*Review Article*_____ *Chapter –17*

MICROGREENS - FOOD AND NUTRITIONAL SECURITY OPTION THROUGH HOMESTEAD VEGETABLE PRODUCTION

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Abstract

Microgreens are a new class of edible vegetables (Pinto *et al.,* 2015), a very specific type which includes seedlings of edible vegetables, herbs or other plants, ranging in size from 5 to 10 cm (Xiao *et al*., 2012). They are older than "Sprouts" and younger than "Babygreens". It can be easily grown in urban and peri urban areas where land is often a limiting factor. Short growth cycle, grown with or without any external inputs like fertilizers and pesticides. Concentrated with bioactive compounds like vitamins, minerals and antioxidants.

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Introduction

Wheat grass was grown and dried, then sold as a medicine in most North American pharmacies during the1930s. In the 1960s sunflower, buckwheat and radish were frequently grown in sunny windows as "WinterGreens". In the 1970s, healthy home grown "Grasses" were popularized for their health benefits. In the 1980s, chefs started growing "Cresses" and "Seedlings" for garnishing.In the 1990s, California chefs started to popularize them as "Vegetable Confetti". The first documented use of the word "MICROGREENS" in USA 1998. Then in the 2000s, local producers throughout North America started distributing fresh "Microgreens" to their local retail outlets. In 2010: Microgreens started to appear in grocery stores so that food enthusiasts can enjoy them at home. The spectrum of life in terms of income, life style and spending is changing rapidly with economic development leading to major challenge of numerous diseases related to nutritional deficiencies. Non-availability of fresh and pesticide residue free vegetables for consumption. In developing countries like India, 14% people are chronically undernourished with Western-Asia and Sub-Saharan Africa, the most severely affected regions (Anonymous, 2020). Diet-related diseases such as obesity, diabetes, cardiovascular disease, hypertension, stroke, and cancer are escalating both in developed and developing countries, in part due to imbalanced food consumption patterns.

Nutritional Importance

- ✓ Phytonutrient levels differ according to the growth stages of plant and often decrease from the seedling to the fully developed stage
- ✓ 7 days after germination, young lettuce seedlings had the highest total phenolic concentration and antioxidant capacity in comparison to the older leaves
- ✓ Microgreens are 4-6 times more nutrient dense than their adult counterpart
- ✓ Supplemental UV-A irradiation can improve antioxidant properties of microgreens. Microgreens from Brassica species are good sources of phenols
- ✓ Among the 25 commercial microgreens tested, red cabbage, red sorrel, garnet amaranth and green daikon radish had the highest concentrations of vitamin C, vitamin A, vitamin K and vitamin E, respectively
- ✓ Microgreens generally had higher levels of phytonutrients like vitamin C, B_9 and K_1 and the carotenoids than mature leaves
- ✓ So, microgreens = 'Functional Foods' which have health promoting or disease preventing properties
- ✓

Important Vegetable Crops Grown as Microgreens

Red Amaranth

- Flavour is sweet and tangy, similar to spinach
- A microgreen with gorgeous magenta leaves to add a vibrant dash of colour to salad or for use as a garnish

Beetroot

- An easy to grow and vigorous growing with very attractive, deep reddish metallic purple leaves with a delicious, mild spinach like flavour
- It is nutritious with antioxidant properties and rich in vitamin

Broccoli

- Distinctive hot, highly nutritious
- Rich in vitamins, minerals, protein, enzyme and chlorophyll
- Stimulate the immune system

Cress

- Traditional microgreen with finely curled leaves and a peppery flavour. Use in garnishing and addition to salads and sandwiches
- Good source of vitamin A, C and sulphur

Dill

- Fine, feathery foliage and a great flavour
- Goes well with eggs, cucumbers, cheese, salmon and cabbage

Fenugreak

- Nutritious microgreen, high in protein, vitamins A, D, E, B and minerals
- Stimulate the appetite and effective against anaemia and fatigue

Kale

- Mild cabbage like flavour, colourful leaves, add vibrancy to salads
- Rich in antioxidants believed to help prevent macula degeneration and other conditions of eye

Linseed / Flaxseed

- Mildly spicy and very tender. Highly nutritious, rich in Omega-3 fatty acids
- A good source of vitamins, minerals, antioxidants and amino acids

Radish

- Spicy microgreen
- Rich in vitamin, minerals, calcium, iron, potassium, zinc, carotene, antioxidants and protein
- Stimulate immune system

Red Cabbage

- Beautiful, red purple microgreen, mild sweet cabbage flavour
- Rich in vitamins A, B, C, E, K and minerals and chlorophyll
- Stimulate immune system

Fennel

- Light leaves and Liquorish flavour
- Higher in vitamin K, C, B and phytonutrient
- Decrease risk of heart disease

Mustard

- Hot and spicy, high levels of antioxidants, protein, vitamins and minerals
- Stimulate blood circulation and effective against fever and cold

Onion

- Easy to digest and sweet flavour

- Full of vitamins, minerals such as Ca, K, S, protein, enzymes and chlorophyll

Pea

- Sweet and tender.
- Very nutritious and source of vitamins A, C, K and minerals Ca, Fe, Mg, P, K, amino acids and protein

Red Veined sorrel

- Red veined with very tangy. Its sour taste comes from oxalic acid
- Boost eye sight, strengthen the immune system, build strong bones, prevent cancer and lower down blood pressure

Golden Corn

- Blanched corn shoot, sweet flavour and use in garnishing
- Good source of vitamin B, antioxidant and carotenoids

Carrot

- Mild carrot flavour with fine textured leaves
- Rich in β-carotene and other phytonutrients like lutein and zeaxanthin
- Beautiful skin, cancer prevention and anti-aging

Microgreen's Growing Process

Materials and Media

✓ Flat tray with good drainage
✓ Media: Organic potting mix, cocopeat, vermiculite or mix
✓ Organically certified or untreated seed
✓ Fill the tray with media 2-3 cm deep and moisture it

Sowing

✓ Soaking
✓ Then sprinkle the seeds top of the media
✓ Covered with paper towel/ vermiculite/ cocopeat

Practices

✓ Watering by fine spray
✓ High light conditions with low humidity and good air circulation
✓ Requires 12 to 16 hours of light

Nutritional Requirement

✓ Not need much fertilizer
✓ Diluted organic nutrients *e.g.,* seaweed spraying will improve the nutrient levels in the microgreens
✓ Germination paper dipping into fertilizer if grown without media

Microgreen's Troubleshooting

Weak, Skinny Microgreens: The plants need more light or feeding. Placing them in dark place or less nutrient feeding very in weak, skinny microgreens

Over Crowding: Too much seed will cause "damping off", it can be overcome by treating the media by Trichoderma.

Wrong Sowing Time: Some seeds will not germinate at very high or very low temperatures.

Over Soaking: Over soaking of seeds may result in dead seeds.

Homestead Utility

In recent years, consumption of microgreens has increased along with consumer awareness and appreciation for their tender texture, distinctive fresh flavors and concentrated bioactive compounds such as vitamins, minerals, antioxidants as compared to mature leafy greens.

- ✓ Plate's presentation (add vivid colours)
- ✓ Dam cool!!!
- ✓ Introduce hidden tangy flavour
- ✓ Microgreen Salads: All the flavour of a big salad in a tiny pile on plat

Harvesting

- ✓ Appearance of 1st set of true leaves
- ✓ Cutting above from media surface
- ✓ Packing without roots
- ✓ Some types will regrow and can be cut several times
- ✓ Invert the media, top it up with a bit of fresh media and replant

Post-Harvest Management

- ✓ Microgreens have a short shelf life. Hence, require better methods of storing and transporting.
- ✓ Commercial microgreens are most often stored in plastic clamshell containers.
- ✓ Clamshell container: Good for transportation of microgreens.

Reviews

Nutritional Value

Dagmar *et al.* (2010) graphically indicated that microgreens of tartary buckwheat showed highest antioxidant activity than common buckwheat microgreens. Among the cultivars of tartary buckwheat Jianjui and Liu cultivar showed highest antioxidant activity.Xiao *et al.* (2012) found that Garnet amaranth obtained highest value of phylloquinone&violaxanthin, red cabbage obtained the highest value of TAA and red sorrel

obtained the highest value of β-carotene & lutein.Ebert *et al.* (2014) observed that in microgreenschlorogenic acid was only detected in cv.2 & cv.1 was significantly highest in neoxanthin, lutein, α-carotene &β-carotene and in fully grown amaranth chlorogenic acid was not detected, neoxanthin &β-carotene significantly highest in cv.2 and lutein &α-carotene highest in cv.2.Pinto *et al.* (2015) found that mature lettuce possessed significantly highest N, P, K &Ca, Fe, Mn, Zn, Se& Mo significantly highest in microgreens.Xiao *et al.* (2016) observed that highest K content found in Argula, highest P content found in broccoli, highest Ca& Mg found in cauliflower and highest Fe found in kohlrabi purple.

Germination

Lee *et al.* (2004) found that primed seed treatment significantly highest in final germination percentage in both beet and chard & also found that minimum days require for 50 % germination lowest in hydrogen peroxide soak.Senevirathne*et al.* (2019) observed that mean germination percentage in total darkness significantly highest in green radish and in 50% light & 50% dark condition significantly highest in green radish and fenugreek. They have also found that minimum days require for 75% germination was lowest in green radish.

Fertilizer

Kou *et al.* (2014) found that among all the treatments 10 Mm $CaCl_2$ treatment was significantly highest in hypocotyl length also found that 10 Mm significantly highest in fresh weight, dry matter and calcium content.Petropoulas*et al.* (2021) found that all over K is the most abundant macro element in spinach microgreens. NO_3^- concentration significantly highest in 20 days of nutrient feeding solution, P content highest in 5 day of nutrient feeding solution, K & Mg content highest in 5 day of nutrient feeding solution & They have also found that Ca concentration decrease when it was allowed to nutrient solution feeding.

Light

Brazaityte*et al.* (2015) observed that at higher intensity DPPH & total anthocianins highest at 390 nm supplemental UV-A, total phenols & ascorbic acid highest at 402 nm supplemental UV-A&α-tocopherols highest at 366 nm supplemental UV-A. Viktorija and Akvile (2015) found that both the light treatments LED 150 & LED 250 had negative effect on hypocotyl length & same tendency observed in plant height and leaf area and they have also found that LED 250 treatment significantly highest in ascorbic acid, total phenols, total anthocyanins& ABTS+.Brazaityte*et al.* (2019) recorded that short duration of all wavelengths negatively affected the content of microelements. They have also found that longer duration with supplemental irradiation 402 nm wavelength increased in Mn, Zn & Cu content while longer duration with 390 nm wavelength had higher B content.

Disease Management

Pill *et al.* (2011) observed that minimum damping-off percentage found in seed ball which was imbibed & applied 1 mg/seed ball trichoderma treated & minimum first

emergence days lowest in treatment 2 which was 0.25 mg/seed ball trichoderma. They have also noted that highest damping-off percent & highest first emergence days in dry seed balls which have not applied trichoderma. Cora *et al.* (2018) in Kale found that plant inoculate with pythium and treated with companion biofungicide resulted in lower root necrosis incidence, damping-off incidence and damping-off severity.

Post-Harvest

Chandra *et al.* (2012) graphically indicated that among all the treatments of sanitizers CA + E solution treatment exhibit lowest score at the end of storage & also indicated that samples were packed in PP film received highest off-odour score compare to PE. Kou *et al.* (2013) graphically indicated that temperature had significantly on mesophillic bacterial growth. Microgreens stored at 15 °C & 20 °C had significantly highest growth after 10 days of storage.

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