

“MICROGREENS: UNDERSTANDING THE IMPORTANCE OF THEIR GROWTH”

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A sustainable, easily available and nutrient-dense food supply is becoming more and more necessary as the world's urban population continues to expand. Both the public and private sectors are interested in urban farming, especially controlled environment agriculture (such as greenhouses, aquaponics, hydroponics, and vertical farms). In controlled environment agriculture, crops are grown in a contained area where irrigation, lighting and climate can be precisely managed, optimized and even automated with the use of machine learning and analytics. Because indoor farming uses less water and depletes less soil, it is more accessible to urban dwellers and more environmentally benign. Although controlled environment agriculture has great potential, it is still in its infancy and is now only used for specific agricultural commodities. Because they can be grown simply in soil or drop-on methods, microgreens are also a popular choice for agriculture in controlled environments. Microgreens are a relatively new variety of edible vegetables that is collected after the first leaves have begun to fully grow but before the actual

caves appear. The term “microgreens” is used in marketing to differentiate them from sprouts and leafy greens. Approximately 25 varieties of microgreens are cultivated commercially worldwide. Since the 1990s, microgreens have been successfully produced in Southern California. Their fresh flavor and nutritional advantages have controlled to their recent ten-year boom in popularity. Young delicate greens called microgreens are frequently added to salads and main courses to enhance their color, texture and flavor. They are suitable for small-scale indoor cultivation, which has made them increasingly popular in controlled environment agriculture. This method of indoor farming is particularly crucial for providing food to the expanding urban populations.

Microgreens are immature, fragile greens that are harvested between 4 to 14 days old. They are a juvenile versions of edible vegetables, aromatic condiments, and other wild edible species. Typically, they consist of the central stem, two cotyledonary leaves, and a pair of true leaves, with a height ranging from 5 to 10 cm. Microgreens stand between sprouts

and baby greens. Sprouts are the youngest and undifferentiated versions, consisting of the seedling, radical, and remaining seeds, all of which are edible. Baby greens are the oldest version, usually 7-10 cm tall, with edible parts similar to microgreens, such as the aerial part of the seedling consisting of central stem cut just above the soil line.



Benefits of microgreens on health

1. Assist in managing type 2 diabetes.
2. Develop your ability to think and reason.
3. Reduce the chance of developing heart disease.
4. Avoid cancer.
5. Preserve your vision.
6. Reduce the chance of anaemia.

Types of microgreens

- Amaranthaceae: Amaranth, beet, and spinach.
- Amaryllidaceae: Onion leek and Garlic.
- Apiaceae: Celery, carrot, fennel and dill.
- Asteraceae: Endive, chicory, radicchio and lettuce.
- Brassicaceae: Arugula, broccoli, cabbage, cauliflower, radish and watercress.
- Cucurbitaceae: Cucumber, melon, and squash.

Procedure of microgreens seedling

1.) Prepare a high-quality seed:

Begin with fresh, premium microgreen seeds, like those found in sunflower, radish, beet, or broccoli microgreens. To ensure viability and successful germination, look for reliable seed vendors. The majority of microgreen seed vendors will list typical germination rates among their specifications.

2.) Select the Growing Medium:

Select a growth medium that is appropriate for germination. Soilless seed-starting mixes, peat moss, and coconut coir are common choices for growing media. When cultivating microgreens, make sure it is sterile and have good drainage.

To germinate seeds, wrap them in a moist paper towel and place them in a sunny window. Make sure to keep the paper towel moist around the seeds using a spray bottle. This method is effective for demonstrating germination and growing in just a couple of weeks.

3.) Prepare Growing Trays:

1. Use shallow trays or flats with drainage holes.
2. Fill the plastic trays with your chosen growing medium, leaving about half an inch from the top. Lightly tamp down the medium to create a flat surface.
3. Then, place the growing trays in a sunny location to warm them. This step is optional, but it can speed up germination by warming up the medium. The young plants will emerge from the seed and reach the soil line faster in a warm environment.

4.) Sow seeds evenly:

Make sure to sprinkle the microgreen seeds evenly over the surface of the growing medium. For smaller seeds, such as broccoli, lightly press them into the medium. It's crucial not to push them in too deep, as this will significantly slow down their growth. Also, avoid overcrowding to provide ample space for proper growth. Remember, baby plants need their space too.

5.) Watering:

Remember to keep the trays of microgreens moist, but be careful not to make them too wet. Use a fine spray bottle to evenly moisten the seeds and the growing medium. Make sure the medium is consistently moist, but avoid overwatering it. Check the medium every few days, or even daily, depending on the type of shallow container and the location of your trays.

6.) Covering Seeds:

To boost germination, it's time to create a humid environment for your seedling trays. Microgreen seeds thrive in humidity, and it's easy to achieve this. Simply cover the trays with a clear lid, plastic wrap, or another tray. While this step is optional, it can significantly aid in germination. Keep in mind that the necessity of this step can vary depending on the type of microgreen variety you are growing.

7.) Provide Warmth and Light:

It's crucial to keep the growing medium and trays warm. Initially, they don't need much light until they emerge from the ground, but warmth is essential.

Place the trays in a hot climate with temperatures between 60°F to 75°F (15°C to 24°C). Room temperature won't cut it. You must use grow mats or heat mats to artificially warm the trays

to the desired temperature.

Once the microgreens have sprouted, ensure they receive indirect light or use artificial grow lights, such as LED lights. The specific light requirements may vary depending on the microgreen variety.

8.) Monitor Germination:

Germination is the essential process of a young plant pushing through the seed and emerging above the surface. Not all microgreen seeds will germinate, so it's crucial to actively monitor for signs of germination. Take the initiative to gently dig into the growing medium to inspect for any sprouting, utilizing a sharp knife or a thin utensil to minimize disruption to the other seeds.

9.) Remove Cover and Transition to Light:

Once the majority of seeds have sprouted and small seedlings are visible, remove the cover immediately. Transfer the trays to a location with direct sunlight or ensure they receive consistent exposure to a light source, such as grow lights. Additionally, make sure to check regularly for proper moisture levels.

MICROGREENS THAT ARE MORE POPULAR IN INDIA

Beetroot: The leaves and stems color of young tender beetroot are vibrant red/green, which tastes sweet and earthy when consumed. They are a good source of antioxidants and rich in vitamins .



Broccoli: Young tender leaves are bright green with slightly pinkish stems. It tastes crunchy, dense, and slightly bitter when consumed. Contains a good amount of chlorophyll, vitamins, minerals, enzymes, and protein



Carrot: The young leaves and stem of carrot are bright yellowish-green in color with a mild and sweet taste enriched with phytonutrients such as β -carotene, lutein, and zeaxanthin



Cauliflower: Young tender leaves of cauliflower are light green with a taste of broccoli flavor enriched with β -carotene and vitamins such as vitamin C, K, and E.



Green mustard: Leaves are slightly yellowish-green in color with a spicy taste when consumed. They are rich in vitamins, minerals, antioxidants, and protein.



Kale: Leaves are bold green in color with light green/pink stems. It tastes sweet when consumed and is a rich source of antioxidants. (planter's library,2022)



Palak: Young leaves of palak are green to reddish-green containing a good amount of phenolics and betalains (Koley 2016).



Pak choi: Young tender pak choi is reddish-green in color and rich in glucosinolates, phenolics, and anthocyanins (Koley 2016).



Pea: Young tender leaves are light green, which tastes sweet and crunchy when consumed in the form of microgreens. They are a rich source of vitamins like A, C, K, and minerals such as phosphorus, potassium, calcium, magnesium, and iron (Kumar et al., 2018).



Radish: Leaves are green in color having white/red stems. They taste spicy with floral flavor when consumed and are reported to possess several vitamins like A, E, K, B complex, and C including minerals such as iron, phosphorus, and calcium (Sreenivasa et al., 2019).



Red cabbage: Young tender leaves of red cabbage are green and purplish with light purple/pink white stems that taste earthy and peppery when consumed. Tender leaves and stems of red cabbage are enriched with vitamins like A, B, C, E, and K along with various minerals (Kumar et al., 2018).



Preharvest factors shaping physicochemical functional quality of microgreens

For the cultivation of microgreens, commercial seed firms provide a wide variety of species, cultivars, and crop mixes. However, only a limited number of plant families are covered in the current literature, with the most studied groups being Chenopodiaceae and Brassicaceae. For microgreens, *Beta vulgaris* and *brassica juncea* are the most commonly utilized species. Important characteristics for promising genotypes include flavor, texture, appearance, phytochemical composition, and nutritional value.

There is currently little information available on the genetic variability of these features both within and between species, as well as the effects of environmental factors and genotypes-environment interactions on microgreens. It is important to understand that variations in the bioactive components of vegetables are influenced by both heredity and the environment. Previous studies have emphasized the impact of preharvest, postharvest, eco-physiological,

and genetic factors of the vegetables. It's crucial to educate customers to the unique flavor of microgreens and concentrate on choosing species and cultivars that will appeal to them the best in order to encourage their use in cooking (Xiao, Lester, *et al.*, (2015).

CONCLUSION-

Microgreens synonymously known as “functional foods” or “super foods” are becoming more popular among people as their health benefits are drawing more recognition. Many studies have revealed that consuming microgreens promotes good health and prevent diseases as it contains higher concentrations of bioactive compounds such as minerals, vitamins, phenolics and antioxidants, than in fully developed greens or seeds. Consuming about 50 grams of micro greens per day can meet our recommended daily nutrient requirements and can replace intake of vita-min tablets. They are easy to grow at home, and are cost-effective to boost nutrient intake without having to purchase large quantities of vegetables. However, commercialization of microgreens is still limited due to their speedy degradation and a very short storage life. Therefore, methods for maintaining the quality and safety as well as post cultivation treatments for extending their life span needs to be further explored and identified to boost the fruitful production of the microgreens which ultimately strengthen the nutritional security of the nation in this 21st century