

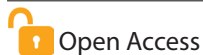


## Advances in Indian Floriculture with Focus on the North-East Region

Mausum Kumar Nath<sup>1\*</sup> and Himadri Shekhar Datta<sup>2</sup>

<sup>1</sup>Dept. of Horticulture, Assam Agricultural University, Jorhat, Assam (785 013), India

<sup>2</sup>College of Horticulture and Farming Systems Research, Nalbari, Assam Agricultural University, Jorhat, Assam (785 013), India



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### Corresponding Author

Mausum Kumar Nath

✉: mausumnath937@gmail.com

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### Abstract

Floriculture is a remunerative and highly competitive industry. In India, floriculture is emerging as an important economic activity and foreign exchange earner. The advances in Indian floriculture sector have been brought about by the application of various technologies like vertical gardening, aeroponics, hydroponics, plasticulture, etc. The North Eastern region of the country has for long been recognized as nature's gift to the country in view of the wealth of ornamental plants. High value flower production in protected poly and green houses are being encouraged for entrepreneurial development in the region. Current study reveals the research works and projects executed by the institutes and development centres that have led to the overall floriculture development in the region thus exploiting its potentiality.

**Keywords:** Aeroponics, Hydroponics, Plasticulture, Remunerative

### Introduction

Floriculture is a competitive and rapidly expanding industry. Floriculture is emerging as a high-tech, interdisciplinary, scientifically outstanding frontier holistic and integrated area. Commercial floriculture is now the most profitable enterprise on the globe. Floricultural cultivation includes a wide range of plants and planting materials. It entails the commercial production of cut flowers, loose flowers, cut greens and foliage, bulbs, seeds, landscape and indoor plants, along with their marketing and value-addition. Today, floriculture is acknowledged as the most lucrative profession having the capacity to generate more returns per unit area as compared to other horticultural crops (Datta, 2019). More than 145 nations are currently active in the floriculture sector, with the global floriculture trade estimated to be worth US\$ 70 billion.

The floriculture business is flourishing all throughout the world, including in India. During the 4<sup>th</sup> Five-Year Plan (1970-71), the All India Coordinated Research Project on Floriculture (AICRP) was developed to conduct multidisciplinary research across the country by bringing together ICAR Institutes and State Agricultural Universities

(SAUs). The project's requirement has been assessed on a regular basis, taking into account the growing influence and potential of floriculture in various sections of the country, as well as the number of Coordinated Centres and the research programme. The formation of an autonomous institute named the 'Directorate of Floricultural Research' (DFR) by ICAR at the IARI Campus in New Delhi was a significant step in the direction of bolstering the existing AICRP on Floriculture network and making it more targeted and research-driven. DFR is expanding floricultural research and strengthening the technological foundation in the sector across the country with the help of the AICRP network. The necessity of the hour is for a state-wide network of coordinated centres to promote technology and create awareness about the advantages of practising floriculture among rural people. Floriculture has been declared as a sunrise sector by the Indian government, with a 100% export-oriented status. Major floriculture centres have evolved in Maharashtra, Karnataka, Andhra Pradesh, Haryana, Tamil Nadu, Rajasthan, and West Bengal. Based on the data published by National Horticulture Board, the area under floriculture sector in India during 2019-20 was 305 thousand hectares including a production of 762 thousand tonnes cut flowers and 2301

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thousand tonnes loose flowers. The floriculture sector in the country has shifted away from traditional flowers and more towards cut flowers for export. The National Horticulture Board (NHB), APEDA, NABARD, and nationalized banks are the key financial resources for establishing the floriculture business in India. APEDA is in charge of marketing exports and the development of the floriculture industry. In 2020-21, India exported 15,695.31 MT of floriculture commodities worth Rs. 575.98 crores or 77.84 million dollars to the world. During the same time period, the United States of America, the Netherlands, the United Arab Emirates, the United Kingdom, and Germany were the top importers of Indian floriculture.

### Area and Production of Floriculture Crops during 2014-2020 in India

The area and production of the floriculture crops in India during the year 2014-2020 has been graphically represented in the figure 1. The figure shows an increasing trend in the area and production aspects of the floriculture sector in India as per the statistical data released by National Horticulture Board.

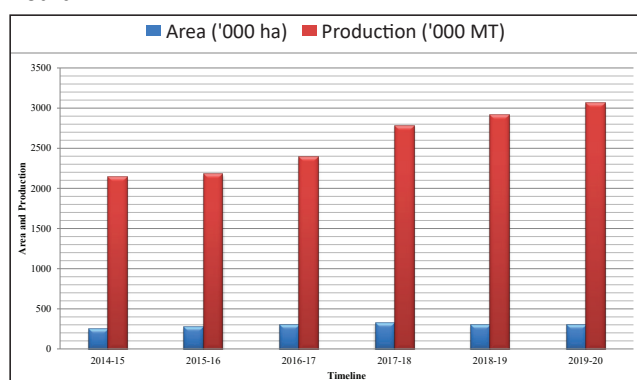


Figure 1: Area Production Statistics (National Horticulture Board, 2020)

### Recent Trends in Indian Floriculture

The advances in Indian floriculture sector have been brought about by the application of new technologies and cultivation practices. Floriculture has evolved both scientifically and commercially as a result of floriculture scientists' concerted efforts.

#### Vertical Gardening

Vertical gardening is a type of urban gardening that is especially suited to confined areas and may be used to decorate the walls and rooftops in a variety of styles. This is a unique kind of gardening that allows individuals to grow plants vertically. The most significant factor in determining the viability of a vertical garden system is the growing medium. In the warm and humid climate of India, careful implementation and maintenance of the garden in terms of the type of vertical garden chosen, maintenance methods, irrigation methods, plant selection, use of recycled materials, use of local plant species, and other factors can make vertical garden implementation feasible (Boby et al., 2020). Piles of ornamental plants and flowers can be organised vertically

one by one or hang some of them in elegant hanging pots, and it takes up very little area for planting.

#### Aeroponics

Aeroponics is the science of growing plants without using soil or a substrate culture. It is a cost effective and efficient technique of growing plants since it uses less water and takes up less space. Aeroponics seems to be a very viable approach for producing both aerial and root portions (Kumari and Kumar, 2019). In aeroponics, suspended plants receive 100% of available oxygen and carbon dioxide to the root zone, stems, and leaves, speeding up growth and rooting times (Pala et al., 2014). Aeroponics has taken off in the West, but it is still in its early stages in the flower production sector of India.

#### Hydroponics

Hydroponics is a method of growing plants in nutrient solutions with or without the use of an inert medium, such as gravel, vermiculite, rockwool, peat moss, sawdust, coir dust, coconut fibre, and so on. Recently, the hydroponic technique has gained popularity since it is a clean and relatively simple method with no risk of soil-borne disease, insect, or pest infection, decreasing or eliminating the usage of pesticides and their toxicity (Sharma et al., 2018). Flower crops suitable for soilless culture: *Tagetes patula* (Marigold), *Dianthus caryophyllus* (Carnations), *Rosa berberifolia* (Roses), *Chrysanthemum indicum* (Chrysanthemum), etc.

#### Artificial Lightning with LEDs

Use of light emitting diodes (LEDs) in artificial lightning for the growth and development of flower crops has been the recent trend. LEDs could give a specified quality and amount of light, allowing plants to develop normally despite current limits. In India, artificial lightning has been used in places like West Bengal to accelerate flowering and stimulate early blooms. When exposed to LEDs with (15 h) and without (11 h) extra blue spectrum, chrysanthemum plants demonstrated a powerful diurnal response that began in the leaves and spread to the apex, taking a minimum of 28 days and a maximum of 61 days, respectively. Bud induction was obtained early due to the low red to far red ratio in the extended exposure of plants with blue LEDs (Singh et al., 2013).

#### Plasticulture

Plasticulture is a crop-growing system that reaps major benefits from the use of plastic polymer-derived products. Plastic mulches, soil sanitation (fumigation and solarization), drip irrigation, fertigation or chemigation windbreaks, season-extension technology, cropping strategies, integrated pest management, postharvest handling, and marketing are all components of a complete plasticulture system. With the growing significance of plastic and its diverse nature, the design of India's floriculture farming is destined to change. Cut flowers were some of the first crops grown in plastic-covered greenhouses. The cut flower plasticulture production technology relies heavily on drip irrigation. Supplemental irrigation is required to maximise profitability in a speciality cut-flower production system due of the high

value and high quality standards. Moreover, cut flower production in high tunnels offers a number of advantages over field and greenhouse cultivation (Ortiz *et al.*, 2012).

#### Rooftop Gardening

Rooftop gardening of flowers is gaining tremendous popularity in the urban areas of the country at present. In this type of gardening, utilizing space effectively decreases building heat and energy costs while also adding beauty to the cityscape by converting CO<sub>2</sub> emissions into oxygen and therefore improving air quality. Suitable plants for rooftop gardening are *Adenium obesum* (Desert Rose), *Brunfelsia americana* (Lady of the Night), *Cordylone terminalis*, *Duranta repens* (Golden Dewdrop), *Codiaeum variegatum*, *Galphimia glauca*, *Ixora* species, *Tecoma stans* (Yellow Bells), *Tecomaria capensis* (Cape Honeysuckle), *Epipremnum aureum* (Money Plant), *Ficus pumila* (Creeping Fig), *Rhoeo spathacea* (Dwarf variety), *Tradescantia pallida* 'Purpurea' (Purple Heart), *Lantana camara*, *Jasminum nitidum*, *Murraya panic*, *etc.* The CII-Sohrabji Godrej Green Business Centre in Hyderabad and the Indian Institute of Management in Guwahati are two excellent examples of green buildings in India with innovative roof gardens (Jawaharlal, 2017).

#### Development of New Flower Forms

To breed cultivars with new flower shapes, several procedures such as hybridization, mutation, polyploidy, and genetic engineering are being used. Single, semi-double, and double flower types are genetically controlled by a single gene or many genes, and induced mutagenesis can easily produce mutants with altered observable features such as flower forms, size, or leaf form and growth habit. Only roses and carnations have been commercialised as floral crops (Chavan *et al.*, 2019). An experiment was conducted for induction of mutation in chrysanthemum (*Dendranthema grandiflorum* Tzvelev.) cultivar Bindiya through gamma irradiation. The study created a mutagenesis methodology that might be utilised to create new chrysanthemum colour mutants (Singh and Bala, 2015).

#### Biotechnological Applications

Biotechnological methods, particularly in crop development, can only provide long-term answers to the majority of problems. There are a variety of biotechnological tools that can be used to improve flower crops in a sensible way. Micropropagation is used to propagate a variety of flower crops, including orchids, anthuriums, gerberas, and carnations. On the other hand, Somaclonal variation has been successfully used in flower crop varieties of chrysanthemum (Miler and Zalewska, 2014), Gerbera (Minerva and Kumar, 2013), and carnation (Esmail *et al.*, 2013). Haploids and double haploid has been developed anthurium, petunia, sunflower, gerbera, carnation, phlox, calla lily, baby primrose, cow cockle, zantedeschia, hepatica gentians, *etc.* (Aswath and Thaneshwari, 2017).

#### Development of New Cultivars

Improved cultivars along with its production technologies have brought about some significant changes in the field of floriculture. Seedlings produced from pollinated seeds

were selected at NBRI, resulting in the evolution and dissemination of several exceptional cvs. 'Birbal Sahni', 'Hemant Singar', 'Suhag Singar', 'Jyoti', 'Kundan', 'Rim Jhim', 'Sharada', 'Sharad Bahar', 'Sharad Mala', 'Sharad Shoba', 'Sharad Singar', 'Varsha' and 'Vasantika' are some of the popular variations released. In addition, 'No pinch, no stake' type cultivars 'Hemant Singar', 'Sharad Singar' and 'Guldasta' were released.

#### North-Eastern Region Scenario

North-Eastern (NE) region of India comprises eight states, *i.e.*, Assam, Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Mizoram, Sikkim and Tripura. The region covers 2.55 lakh km<sup>2</sup> and lies between 21°57' and 29°28' North latitude and 89°40' to 97°50' East longitudes, accounting for nearly 8% of the country's entire geographical area. The Meghalaya plateau, North-eastern hills, and Brahmaputra valley are the three physiographic divisions of this region. Given the abundance of ornamental plants, the North-eastern area of India has long been perceived as nature's treasure to the nation.

Table 1: Area and production of flowers in the North East region 2019-20 (final estimate) as per the data published by DAC & FW, Ministry of Agriculture Cooperation and Farmers welfare, Govt. of India

State	Area ('000 ha)	Production ('000 MT)	
		Loose flowers	Cut flowers
Arunachal Pradesh	0.00	0.00	0.00
Assam	5.04	33.88	55.50
Manipur	0.06	0.00	0.09
Meghalaya	12.41	0.00	1.55
Mizoram	0.08	0.00	0.80
Nagaland	0.04	0.02	25.00
Sikkim	0.24	16.50	0.09
Tripura	0.00	0.00	0.00

#### Assam

Floriculture is a sunrise area in Assam. Flower growing is a tradition in Assam's Hajo (flower capital), which is located in the Kamrup district. Earlier people from Hajo used to supply their floriculture produce to the Kamakhya temple. Presently, the region has emerged as the most important flower-growing region on a commercial scale, feeding 30% of Guwahati's floral market. Cultivators of Kamrup district are entering into commercial floriculture followed by Jorhat, Tinsukia, Morigaon, Nagaon and Cachar (Talukdar, 2017). Area under floriculture in Assam during 2013-14 was 3,000 ha which has increased to 5,200 ha in 2019-20 according to the data published by National Horticulture Board. Daffodil Nursery established in the year 1985 has emerged as the prominent and biggest nursery in the State catering to the demands of quality planting materials. Assam Agricultural University (AAU) has immense contributions in

the development of floriculture sector in the state.

Some important Technologies developed under AAU:

1. Standardization of pot mixture and composition for growth and flowering of epiphytic orchids, Dendrobium and Vanda terrestrial orchid, *Cymbidium mastersii* was done.
2. Protocols were developed for micropropagation of orchids and carnation.
3. Technology was developed for off season flowering of Chrysanthemum.
4. Technology was developed for year round flowering of tuberose by using 50 micron black polythene mulch.
5. Production technologies were developed for organic cultivation of Gerbera, Gladiolus and Chrysanthemum.
6. Standardization of agro technique and identification of cultivar of Summer Marigold was done.
7. Standardization of growing media and its depth for Rooftop Gardening of flower and vegetable crops was done.

#### *Arunachal Pradesh*

The State Department of Horticulture in Arunachal Pradesh is focusing on the cultivation of cut flowers such as Orchids, Gerbera, Rose, Anthurium, and Carnations, among others. Arunachal Pradesh has been termed as '*Orchid Paradise of India*'. Around 622 species of orchids has been reported from the state. Renades "Arunodaya," Arachnocentron "Tipi Jubilee Star," Esmeranda "Millennium Dawn," Cymbidium Sessa "Green Beauty," and Ascocenda "Tipi Blue Boy" are among the five hybrid genus that have been registered with the Royal Horticulture Society (RHS) in London produced from Orchid Research Centre, Tipi (Oyi et al., 2012). Green house technology is a new trend in the state that is highly sought after for export production with the requisite quality, quantity, and consistency. A centre for conservation and propagation of wild orchids of Arunachal Pradesh was inaugurated on Sunday by Agriculture and Horticulture Minister on September 2021. On institutional basis, significant research works are conducted by College of Horticulture and Forestry, CAU contributing to the development of floriculture in the state.

#### *Manipur*

Siroy lily, a rare and endangered species of lily has been registered for GI in 2017. Dendrobium species have shown promise in the state when it comes to orchids. Orchid species are being preserved at Orchid Preservation Centre, Khonghampat. Dendrobium, carnation, anthurium, gerbera, leather leaf Ferns, and alstroemeria are supplied by the Flower Growers Association of Manipur through the Bangalore-based Florence Flora under buy-back arrangements to several Metropolitan cities such as Delhi, Kolkata, Bangalore, and others (De and Singh, 2019).

#### *Meghalaya*

The Horticulture Mission was launched in Meghalaya, resulting in the introduction of cut flower production including Anthurium, Roses, Orchids, Carnations, and Liliiums (De and Singh, 2019). Moreover, Polyhouses promoted the

adoption of cut flower gardening in the state even more. Model Pilot Projects boosted the production of roses and anthuriums in the state.

#### *Mizoram*

Annual Anthurium festival is held to promote flower cultivation in the state. Mizoram's Anthurium blooms have gained national and worldwide acclaim. Anthurium growers have formed a society named 'Zoo Anthurium growers Society' (ZAGS) for smooth marketing of the cut flowers. Mission for Integrated Development of Horticulture (MIDH) has helped in uplifting the floriculture sector of the State.

#### *Nagaland*

Floriculture is one of the state's most important activities, owing to the intrinsic love of flowers, especially among women, that has existed since the dawn of time. Flower shows are held by the Department of Horticulture every year to promote commercial flower, foliage, and decorative plant production (De and Singh, 2019). Mrs. Akruzo Pusture founded a society named the Blossoms Florist Society after touring Holland's auction and breeding facilities. The society has presently developed a high-tech polyhouse to grow flowers like roses, liliiums, etc. for the export market. Also, research works are taken by the Central Institute of Horticulture to promote the development of floriculture in the state.

#### *Sikkim*

Cultivation of orchids and anthuriums has long been popular in Sikkim's floriculture. Cymbidium development and model floriculture centres have been developed in the state. In Rangpo, East Sikkim, an Integrated Pack House has been established to ensure minimal post harvest losses and quality flower production. Moreover, rose villages have been developed to encourage the farmers to adopt scientific based rose cultivation on commercial basis under the supervision of State Department of Horticulture (Sarmah, 2019). National Research Centre for Orchids (NRCO) has developed protocols for the cultivation and preservation of orchids in the state.

#### *Tripura*

Commercial production of flowers such as marigold, tuberose and gladiolus, has received much interest in open fields. Flower exhibitions are held annually to revitalize floriculture. Nath Para, a village in the Laxmibil area of Sepahijala district has turned out into a model floriculture village with the villagers earning around 20,000-30,000 per month by exporting their produces. This is the one and only village in the state where the farmers only cultivate flowers.

#### **Conclusion**

In spite of the rapid advancement of the floriculture sector in the North-Eastern region, there are still some constraints left behind. To achieve the vision and goals of further floriculture development in the North Eastern region, strategies like development of improved cultivars and generation of quality planting materials can be implemented. Development of farmer's friendly production technologies can also aid in the progress of the sector (Ram and Aier, 2017). Moreover,



Post-harvest management and product value addition are two important aspects that should not be neglected. Finally, provision of proper health management should be done which will not only contribute to the overall development of the economy in the region but of the nation as well.

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