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Research Journal of Agricultural Sciences

ISSN: 0976-1675 (P)
ISSN: 2249-4538 (E)

International Conference on "Millets- Ensuring Food Security and Sustainable Farming"
Volume 14; Issue 04 (July-Aug 2023); pp 973–976

Full Length Research Article

Ragi and Sorghum Microgreens: Cultivation and Development of Value-Added Recipes

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Abstract

Microgreens - a superfood rich in micronutrient and antioxidant is gaining popularity among researchers and homemakers to identify its health benefits, nutrient content, cultivation techniques, phytochemical properties and recipes development and it became an essential part of kitchen garden. With this inference the present study was conducted with the following objectives: to cultivate the millet-based microgreens from Ragi and Sorghum and to develop value added recipes using the cultivated microgreens. A suitable tray was selected and filled with coconut coir for well development of seeds and water was sprinkled to make it wet. The selected millets were soaked overnight and sowed on the wet tray evenly. The moisture content of the trays was maintained and kept in appropriate zone in order to get enough sunlight for proper growth and allowed them to germinate. Ragi and sorghum started to sprout after three days and started to grow. Ragi took 21 days to reach the microgreens height of 4.2cm and sorghum took eight days to reach the height of 4.4cm. After they reached the height of 4cm the microgreens were ready for harvest. Thus, the ragi and sorghum microgreens were harvested and incorporated into vegetable soup and juice respectively and sensory evaluation was carried out. The result of sensory evaluation revealed that both the recipes scored high and were highly acceptable by the panelists. Thus, the millet microgreens were really a super food which grows faster and super nutritious and delicious which can be added in our day-to-day recipes and its benefits can be harvested to achieve food and nutrition security.

***Key words*:** Ragi, Sorghum, Microgreens, Cultivation, Value added recipes

Millet is an ancient grain that people have enjoyed for thousands of years. It is becoming increasingly popular as it is fast-growing, drought-resistant, and requires low input. Millet can supplement our diet with many nutrients and provide long-lasting energy. Millet is not only a great source of calories and carbohydrates but an easily accessible crop that is high in micronutrients like iron, zinc, and vitamin A (Rao et al., 2017). Microgreens are young vegetable greens that are approximately 1–3 inches (2.5–7.5 cm) tall. They have an aromatic flavor and concentrated nutrient content and come in a variety of colors and textures. Microgreens are considered baby plants, falling somewhere between a sprout and baby green. Microgreens have fully developed cotyledon leaves and usually one pair of very small, partially developed true leaves. The average crop-time for most microgreens is 10–14 days from seeding to harvest. (Parida, 2020).

Microgreens are packed with nutrients. While their nutrient contents vary slightly, most varieties tend to be rich in potassium, iron, zinc, magnesium and copper. Microgreens are also a great source of beneficial plant compounds like antioxidants. Microgreens reduces the risk of heart disease, helps to fight cancer, improves eyesight, reduces constipation, helps to ward off digestive ailments, lowers cholesterol, boosts our immune system and considered a super-food. (Zhang et al., 2021). The cultivation of microgreens doesn't demand a big field. We can grow it easily in small backyards or even on terraces. All they need is some direct sunlight and timely irrigation. Hence, small-scale farmers can adopt this easily and boost their earning substantially. Microgreens have good market-value. Hence, with this background, the present study was undertaken with the following objectives:

- To cultivate microgreens from selected millets – Ragi and Sorghum
- To develop recipes incorporated with the harvested microgreens
- To impart nutrition education on the health benefits of microgreens.

MATERIALS AND METHODS

i) *Selection of ingredients*

Millets are group of grains belonging to the grass family Poaceae, which are the good source of fibre and micronutrients and have less glycemic index compared to the other cereals. Among the millets, ragi is a gluten-free and staple food of many

countries, and Sorghum is a widely produced grain around the World and commonly used in all type of cuisines. And they are easy to grow crops. Hence for the present study the millet Ragi and Sorghum were selected for cultivating into microgreens and enjoy their benefits.

ii) *Planting and cultivation of microgreens*

- Select a suitable tray; fill with soil or coconut coir.
- Sprinkle the water sparingly to the soil and let it get wet.
- Then soak the seeds in a bowl of water.
- Soak the seeds overnight and drain the water next day then, sow the seeds in the soil with equal spacing as possible, cover the seeds with soil and again sprinkle water to it.
- Place the prepared tray in an appropriate zone in order to get enough sunlight for proper growth and allow them to germinate further.
- After 4-5 days the seeds start sprouting.
- Microgreen leaves starts to grow within 5-9 days
- Microgreens are now ready to harvest, when we see the first set of real leaves usually after two to three weeks (21 days) they are ready for harvest.
- Microgreens are ready for incorporation and consumption (Plate 1-2).

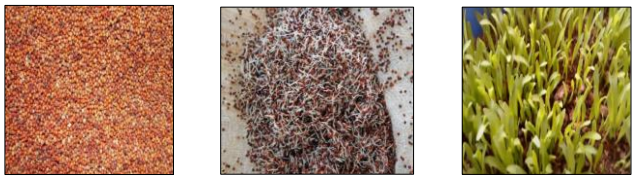

Plate 1 Planting and cultivation of ragi microgreens

Plate 2 Planting and cultivation of sorghum microgreens

iii) *Incorporation of harvested microgreens into selected recipes*

Ragi microgreen soup

Ingredients	Quantity
Ragi Microgreen	1 cup
Water	150 L
Small Onion	3 no
Tomato	1 no
Pepper	10 g
Garlic	2 Pods
Oil	2 Tsp

Plate 3 Ragi microgreens soup

Procedure

- Take Ragi Microgreen leaves, remove the roots and wash thoroughly.
- Take a pot and add Ragi microgreens, water and add the other ingredients in crushed form. Bring to boil for 10-15 minutes, finally add salt and oil for taste.
- Filter and serve hot (Plate-3)

Sorghum microgreen juice

Ingredients	Quantity
Sorghum Microgreen	1 cup
Country Sugar	4 Tsp
Lemon	½ no
Ginger	10 g
Water	100 ml
Salt	A Pinch

Plate 4 Sorghum microgreens juice

Procedure

- Remove the roots and wash the Sorghum Microgreen leaves
- Take a mixer jar, add Sorghum Microgreens leaves, country sugar, ginger, water and grind it finely and filter the juice.
- Finally add a pinch of salt and squeezed lemon in it.
- Chill and Serve (Plate 4).

iv) *Sensory evaluation of microgreens incorporated recipes*

Hedonic Scale testing method was adopted to find the acceptability of the microgreens incorporated recipes. Thus, a panelist of 15 members evaluated the ragi microgreen soup and sorghum microgreens juice and rated the recipes weather they extremely like it or dislike it with nine scale hedonic rating.

v) *Imparting nutrition education about microgreens*

Awareness on microgreens was created to the college students, self-help group, and home makers using different audio-visual aids. Lecture method, power point presentation, cooking demonstration, demo of microgreens cultivation – methods were used. The impact of nutrition education was also assessed.

RESULTS AND DISCUSSION

i) *Growth rate and growth chart of ragi microgreens*

Table 1 Growth rate of ragi microgreens

Day	Observation	Measurements (cm)
1	Sowing	-
2	No Development	-
3	Slightly Sprouts	0.5
4	Sprouts	0.7
5	Growing	1
6	Growing	1
7	Growing	1
8	Growing	1
9	Growing	1.5
10	Growing	1.5
11	Growing	1.5
12	Growing	2.2
13	Growing	2.2
14	Growing	3
15	Growing	3
16	Growing	3
17	Growing	3.2
18	Growing	3.4
19	Growing	3.7
20	Well Grown	3.8
21	Harvested	4.2

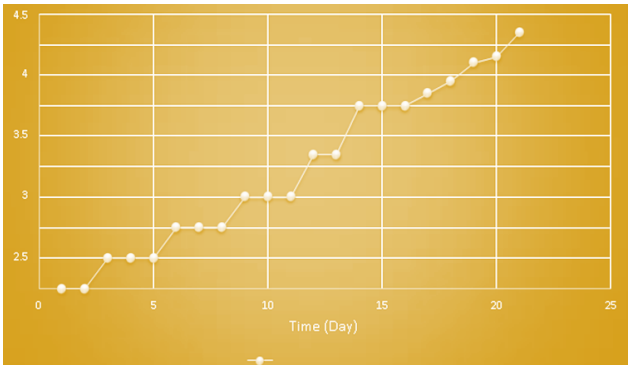

Figure 1 Growth chart of ragi microgreens

Data from the Table 1 and Figure1 of Ragi microgreens reveals that for the first two days there was no development. On the third day slight sprout was seen with 0.5 cm and on 4th day it was about 0.7 cm and till the eighth day the height of the microgreens was only one cm. On 9th, 10th and 11th day the height of the microgreens was 1.5 cm, 12th and 13th day the height was 2.2 cm, on 17th day it reached the height of 3.2cm and finally on the 21st day it reached the microgreens height of 4.2 cm and was ready for harvest with small first real leaves.

ii) *Growth rate and growth chart of sorghum microgreens*

Table 2 Growth rate of sorghum microgreens

Day	Observation	Measurements (cm)
1	Sowing	-
2	No Development	-
3	Slightly Sprouted	0.5
4	Sprouted	1
5	Growing	1.8
6	Growing	2.5
7	Growing	3
8	Well Grown	4.4
9	Well Grown	5.0
10	Well Grown	6.2

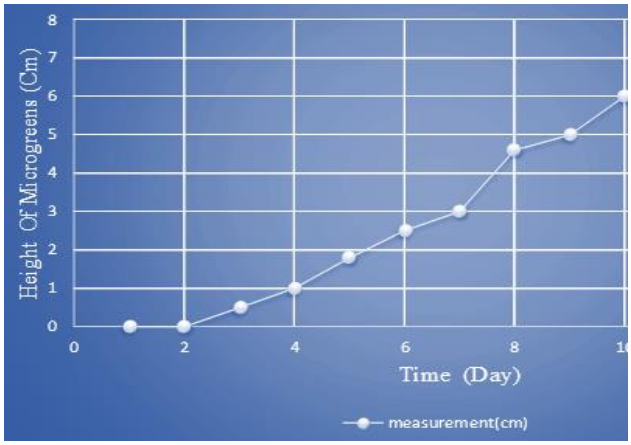

Fig 2 Growth chart of sorghum microgreens

From Table 2 and Figure 2 it is evident that sorghum started to sprout on the third day and reached the height of 3cm on the seventh day itself. On the eighth day it reached the height of microgreens 4.4cm and was ready for harvest.

According to the study by Du et al., (2022) sprouts refer to the plants at their first stage of growth during seed germination, and microgreens are the young and tender leafy greens during cotyledon growth stage when the first couple of true leaves appear (7–14 days after sprouting, depending on the species. This is also on par with the current study.

iii) *Sensory evaluation of the microgreens incorporated recipes*

The ragi microgreen soup and sorghum microgreen juice was highly acceptable and was liked by all the panelist. The taste of the recipes was excellent.

iv) *Impact of nutrition education*

Nutrition education imparted through various audio-visual aids impressed the beneficiaries and they were all ready to grow and harvest microgreens in their own kitchen garden.

CONCLUSION

Microgreens with their vibrant colors, tender textures, and unique flavors, also with their concentrated nutrients and health benefits can be easily grown at home in a confined space.

A small outlay can provide a significant return in terms of bulk, variety, and nutrients. As they just take a few days to grow, it is possible to have an ongoing source of microgreens. By rotating different crops, people could have fresh microgreens every week. Thus, with fresh millet microgreens various recipes can be developed and revolutions can be done at household level in order to achieve food and nutrition security.

Recommendations

Microgreens can be cultivated from other varieties of millets and also from the seeds of various cereals, pulses and vegetables. More value-added products can be developed using these microgreens. Government subsidy can be sought by the growers of microgreens to improve their economy and there by achieve the virtuous cycle of nutrition.

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