



Research Article

NON-CONVENTIONAL FARMING PRACTICES FOR CULTIVATION OF IMPORTANT GREEN LEAFY VEGETABLES

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Received: May 05, 2023; Revised: May 26, 2023; Accepted: May 28, 2023; Published: May 30, 2023

Abstract: The India is endowed with climatic conditions which provide opportunities for growing an array of leafy vegetables. These leafy vegetables are a storehouse of vitamins, minerals, dietary fibers. Consuming green leafy vegetables are the right and smart way to augment and meet out the nutritional requirements necessary for good health and wellbeing. There is a wide variation in consumption of green leafy vegetables indifferent parts of the world. Being short duration crop, these can be grown as intercrop or as mixed crop or in roof gardening.

Keywords: Green Leafy Vegetables, Vertical Farming, Hydroponics

Citation: Thakur S., et al., (2023) Non-Conventional Farming Practices for Cultivation of Important Green Leafy Vegetables. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 15, Issue 5, pp.- 12329-12331.

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Introduction

Majority of the green leafy vegetables belong to Amaranthaceae, Brassicaceae family. A number of greens are cultivated in India throughout the year. Some are suitable for growing during winter eg. Palak, spinach, fenugreek, coriander and mustard. The ten most popular green leafy vegetables are spinach, amaranthus, fenugreek, coriander, mustard greens, lettuce, parsley, celery, drumstick leaves, kale etc. [1]. Each green leafy vegetable has unique flavour, taste, aroma, depending upon the way it blends with other foodstuffs. Spinach can be used in salt, spicy and sweet food preparations.

Nutritional and Health Benefits of Green Leafy Vegetables

Dark green leafy vegetables are good sources of minerals like iron, calcium, potassium, and magnesium and vitamins including K, C, E, provitamin A and many of the B vitamins. They also provide a variety of phytonutrients including beta-carotene, lutein, zeaxanthin, and omega-3 fatty acid which protect cells from damage and age-related problems [2]. It has been reported that fenugreek, coriander, cabbage, and spinach are a very good source of soluble dietary fiber content

Medicinal Importance of Green Leafy Vegetables

Leafy vegetables useful in reducing the risk of cancer and heart disease since they are low in fat, high in dietary fibre, and rich in folic acid, vitamin C, potassium and magnesium, as well as containing a host of phytochemicals, such as lutein, beta-cryptoxanthin, zeaxanthin, and beta-carotene. Most studies have established that intakes of green leafy vegetables reduce cardio vascular diseases [3]. The high level of vitamin K in greens makes them important to produce osteocalcin, a protein essential for bone health [4]. Lutein and zeaxanthin, carotenoids found in dark-green leafy vegetables protect against both cataract and age-related macular degeneration, the major cause of blindness in the elderly.

Non-Conventional Farming Practices for Cultivation

Vertical Farming

Vertical farming has been proposed as an engineering solution to increase productivity per unit area by extending plant cultivation into the vertical dimension,

thus enhancing land use efficiency for crop production [5]. In Vertical Farming system crops are planted in vertically managed layers to harness the unaccustomed vertical area which is otherwise left unconsidered in almost every cultivation practices.

It is estimated that there is approximately 800 million hectares of land that is designated to soil-based farming globally, which constitutes about 38% of the total global land area. Some urban planners and agricultural leaders have argued that cities will need to produce food internally to manage the ratio of demand and supply to avoid falling food prices, harmful pollution, and inflation [6].

Vertical gardening/farming systems are not only suitable for small farms, but can also be developed on marginal lands, because plants grown in growth media do not depend on the state of the local area [7]. Vertical farming systems can also be applied to multilevel buildings, public housing or even on settlements in areas. With this method the land can be utilized optimally and more efficiently. Furthermore, it is said that a vertical farming system is able to double crop yields up to 3-4 fold when compared with conventional systems, i.e., directly planted in the ground [8,9].

Vertical Farming

Vertical farming has numerous of benefits if adopted. Some of the major and crucial advantages of the vertical farming are as listed below:

- a. It increases yield per unit area i.e. productivity even from a small piece of land.
- b. It increases the amount of net return to the farmer.
- c. It helps in best utilization of the vertical area which is generally left unused.
- d. It provides fresh vegetables to the consumers.

Present Status of Vertical Farming in India

India is one of the strongest economy in the world. It is the hub of variety of cultivated species of plant. The majority of population of India is dependent upon farming for their livelihood. So, it is necessary to develop, explore and adapt new techniques to increase food resources with this continuously increasing urbanization [10]. Vertical farming is one such solution. The vertical farming can be carried out in a small structure to large sky scrapers.

Total control over the environment is maintained by growing of crops vertically in controlled atmosphere using LED lighting, heating and air conditioning system.

Vegetable Crops Suitable to Grow in Vertical Farming

An early crop can be harvested in vertical farming than the open environmental conditions. As it enhances the productivity, so it is best for the cultivation of those crops in which the leafy part is useful and these crops are none other than salad crops which are mostly vegetables. Leafy greens like Lettuce, Spinach, Parsley, Swiss chard, Chinese cabbage etc. are suitable for cultivation under vertical farming.

Techniques used in Vertical Farming:

The vertical farming allows the merging of other sophisticated growing techniques to a single system to get higher productivity. The techniques viz. hydroponics and controlled environment conditions can be used to grow crops based on a common principle of vertical farming. These methods can be incorporated together or can be used solely to grow crops in vertical structures.

Hydroponics

The term 'Hydroponics' was derived from Greek word 'hydro' means water and 'ponos' mean labour. Hydroponics is a modern agriculture technique that uses nutrient solution rather than soil for crop production [11,12]. Solution culture method and media culture methods are generally used. The former methods implies the application of water to plants along with dissolved nutrients in it and the latter method enlist the use of various growing substrates viz. perlite, vermiculite, vermicompost, sand, coco-peat etc. for crop cultivation. The hydroponics also considered as a better option for crop cultivation rather than the other traditional methods because of its better result in a sense that we get early yield, high yield and very less chances of insect pest and disease are noticed in hydroponics cultivation. Results of Yield Comparisons between hydroponic and open field cultivation in different vegetables backed the uses and importance of hydroponic cultivation [13].

With growing population, urbanization and squeezing of land resources, there is a need to create alternative means of cultivation so that the limited space available can be used in the best possible way. All plant varieties can be grown using this method which enables more control of external plant growth factors, such as nutrient availability, as a closed system [14].

Benefits of Hydroponic Cultivation

Soil is not necessary for growing plants and advantages are many for the use of hydroponics. It has efficiency due to control over nutrient levels hence, it saves an enormous amount of water [15]. Fertilizers are retained, since they can be reused. There is no leaching of minerals and water leakage. Crop rotation is not necessary because nutrients are not lost, and there is no issue with soil sickness. Very useful for areas where stress on the environment (cold, heat, drought etc.) is a big problem [16]. Growing isn't regulated by the seasonal changes. Hydroponics allows for continuous year-round development [17]. Cloning or cutting of already-in-bearing plants will cut short vegetative growth to quickly flower. Regulated systems present little or no risk of weeds or parasites and reduce labour charges [18]. Hydroponics can provide locally grown, high-value specialty crops such as fresh salad greens, and herbs in densely populated tourist areas where high land prices have forced out conventional agriculture.

Suitable Crops grown under Hydroponics

Hydroponics system may produce a large number of plants and crops or vegetables. Leafy greens like lettuce, spinach and parsley can be successfully and easily grown in hydroponic system as these crops have a good capacity to absorb nutrient.

Life cycle of hydroponic lettuce is very short compared to traditionally grown lettuce. Hydroponic lettuce can be harvested after 35 to 40 days of production. Lettuce can be successfully grown in NFT system and more than 8 crops per year can be grown efficiently in this system [19].

Floating Vegetable Gardening

Floating vegetable gardening is a method of indigenous wetland farming, locally known as 'VasomanChash'- meaning floating cultivation [20]. In this type of gardening the vegetables are grown in water on a floating base like boat. These floating gardens in India can be seen in Dal lake of Kashmir valley. The floating base is kept in the water and seedlings are transplanted on leaf compost made out of the local vegetation growing in the area. According to the need of the crop, inter cultural operations can be done by sitting in boats. Most of the summer season vegetables are supplied from Dal Lake to Srinagar.

The purpose of the technology has been to grow vegetables and seedlings under soil-less condition that aims at adapting to more regular or prolonged flooding. The floating method of cultivation represents a possible alternative to conventional agricultural approaches which has attracted much interest especially in places where risk of floods is very high. This method is not only highly productive, but it also uses local, easily accessible agricultural inputs such as water hyacinth, typha. In a nutshell, the technology is productivity enhancing, eco-friendly, and socially just [21].

Vegetables Grown in Floating Gardening

Leafy Vegetables and seedlings grown under floating gardens include Indian spinach, winter spinach, cabbage, and lettuce.

Cost-Benefit Calculation of Floating Cultivation

Cost benefit calculation in floating cultivation is very low due to the easy availability of raw material for the construction of floating beds

Technology adoption

Floating beds has been widely used in south-eastern Mymenmar (Kaing), the Tonle Sap in Cambodia, Kashmir in India, and in south-west coastal region of Bangladesh in different traditional ways.

Advantages of the Floating Vegetable Gardening Technology

Floating cultivation enhances food productivity and nutrition security through year round vegetable gardening. It provides food security not only by increasing land output but also by supporting capacity of the poor people and smallholder farmers [23-24]. Short production cycles facilitate early production of seedlings of winter vegetables. This increases supply in the area and the surroundings during monsoon.

Conclusion

The productivity of this farming system is much higher than that of terrestrial agriculture, as no additional chemical fertilizers or manure is required unlike in the conventional agricultural system (traditionally farmed land). The compost manure generates from refused organic bed is nutrient enriched and acts as soil conditioner. When the crops have been harvested and floating rafts are no longer required, they can be used as organic fertilizers in the fields.

Application of research: Non-conventional techniques for raising leafy vegetables are becoming popular amongst farmers.

Research Category: Hydroponics, vertical farming

Acknowledgement / Funding: Authors are thankful to ICAR- Krishi Vigyan Kendra, Solan, Kandaghat, 173213, Himachal Pradesh, India and Department of Vegetable Science, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, 173230, Himachal Pradesh, India

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Research project name or number: MSc Thesis

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: ICAR- Krishi Vigyan Kendra, Solan, Kandaghat, 173213

Cultivar / Variety / Breed name: Green Leafy Vegetables

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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