,7	239	265	100	0,025	0,0013	0,000002

DISCUSSION

This part allows you to elaborate on your results findings academically. You must not put numbers related to your statistical tests here; instead, you have to explain that numbers here. You have to compile your discussion with academic supports to your study and a good explanation according to the specific area you are investigating.

CONCLUSIONS AND RECOMMENDATIONS

Based on the discussion that has been carried out, it can be concluded as follows:

1. Microgreen can be a solution to land limitations in meeting vegetable food needs. Microgreen cultivation does not require extensive land for production, using simple planting media can produce household-scale vegetables in urban areas. The advantages of microgreen include very easy maintenance, saving space, saving time and saving energy.

2. The nutritional content contained in microgreen is at least 4-10 times more than vegetables in general, this can meet the nutritional needs of people in urban areas by consuming a little microgreen already get the nutrients needed by the body.

There needs to be support from the government, especially the Department of Agriculture and Food Security to conduct further research and develop microgreen as a program in meeting family-scale food needs. There needs to be a pilot project first before the development of microgreen can be implemented in urban areas.

FURTHER STUDY

The writing of this paper still has limitations, it is necessary to conduct further research related to microgreen. research that needs to be done to get results that can be more useful in the future for the community.

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