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Dynamics in temperate floriculture

The temperate region of India, with its rich biodiversity and favourable agro-climatic conditions, is ideally suited for floriculture. Its diverse flora, including a range of ornamental flowers, offers significant opportunities for entrepreneurs in both domestic and international markets. The increasing demand for ornamental plants presents a lucrative prospect. However, the sector faces challenges such as inadequate infrastructure, limited cold storage, and insufficient financial and technical resources. Overcoming these hurdles requires targeted government support, infrastructure improvements, and collaboration among entrepreneurs, researchers, and institutions. Enhancing market linkages and fostering innovation can drive the growth of temperate floriculture and bolster the socio-economic development.

TEMPERATE floriculture in India has emerged as a dynamic and evolving sector, especially in the northern and mountainous regions, such as Himachal Pradesh, Jammu & Kashmir, Uttarakhand and the North-eastern states, where the climate is conducive for cultivating a wide variety of temperate flowers. With its diverse agro-climatic zones, India has become an important player in the production of ornamental plants suited for temperate environments, including lilium, tulip, chrysanthemum, gladiolus etc. Ornamental bulb production in temperate areas of India has seen considerable growth, where the climate provides ideal conditions for the cultivation of bulbous flowers such as tulips, lilies, gladiolus and daffodils. These regions are known for producing high-quality bulbs, which not only serve the domestic market but also have export potential.

In recent decades, the Indian floriculture industry has undergone significant transformation, driven by advancements in hybridization, improved cultivation techniques and a growing domestic as well as export demand for quality flowers. The introduction of protected cultivation, tissue culture and modern greenhouse technologies has enhanced the productivity and quality of temperate flowers. Additionally, government initiatives and programs promoting horticulture in temperate regions have further bolstered the growth of floriculture in India. India's temperate floriculture is not only contributing to the livelihoods of farmers but also catering to the increasing demand for ornamental plants. However, challenges such as climate change, limited infrastructure, and the need for sustainable practices remain critical factors influencing the sector's growth. This article outlines the current trends, opportunities, and challenges shaping the dynamics of temperate floriculture in India, highlighting its potential to become a significant contributor to the global floriculture market.

Climatic and geographical advantage

India's diverse agro-climatic zones provide an edge for cultivating a wide range of temperate flowers. The northern and north-eastern states of India, with their cooler temperature and higher altitude, are ideally suited for growing flowers that require temperate conditions. The Himalayan region, with its varied altitude and climate, provides an ideal environment for growing ornamental flowers that are traditionally found in cooler European and North American regions. The climate in these regions is characterized by distinct seasons, with cold winters, mild summers, and adequate rainfall, which are conducive for the cultivation of flowers such as lilium, gladiolus, tulip, chrysanthemum, orchids, carnation, daffodils etc.

Floriculture in North-eastern region

Floriculture in North-east India is a burgeoning industry marked by its diverse climatic conditions, fertile soil, and rich floral biodiversity. This region, which includes Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, and Tripura, covers 7.9% of the country's geographical area and 3.75% of its human population. Its varied agro-climatic conditions are ideal for cultivating numerous low-volume, high-value flower crops. The major temperate regions of north east are Tawang, Bomdila, Ziro valley, Dirang, Shillong, Cherrapunji, Mokokchung, Kohima, Ukhrul, Senapai, Lunglei, Champhai and Phek.

Government initiatives, particularly the Technology Mission for Integrated Development of Horticulture, have substantially advanced floriculture in the region. These programs offer subsidies and promote contract farming, resulting in the establishment of large-scale Anthurium plantations in states like Mizoram, Meghalaya, Nagaland, and Arunachal Pradesh. Currently, there are around 700 Anthurium production units with an annual production

capacity of 100 million cut stems; and Mizoram and the Garo Hills of Meghalaya. Orchids, with around 1300 species from 190 genera found in India, are another significant floricultural product. The North East hosts approximately 700 orchid species, with notable commercial production in Arunachal Pradesh and Manipur. Orchids are valued for developing novel hybrids and for use as potted plants. The production of ornamental plant bulbs and tubers is currently concentrated in Kalimpong and Darjeeling.

Each state in the region has unique floricultural trends. In Assam, farmers have traditionally grown marigold, gladiolus, tuberose, and gerbera, with recent introductions of anthurium and dendrobium under greenhouse conditions. Arunachal Pradesh focuses on cultivating top cut flowers like gerbera, anthurium, rose, and carnations. Manipur began commercial cultivation of anthurium, gerbera, roses, and dendrobium in 2007-08 and also has potential for dry flowers, with 86% of flowers produced under open conditions. Meghalaya has benefited from the Horticulture Mission, which introduced anthurium, roses, carnations, lilies, and orchids. The adoption of polyhouses has further promoted cut flower cultivation. New flower crops like heliconia, chrysanthemum, and zantedeschia are gradually being accepted. Mizoram hosts 37 hi-tech greenhouse rose cultivators, and Nagaland's floriculture sector is thriving, offering employment to many youth and self-help groups, with zantedeschia being an important crop grown under hi-tech greenhouses.

Sikkim is renowned for its cultivation of orchids and anthurium, and has also introduced other flowers such as roses, alstroemeria, zantedeschia, carnations, and gerbera. The state's rose villages have contributed to high average incomes per unit area. In Tripura, about 108 hectares is dedicated to floriculture, with exotic flowers like anthurium, orchids (Dendrobium), gerbera, and lilium being cultivated, alongside open field flowers such as tuberose, gladiolus, and marigold. Overall, the North Eastern states of India offer significant opportunities for floriculture, supported by their diverse climatic conditions and government initiatives. With ongoing development and innovation, the region is well-positioned to become a prominent player in the global floriculture market.

Floriculture in Himachal Pradesh

In recent years, farmers in Himachal Pradesh have been transitioning from traditional crops to cultivating high-value flowers. The state's diverse agro-climatic conditions allow for a year-round supply of blooms from various climatic zones. The mid- and high-altitude regions of Solan, Shimla, Sirmaur, Mandi, Kullu, Bilaspur, and Chamba districts have become the most productive for flower cultivation. Farmers in these areas are growing commercial varieties such as marigold, carnation, tulip, lilium, gladiolus, chrysanthemum, and rose. The carnations from Himachal Pradesh are particularly sought after in the cut flower markets, fetching premium prices due to their superior quality and shelf-life. In the Solan district, most farmers focus on cultivating exotic rose varieties within greenhouses. Currently, approximately 2500 farmers are engaged in flower farming across 264 ha in the state.

Cultivation of important temperate flower crops in Himachal Pradesh

The state has benefited from the CSIR floriculture mission in which quality planting material has been distributed to farmers. The dry temperate zone of Lahaul and Spiti is particularly well-suited for the multiplication of lilium and tulip bulbs. Temperate potted plant production, including Cyclamen, Begonia tuber hybrida, Alstroemeria and Primula, is successfully undertaken in the Chail, Mashobra, and Kandaghat regions. There is also significant potential for the commercialization of native ornamentals such as Hypericum, Inula, *Indigofera pulchella*, *Pyracantha crenulata* and *Buxus wallichiana*. Cymbidium orchid production and bulb multiplication have also been successfully pursued. Crops such as Lisianthus, Rananculus, Hydrangea, Zantedeschia and Limonium are also cultivated under protected conditions in Seraj valley.

Floriculture in Jammu and Kashmir

The commercial-scale cultivation of flowers by individual growers in the state is still in its early stages, but it is gradually expanding with support from the state government. The temperate zone essentially covers the hilly area of Kishtwar, Poonch, Doda and Kathua. In these areas, offseason production of flowers like marigold, gladiolus, lilium, rose, carnation, tulip and gerbera can be obtained to fetch higher returns. High altitude pockets of sub-division like Kishtwar, adjoining to Zanskar region of Kargil district where gladiolus, hollyhock, pansy etc. can be cultivated under protected condition. The Tulip Garden in Srinagar, one of the largest in Asia, not only attracts tourists but also underscores the potential for large-scale flower cultivation in the region. Around 50 exotic tulip varieties imported from Holland are cultivated on more than 90 acres, producing about 3 million tulip bulbs each year. The Patnitop Development Authority has established a vibrant flower valley in its high-altitude meadow, planting over 90000 lavender seedlings across

Cultivation of important temperate potted plants in Himachal Pradesh

12.50 acres to enhance tourism, biodiversity, and socio-economic development.

Floriculture in Uttarakhand

Floriculture is swiftly gaining momentum in Uttarakhand, as numerous farmers opt for it as a lucrative alternative to traditional farming. Spanning 100.1 ha, this shift towards flower cultivation is increasingly favoured. The region's high altitude, coupled with cold winds and moist soil, provides an ideal setting for floriculture. Farmers observe that the cool temperatures are particularly conducive to flower blooming. Cultivation mainly takes place in polyhouses, where highly sought-after flowers like carnations, lilies, chrysanthemums, gladioluses, gerberas, and Indian red roses are cultivated. These flowers enjoy high demand not only in domestic markets but also across Europe.

Technological advancements in temperate floriculture

- The dynamics of temperate floriculture in India have been transformed by modern agricultural practices and technology. Techniques like polyhouses, greenhouses, and shade nets enable year-round flower production and protection from fluctuating temperatures and extreme weather, which are crucial in temperate regions.
- Tissue culture technology has been crucial in propagating high-quality planting material for crops like gladiolus, lilium, and chrysanthemum. It enables rapid multiplication of disease-free plants, ensuring consistent quality and meeting the rising demand for cut flowers in domestic and export markets.
- Drip irrigation and fertigation systems enhance water-use efficiency and nutrient management, resulting in higher yields and better-quality flowers. In temperate regions with limited water, these technologies optimize resource use and lower input costs for farmers.

Challenges faced by temperate floriculture in India

- Climate change poses a major threat to temperate floriculture by increasing extreme weather events like unseasonal rainfall, frosts, and temperature fluctuations, which can severely affect flower production.
- Underdeveloped infrastructure for post-harvest handling, storage, and transportation in many temperate regions affects flower freshness and quality. Inadequate cold storage and inefficient supply chains limit access to high-value markets.
- Despite advancements in tissue culture and hybrid seeds, many farmers face challenges in accessing high-quality, affordable seeds and bulbs. Dependence on imported planting material for crops like tulips also raises production costs.
- Farmers struggle with market access due to fragmented supply chains and disorganized marketing channels. Price fluctuations and seasonal demand also make it challenging to secure stable incomes from floriculture.
- A lack of a reliable database for floricultural crops hinders effective planning and development.
- Floricultural crops have not been integrated into overall landuse planning, limiting their potential growth.
- The sector suffers from poor extension services and training efforts, which are crucial for its development.

Opportunities and strategies for floriculture development in temperate regions

- The diverse landscapes, altitudes, and climates of regions like Meghalaya, Mizoram, and Himachal Pradesh, along with rich soil and well-distributed rainfall, create perfect conditions for floriculture.
- Social and cultural events, such as weddings and church gatherings, boost the demand for flowers. There is also a high demand from hotels, airports, and corporate buyers, especially for cut flowers and orchids like the Cymbidium from the Sikkim Himalaya.
- Himachal Pradesh offers untapped potential for floriculture, with opportunities for both the domestic market and exports. The establishment of a Tulip Garden at the CSIR-Institute of Himalayan Bioresource Technology (IHBT) in Palampur has become a major attraction, drawing thousands of visitors and showcasing the potential for tulip cultivation. Furthermore, model floriculture centres are being developed in Himachal Pradesh, with one

located in Chail and another in Palampur, to serve as hubs for innovation and training in the floriculture sector.

- Uttarakhand's varied climate zones are also ideal for year-round flower cultivation, catering to both local and international markets.
- Floriculture promises employment through traditional and protected cultivation, nursery production, landscaping, tissue culture, essential oil extraction, and more.
- Production of high-quality planting material with the help of research institutions and developing infrastructure like roads, electric supply, water, and cold storage at airports is crucial.
- Training customs officials will ensure faster clearance. Developing high-yielding flower varieties for the domestic market and managing pests with local research will help increase productivity.
- Establishing model floriculture villages near urban areas, supported by modern sales centres and linked with export bodies like APEDA, will promote commercialization. Identifying intensive floriculture zones and providing technical and financial support to farmers is key.
- Conservation efforts should include the propagation of endangered orchids in the region.

CONCLUSION

Temperate floriculture in India holds immense potential for growth, driven by the country's unique climatic advantages in regions like Himachal Pradesh, Jammu & Kashmir, and Uttarakhand. Despite challenges such as climate change, infrastructure limitations, and market access, the sector is witnessing dynamic changes through the adoption of modern cultivation technologies, improved planting material, and the development of value-added products. With increasing demand in both domestic and international markets, temperate floriculture can play a crucial role in India's horticultural economy. To fully capitalize on this potential, continued investment in infrastructure, research, and sustainable practices will be essential to ensure long-term growth and global competitiveness.

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SUSTAINABLE DEVELOPMENT GOALS RELATED TO FRUITS AND VEGETABLES

SDGs 2 3

Health benefits of fruit and vegetables

Harness the goodness

Fruit and vegetables have multiple health benefits. They strengthen the immune system, combat malnutrition and help prevent non-communicable diseases.

SDGs 2 3

Diversified diet and a healthy lifestyle

Live by it, a diverse diet

Adequate amounts of fruit and vegetables should be consumed daily as part of a diversified and healthy diet.

SDGs 2 8 12 13 14 15

Food loss and waste

Respect food from farm to table

Fruit and vegetables are worth more than their price. Maintaining their quality and assuring their safety across the supply chain, from production to consumption, reduces losses and waste and increases their availability for consumption.

Innovate, cultivate, reduce food loss and waste

Innovation, improved technologies and infrastructure are critical to increase the efficiency and productivity within fruit and vegetable supply chains to reduce loss and waste.

SDGs 1 2 12 15

Sustainable value chains

Foster sustainability

Sustainable and inclusive value chains can help increase production, and help to enhance the availability, safety, affordability and equitable access to fruit and vegetables to foster economic, social, and environmental sustainability.

SDGs 1 2 3 4 5 8 11 12 15

Highlighting the role of family farmers

Growing prosperity

Cultivating fruit and vegetables contributes to a better quality of life for family farmers and their communities. It generates income, creates livelihoods, improves food security and nutrition, and enhances resilience through sustainably managed local resources and increased agrobiodiversity.

Source: *Fruit and vegetables – your dietary essentials, FAO background paper, FAO, Rome*