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# Organic Microgreen: Production Procedure for Cold Desert Himalaya Zone

**Microgreens, the miniature plants are often referred to as "Superfoods" due to their significant nutritional properties characterized by high levels of micronutrients and bioactive compounds. While the need for food and nutritional security is the most fundamental necessity for mankind, the distinctive geography of the Himalayan State like Sikkim poses a challenge of limited access to fresh vegetables and fruits, coupled with high prices. This issue becomes especially crucial in regions characterized by harsh conditions and high altitudes, *viz*. Mangan, Lachen, Lachung, Kupup, Nathang Valley, inhabited by local communities and serve as deployment zones for a significant portion of the Indian armed forces. In such adverse scenarios, microgreen as addressing issues of food and nutritional security becomes a humanitarian call for all.**

MICROGREENS are known for their physical characteristics, including vibrant colours, crispy texture, and a fresh and tender appearance. Microgreens have gained significant global attention in the past decade, often confused with sprouts but distinguished by their tender and young 5-7 cm aromatic herbs, and vegetables. They are harvested just days or weeks after germination when cotyledons are fully open and the first true leaves begin to emerge. Given the challenging circumstances where access to fresh food, particularly green leafy vegetables, in the higher regions of Sikkim and Himalayan range is limited, incorporating microgreens into one's diet plan gradually can be a solution for filling up the invisible pit in the daily nutritional bowl. Microgreens inclusion into the daily diet holds the potential of diversifying and enhancing the nutrient content in daily meals, crucial for maintaining adequate health.

**Microgreen Farming in High-Altitude Areas**

In response to high-altitude of the region, a small-scale microgreens cultivation set up was established at the Department of Horticulture, Sikkim University, Gangtok. Every effort was made to adopt organic practices, encompassing disease control, nutritional application, growing media, and pest control. This initiative was designed with careful consideration of local conditions and resource availability with an aim to investigate the feasibility and outcomes of growing microgreens in a designed set-up and package of practices.

**Standard Growing Set-up**

Commercial growers worldwide adopt various types of growing systems. While such systems can be crafted using locally sourced bamboo or purchased from nearby stores, in this case, a practical and efficient multilayer vertical growing system was implemented for its convenience in movement and dismantling.

**Selection of Seeds**

Microgreens can be cultivated using any edible seeds; however, different crops have distinct growth requirements. Through numerous trials and tested experiments, it has been observed that certain vegetables thrive exceptionally well in this region. Notable performers include Radish varieties such as China pink rose, Purple Radish Sango, Mustard, Bokchoy, Amaranthus red, Pea, and locally available seeds of Raya saag (*Brassica juncea*). A noteworthy observation is that almost all vegetables belonging to the Brassicaceae family exhibit robust germination and performance compared to other plant families.

**Climate**

Within an average range of temperature of 22-30°C and average humidity of 60-80%, and to ensure ideal growth conditions for microgreens, characterized by active light requirement, two photosynthetically active tube lights (22 Watt lights providing 4400 lux) were installed. These lights mimicking natural sunlight, were switched on once the seeds had developed into 3-4 inch plantlets and remained illuminated until the day of harvest. This practice aimed to comprehensively address the sunlight requirements essential for the healthy development of microgreens. This period recorded normal growth and development. It has been observed that the germination of microgreens varies from seed to seed. Notably, a slow growth was noted under conditions of low light or complete absence of light.

**Growing Media and Seed Quality**

Taking into account the prevailing conditions and resource availability, vegetable seeds were cultivated in a blend of coco peat and vermicompost. The ratio of these two components, set at 3:1, has proven to be effective. Untreated and non-GMO seeds, labelled as such, were sourced from various farms across the state. An alternative approach to traditional fungal treatment involved pretreating seeds with *Trichoderma viridae*, offering a practical and viable option.

**Sowing Time**

Seeds can be sown at any time, as needed. It is crucial to thoroughly clean the trays and sow the seeds judiciously. Following the sowing process, the trays are placed within the specially designed microgreen vertical farming unit.

**Watering, Growth and Nutrient Management**

A single misting during sowing, followed by tray stacking, is sufficient to facilitate germination. Depending on the vegetable variety and temperature conditions, germination typically begins within 3-5 days post-sowing. Once yellowish cotyledon leaves emerge, trays can be unstacked. After root establishment, a bottom watering method is introduced, applying 50-70 ml of high-quality drinking water. The concept of fertigation proves beneficial in microgreen farming, as seedling development does not demand intricate nutrient management. Utilizing liquid organic fertilizers mixed with water has shown positive and luxuriant growth results.

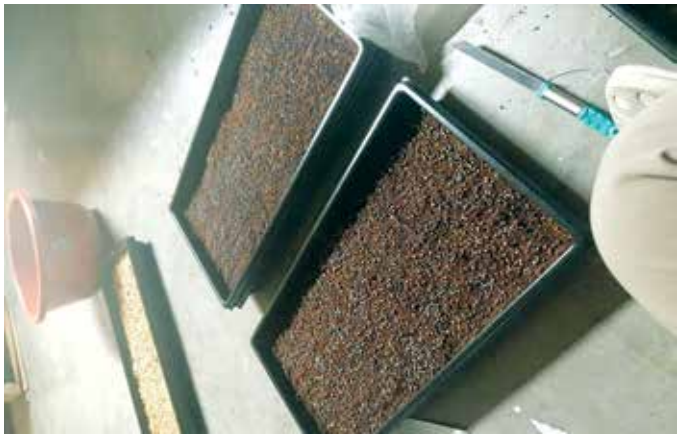
**Harvesting**

The initiation of germination in vegetables occurs within 2-4 days after sowing, influenced by the specific variety and temperature conditions. Certain vegetables like Purple radish sango, China pink rose, and mustard can be harvested within 8 to 12 days under summer conditions. However, varietals like basil require a longer period, typically 20-25 days, to reach the optimal size for harvesting.

**Disease and Pest Control**

Fungal issues are prevalent in low-quality or reused growing media, and practicing proper sanitary measures is an effective preventive measure. Elevated relative humidity has consistently led to the regular occurrence of both fungal growths. Among various pests, fruit flies stand out as the most prominent insect. A straightforward solution involves suspending a plastic bottle filled with a small amount of apple cider vinegar, featuring a hole punched at the top for control and hanging to the rack installed.

Multilayer vertical growing system



Uniform distribution of Radish seeds on well mixed media

5 days old mustard seeds ready to go under light

Harvesting of the crop (5-7 inch)

## CONCLUSION

Colder regions of all Himalayan states of India have numerous geographical constraints with limited agricultural activities. Under such situations, the availability of fresh vegetables particularly green leafy diets eventually leads to nutritional compromise in the region. Microgreen vegetables which can be harvested at a tender stage (8-12 days), under a monitored environment could act as a superfood and dietary buffer to nutritional shortages.

Although limited studies have been carried out with regard to the development of a standardized package of practice for growing microgreens due to various reasons. Applications of such technology in practice and popularizing microgreen farming at remote locations without any chemical inputs as a mean of organic vegetable microgreens production will not only aid in providing fresh superfood to the troops in harsh areas but also keep their minds engaged in growing microgreend which could be helpful for minimizing lassitude and refresh their monotonous set of routine.

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