

Harnessing Floriculture Potential of Northeastern India

Genetic resources of Northeast are depleting very fast. They need to be conserved and protected from biopiracy, while at the same time, they need to be used wisely for commercial purposes. In a globalised economy where trade barriers are being relaxed, it is obvious that orchids and exotic flowers from other countries will dominate our markets and it is necessary to protect the interests of our growers. We need to find ways and means to secure our markets against competing countries and to exploit the potential for export markets. In addition, new centres of consumption are emerging in South East Asia, the Middle East and Eastern Europe. The scenario offers the opportunity to capitalise on strengths and turn weaknesses into opportunities. However, in the consumer-oriented market, the quality of the product and the delivery system will play an important role. Marketing is no longer a meeting of buyers and sellers, but a complex process determined by the quantity of products and the reliability of delivery. With the help of IT, there is likely to be a new distribution structure, which will be a virtual market requiring demand, branding, cataloguing and quality assurance.

THE Northeastern states of India are blessed with climatic conditions suitable for the cultivation of various flower crops including orchids like *Dendrobium*, *Cymbidium*, *Vanda*, *Phalaenopsis*, *Paphiopedilum*, *Cattleya*, etc. The rich biodiversity of the region is another advantage for developing high quality varieties with high productivity and resistance to diseases and pests. The globalisation of the Indian economy has opened up new markets and improved access to agricultural machinery and inputs, especially seeds and planting materials from all parts of the world. The demand for floriculture products has increased manifold in national and international markets. Sporadic but impressive attempts to develop floriculture have begun in several states in the region. However, to realise the potential of floriculture in Northeast India, a well thought out strategy involving all stakeholders and government support is required. This paper outlines the status, opportunities and strategy for harnessing the potential of floriculture in the Northeastern states of India.

The Northeastern region of India comprises eight states, namely Arunachal Pradesh, Assam, Manipur,

Meghalaya, Mizoram, Nagaland, Tripura and Sikkim. This region lies between 21°57' and 29°28' north latitude and 89°40' to 97°50' east longitude and occupies 2.55 lakh km², which is about 8% of the total geographical area of the country. Physiographically, it is divided into three divisions namely the Meghalaya Plateau, the Northeastern Hills and the Brahmaputra Valley. The NE hills alone account for 65% of the total land area, while the Brahmaputra Valley and the Meghalaya Plateau account for 22% and 13% respectively. More than 64% of the total land area in the Northeastern states is covered by dense deciduous forests. Dr M S Swaminathan, a renowned Indian scientist, described the region as a cultural and genetic paradise and a granary of mega diversity in terms of

flora and fauna. Despite the wealth of natural resources and climatic diversity, economic development in Northeastern states of India is poorest from the rest of the country. Climate change, declining crop yields, poverty and unemployment are putting pressure on natural resources. As a result, natural resources in the region are under threat. Floriculture is a very important sector of



Cymbidium Orchid

the horticulture industry, which is labour intensive and offers the highest profitability per unit profitability. It also creates jobs, from cultivation to post-harvest handling, marketing, value addition and retail sales of the products. Among the flower crops, high-value and low volume crops are promising for this area.

In India, floriculture is a fast-growing agricultural sector that is witnessing a revolution consisting of production and marketing of high-value crops, which has made it a 100 per cent export-oriented industry. In 2020-21, flower crops were grown on about 322 thousand hectares of land, with an estimated production of 2151.96 thousand tonnes of loose flowers and 828.09 thousand tonnes of cut flowers (NHB, 2022). Subsequently, India exported 23,597.17 tonnes of floriculture products worth ₹ 771.41 crores/\$103.47 million across the world (APEDA). Floriculture is emerging as a diversified industry with flowers and ornamental plants having significant aesthetic, social, environmental and economic value. The Indian flower business is worth an estimated \$ 400 million in retail trade and about \$ 100 million in international flower trade.

Status of Floriculture in Northeastern States

According to the gross value of output (GVO) of Agriculture and Allied Sectors report, the value of floriculture in the country has increased by 55% from ₹ 17,365.38 to ₹ 26,987.41 crore in 2019-20. Though exports have increased by a similar proportion in the last nine years, its share in value remained around 2%. India's floriculture exports increased by 48% to ₹ 541.61 crore in 2019-20 from ₹ 365.32 crore in 2011-12, but by 34% to ₹ 771.41 crore in 2021-22 from ₹ 575.98 crore in the previous year, promising a brighter future for the flower trade in India. The gross value of output (GVO) of floriculture in the Northeastern states, except Assam, has declined by 5-10% between 2011-12 and 2019-20. Assam is the only state that recorded a growth of 251%. According to the National Statistical Office data, the total value of floriculture in Arunachal Pradesh, Mizoram, Sikkim, Nagaland and Manipur has declined by 31% from ₹ 277.19 crore in 2011-12 to ₹ 191.13 crore in 2019-20. Sikkim saw a decline of 34% to ₹ 157.25 crore in the nine years. No data is available for Meghalaya and Tripura, while Assam's GVO has increased from ₹ 128.89 crore to ₹ 452.43 crore. The status of floriculture in Northeastern



Foxtail Orchid

is described as below:

Arunachal Pradesh

Arunachal Pradesh lies in the uppermost part of seven sister states. It borders Assam and Nagaland in the south and has international borders with China in the north, Myanmar in the east and Bhutan in the west. The uppermost part, which borders China, has a tundra climate, while the mid-hill regions have a temperate climate. The sub-Himalayan part of the state has a subtropical and tropical climate. The state has a variety of microclimatic niches that vary from hill to hill and altitude to altitude. The state has the potential to grow almost all types of flower crops. The state government has focused on anthuriums, carnations, gerberas and orchids. The climatic conditions of Hapoli (Ziro) are suitable for growing cymbidium orchids.

Nana-Koo Agro Pvt. Ltd. in Ziro-Hapoli grows cymbidium orchids for the cut flower market. There are

also a number of orchid centres in Sessa, Dirang, Jengging and Roing, as well as nurseries in Bomdilla, Dirang, Hapoli and Yazali areas, which have expanded the range of floriculture.

Assam

The hilly region of Assam has a sub-alpine climate, while the plains have extremely humid weather. The temperature ranges between 35°C and 38°C in summer and drops to 6–8°C in winter. The rainfall varies between 180 and 300 cm. The climatic conditions in Assam are ideal for growing tropical orchids like *Arachnis*, *Dendrobium*, *Mokara*, *Vanda*, *Oncidium* orchids for cut flower production and *Phalaenopsis*, *Cattleya*, *Laelia*, *Oncidium*, *Paphiopedilum* orchids for potted plants.

The ICL Flora Exotica was established in Guwahati for the production of cut orchids but is not in operation at present. The Assam government is setting up an orchid park in Guwahati in PPP mode. *Dendrobiums* are popular orchids and enjoy high demand in the market. They are available in different colours and are currently imported from Thailand and reach the Guwahati market through Kolkata. Assam should initially focus on the production of *Dendrobium* cut flowers in suitable growing areas. Kamrup district in Assam has become a centre of floriculture in the state. Hajo is a satellite town of Kamrup district of Assam has the potential for the growth of an orchid business. According to the National Horticulture Board database, 2018, 5100 ha of flowers are cultivated in Assam and 33.9 thousand MT loose flowers and 56.1 thousand cut flowers are produced. Recently, the Chief Minister's Floriculture Mission was launched to increase the area under flower cultivation and improve infrastructure for flower growers in the state.

Manipur

Manipur shares borders with Nagaland to the north, Mizoram to the south and Assam to the west. The international border with Myanmar runs to the east. Physiographically, Manipur consists of rugged hills, valleys and plains. The altitude ranges from 40 to 2994 m above sea level. The climate in the state is temperate throughout the year and the temperature hardly rises above 32°C in summer. The state has the advantage of being India's 'Gateway to the East' through the city of Moreh, as this is the only viable land route for trade between India and Myanmar and other Southeast Asian countries. Both loose and cut flowers are grown in the state over an area of 200 ha (NHB Database, 2018). The climatic conditions in Manipur favour the growth of various flower crops, including orchids. Cut flowers like anthurium, gerbera, roses, carnations, alstroemeria and *dendrobium* orchids are gaining popularity in the state.

Meghalaya

Meghalaya borders Assam to the Northeast and the plains of Sylhet and Rangpur Division (Bangladesh) to the southwest. It includes the Khasi Hills, the eastern part of the Jaintia Hills and the western part of the Garo Hills. The state has two major floriculture zones: the temperate zone and the subtropical zone. The entire eastern and



Lady's Slipper Orchid

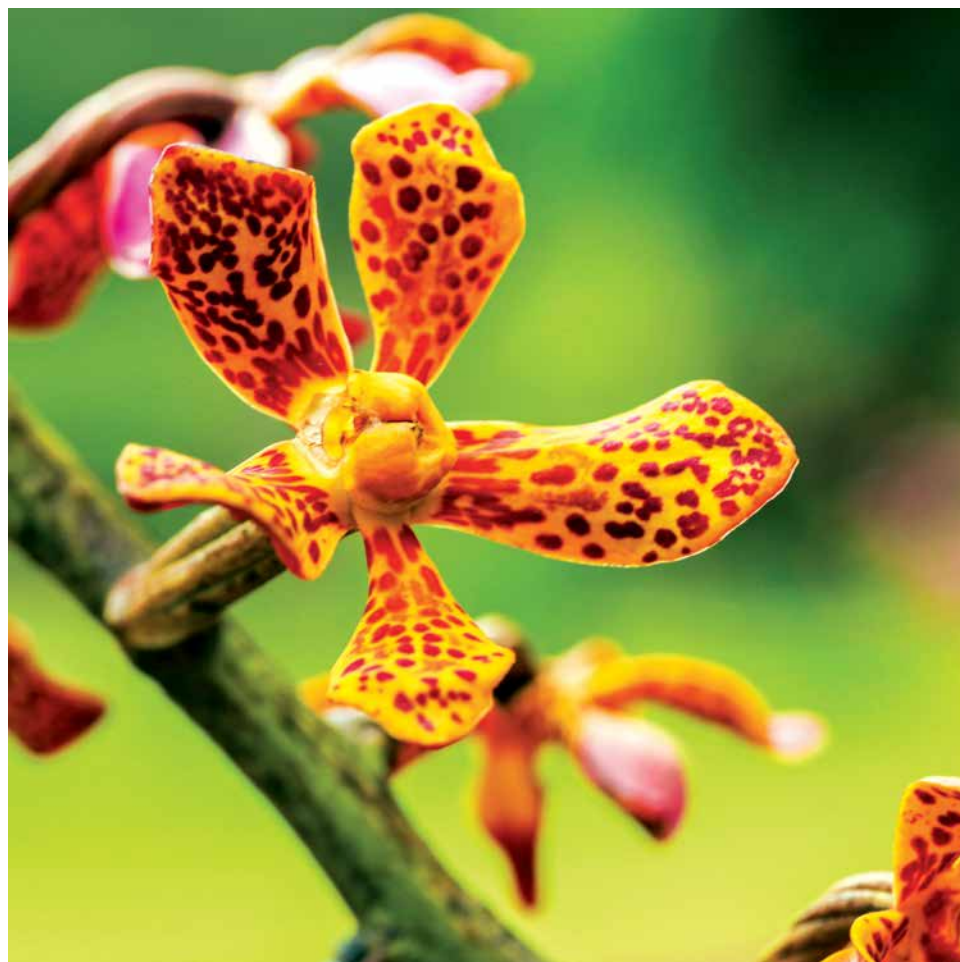
western Khasi Hills and the upper parts of Jaintia Hills district fall in the temperate zone, while Ri-Bhoi and the Garo Hills fall in the subtropical zone. The temperature in the state varies from 2 to 36 °C depending on the altitude. Meghalaya has a monsoon-like climate, but it varies greatly depending on the altitude and physiographic differences of the land mass. While the Shillong plateau (600-2000 m) has a temperate climate, the lower regions bordering the Surma and Brahmaputra valleys (100-300 m) have a tropical climate.

The climatic conditions are favourable for the cultivation of various flower crops. However, flower cultivation in the state started only with the launch of the Horticulture Mission. The state has taken several measures to promote flower cultivation in the state. It has established Horti Hubs & Farms under the District Horticulture Office, which serve as model farms and learning centres for farmers. The office also serves as a marketing centre for various horticulture activities offered by state-approved service providers. The department undertakes protected cultivation of various crops by introducing greenhouses, shade net houses, etc., for off-season production of vegetables and flowers. The farmers of the district are updated with the latest technology through various visits organised by the department.

Mizoram

Mizoram is a landlocked state and shares its domestic borders with Tripura, Assam, and Manipur and international borders with Myanmar and Bangladesh. It enjoys a mild climate, and the maximum temperature hardly reaches 30 °C during the summer months. It experiences heavy rainfall during the monsoon period.

The climatic conditions of Mizoram are suitable for



Red Vanda Orchid

The state borders Nepal, Tibet, Bhutan and West Bengal. It is a mountainous state and lies between 280 and 8586 m above sea level. The climate in Sikkim varies from subtropical in the south to tundra in the north of Sikkim. The region has a temperate climate and the temperature hardly rises above 28°C in summer. The average annual temperature in Sikkim is 18°C. Sikkim is heavily forested, which provides a pleasant habitat for epiphytic plants, including orchids.

The climatic conditions in Sikkim are suitable for growing various types of flower crops. At present, farmers grow orchids, roses, alstroemeria, zantedesia, carnations, gerbera, birds of paradise, heliconia and chrysanthemum. Flower crops in the state are grown over an area of 200 ha with a production of 16,500 MT loose flowers and 100 MT cut flowers (NHB Database 2018). Cymbidium orchids dominate and are grown on an area of about 35 ha. The state government has established a

growing almost all types of flowers like anthurium, roses, bird of paradise, etc., round the year. At present, more than 400 farmers are growing anthurium within the state. Anthurium and rose cultivation have become popular among the farmers of the state. The climatic conditions of the state are suitable for the growth of various types of orchids. Further, the state can focus on Cymbidiums at higher hills and Dendrobium and Phalaenopsis at lower state hills.

Nagaland

Nagaland is a mountainous state running from northeast to southwest. It borders Assam on the west, Tirap district of Arunachal Pradesh on the northeast and Manipur on the south. The eastern side borders Burma. The Barail Range runs northeast to Kohima, where it merges into the mountain range that extends to Manipur. 94% of the area of this state is hilly, with the remaining 4% bordering Assam being plains.

The state receives an average rainfall of 200-250 cm. Summer temperatures range from 31 to 16 °Celsius, while winter temperatures range from 24 to 4 °Celsius. The state offers favourable climatic conditions for various flower crops like orchids, anthuriums, begonias, liliiums, gerberas, carnations, heliconias, etc. Kohima, Dimapur, Mokokchung and Wokha have emerged as important centres of flower cultivation in the state.

Sikkim

Cymbidium Development Centre at Rumtek, Sikkim, which takes care of planting material and provides training to orchid growers on cultivation. ICAR-NRC for Orchids, Sikkim is engaged in research and development of orchids and provides training to farmers and extension workers.

Tripura

Tripura is the third smallest state in India. It borders Bangladesh to the north, south and west and Assam and Mizoram to the east. This state consists of hills, valleys and plains. Tripura has a tropical savannah climate, although there are slight variations in temperature due to the hilly



Anthurium

topography.

The maximum temperature in the state reaches 35°C in summer. It rains heavily here during the monsoon season. Flowers like anthurium, tropical orchids (dendrobium), gerberas, tuberose, gladioli, roses and marigolds are grown in this state.

Floriculture Potential of Northeastern States

Floriculture products consist mainly of cut flowers, potted plants, cut foliage, seed bulbs, tubers, rooted cuttings and dried flowers or leaves. The diverse climatic conditions in the Northeastern states provide scope for growing almost all flowers and foliage, from temperate to tropical. The cultivation of orchids for cut flower and pot plant production holds the greatest potential in this region. The Netherlands and Thailand are the dominant players in the orchid business worldwide. Apart from cut orchid flowers, orchid growing countries also ship live plants, tissue culture plants, pot plants and orchid plant extracts. India has several competitive advantages in marketing orchids in the country. The key advantages include suitable climatic conditions for cultivation of different orchid species, extensive genetic resources for development of new varieties, comparatively cheap labour and proximity to global consumption centres. It has the potential to become a global player in the orchid business.

Plant genetic resources of flowering plants

The Northeastern states are very rich in the biodiversity of flowering plants. These states harbour about 50% of India's flora (about 8,000 species), of which 31.58% (about 2526 species) are endemic. The region is rich in orchids, ferns, primulas, oaks, bamboos, rhododendrons, magnolias, rhododendrons, cassia, erythrina, calustemom, dacasenda, myrica, bauhinia, primula, etc. Of the 1,350 orchid species reported from India, 900 species (nearly 69%) occur in the Northeastern states of India. As far as distribution by state is concerned, Arunachal Pradesh has the highest number of orchids, namely 577 species in 147 genera, followed by Sikkim with 561 species in 144 genera, Meghalaya with 380 species in 113 genera, Nagaland with 387 species in 107 genera, Manipur with 314 species in 93 genera, Mizoram with 253 species in 86 genera, Assam with 231 species in 82 genera and Tripura has the least number of orchids, namely 39 species in 29 genera. Several species of orchids enjoy the status of state flower of the Northeastern states, for example, *Rhynchostylis retusa* (state flower of Assam and Arunachal Pradesh), *Dendrobium nobile* (state flower of Sikkim), *Papiopedilum insigne* (state flower of Meghalaya), *Renanthera imschootiana* (state flower of Mizoram). Rhododendrons are epiphytes, shrubs, trees and known for their beautiful flowers and foliage. They are found in the western Himalayas and in the Northeastern states of India. So far, 121 taxa have been recorded from India, of which 117 (98%) are distributed



Rhododendron Arboreum

in the Northeastern states of India. The highest number of taxa has been reported from Arunachal Pradesh (106), followed by Sikkim (40), Manipur and Nagaland (10), Mizoram (4) and Meghalaya (3). The pink rhododendron *Rhododendron campanulatum* is the state flower of Himachal Pradesh and *Rhododendron arboreum* is the state flower of Nagaland and the official state tree of Uttarakhand. Out of the total 115 species of bamboos in India, nearly 90 species of bamboos are found in this region, out of which 41 are endemic to this region and several of them have ornamental value. *Lilium mackliniae*, the Shirui lily or Shirui Kashong Timrawon, is a rare Indian plant species found only in the upper reaches of the Shirui hill range in Ukhrul district of Manipur, India, at an altitude of 1,730 to 2,590 metres above sea level. This species is the state flower of Manipur. Hedychiums of the Zingiberaceae family make excellent ornamental plants; of the nearly 1000 species found in India, about 50% are found in the Northeastern states of India. Among non flowering category plants category of plants, ferns belonging to different groups can also be classified as ornamentals. Epiphytic species like *Lycopodium phlegmaria*, *Selaginella* spp, *Nephrolepis* sp. silver, golden and walking ferns, bird's nest ferns including some tree fern species are among the cryptogamic plants that can be popularised as ornamentals. The Red Data Book of Indian Plants reports that of the 1500 endangered flowering plant species, 800 are from Northeast India.

Suitability of agro-climatic conditions

Geographical location, varying altitudes and myriad water bodies contribute to the diverse microclimates in the Northeastern states. The NARP of the Indian Council



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of Agricultural Research has classified the region into seven distinct agro-climatic zones based on altitude, rainfall pattern and temperature variation: Alpine Zone, Temperature, Subalpine Zone, Subtropical Hilly Zone, Subtropical Lowland Zone, Mild Tropical Hilly Zone, Mild Tropical Lowland Zone. The agro-climatic conditions of the Northeastern states are suitable for growing various flower crops *viz.*, rose, tuberose, anthuriums, chrysanthemums, lilies, gerberas, carnations, gladioli and orchids like Dendrobium, Phalaenopsis, Cattleya, Oncidium, Vanda Paphiopedilum and Oncidium, etc.

Institutions to support research and development

There are several institutions in the Northeastern States *viz.*, NRC for Orchids, Sikkim, Assam Agriculture University, Jorhat, Central Agriculture University, Imphal and its colleges in different Northeastern states, Institute of Bioresources & Sustainable Development (IBSD), ICAR-Complex for NEH Region, Barapani, Meghalaya and its regional centres in all Northeastern states. State Forest Research Institute, Arunachal Pradesh, Rajiv Gandhi University, Papum Pare, Arunachal Pradesh, Nagaland University, Kohima, North Eastern Hill University, Shillong, Botanical Survey of India, Shillong and Gangtok, etc., that can play a significant role in the development of floriculture industry in the region. In addition to these institutions, there are 70 Krishi Vigyan Kendra that can help disseminate flower production technologies.

Increasing domestic consumption

The consumption of floriculture products is increasing with the change in socio-economic structure and globalisation. The Indian floriculture market was worth

₹ 130 billion in 2017 and is expected to reach ₹ 394 billion by 2023, at a CAGR of 20% during 2018-2023. In 2020-21, floriculture crops were grown on about 322 thousand hectares of land, with an estimated production of 2151.96 thousand tonnes of loose flowers and 828.09 thousand tonnes of cut flowers (APEDA, 2022). Floriculture is emerging as a diversified industry with flowers and ornamental plants having significant aesthetic, social, environmental and economic value. India imported orchid cut flowers worth ₹ 3425 lakhs in 2015-16, which declined to ₹ 2248 lakhs in 2018-19 and further to ₹ 1585 lakhs in 2019-20. Since 2015-16, there has been a steady decline in orchid cut flower imports as domestic production has increased.

Strategies for Developing Floriculture Industry in Northeast India

The Northeastern states have enormous potential for development of floriculture. The Technology Mission for Development of Horticulture in the Northeastern States provided a momentum for development of floriculture in Northeastern states. The scheme has created awareness about

flower cultivation in the region. The following strategies are proposed for harnessing floriculture potential of Northeastern states.

Scaling up production area

The area under floriculture in the Northeastern states is very small compared to other states in India. According to the data released by the National Horticulture Board (Indian Horticulture Database 2018), the area under flower cultivation in the Northeastern states was 5800 ha, producing 50,900 MT loose flowers and 67,800 MT cut flowers. The production of loose flowers and cut flowers from these states accounted for only 2.59 and 8.24% of the total production in the country. The area under flower crops needs to be expanded. The following measures are proposed to increase the area under cultivation in the Northeastern states of India.

Attracting rural educated youth in floriculture

The involvement of unemployed, educated youth can be a game changer for the development of the flower industry in the Northeastern states of India. Private investment in floriculture, including orchids, may take time due to social and political upheavals. The youth in these states speak English and Hindi and can interact with people from other states or countries. They need to be mobilised and encouraged to take up floriculture as a business.

Encouraging Cluster /Contract /Cooperative farming

In floriculture, quality, quantity and continuity in the supply of products are crucial to achieve higher prices in the markets. Contract farming of flower crops could be profitable for small and marginal farmers in



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the Northeastern states where availability of inputs and marketing of the product is still a problem due to lack of marketing infrastructure for perishables. Formation of clusters of flower growers with backward and forward linkages would be beneficial.

Promotion of export-oriented ventures

The cultivation of high value cut flowers and potted plants is a suitable agricultural product for export from the Northeastern states of India. The export-oriented enterprises need to be encouraged by the governments. These farms can import new varieties and technologies for growing flower crops from other countries. An export-oriented company, 'Himalayan Orchids', has been set up in Sikkim to export cymbidium orchids, but it is not functional at present.

Economising production cost

Increasing production costs reduce the producer's profit margin in the consumer rupee. Therefore, the efforts should be made to reduce the cost of production by optimising inputs, reducing energy costs, increasing productivity and improving the quality of the product. The following measures will help reduce production costs.

Determining the ideal production areas

The climatic conditions in the Northeastern states are favourable for growing flower crops. However, mapping the microclimatic conditions suitable for a particular type of crop would reduce the cost of infrastructure and energy. The flower crops can be grown in these locations

under rain shelter rather than in climatically controlled greenhouses. Clusters for growing a particular flower crop can be promoted in such areas to share post-harvest infrastructure and other common facilities. Delineation of such production zones in an area would lead to pooling of resources and sharing of facilities for post-harvest management, transportation and marketing.

Reducing production costs

The climatic conditions in the Northeastern states are favourable for growing various high-value flower crops, including orchids, which would reduce the energy costs of running greenhouses. Flowers produced in this region would be more competitive in national and international markets. However, to reduce costs and produce high quality flowers and potted plants, technological interventions are required in terms of production practises such as production system, planting containers, integrated nutrient management, integrated pest and disease management and production season control are needed to reduce the cost and produce quality flowers and pot plants. Optimised post-harvest practises such as grading, shelf-life extension treatments, packaging, fumigation, long distance shipping protocols and value addition would help to achieve the best prices in the market.

Ensuring availability of quality planting materials

Varieties are one of the most critical inputs in the cultivation of flower crops. ICAR and Agricultural Universities have developed a large number of varieties of different flower crops like rose, tuberose, chrysanthemum,



Siroi Lily

gladiolus, etc., which are available for cultivation. But the indigenous improved varieties in crops like anthuriums, carnations and orchids are not available for cultivation. Therefore, flower growers have to depend on imported varieties.

Skilling human resource for flower industry

Commercial cultivation of flower crops, including orchids, has recently been introduced in the Northeastern states. Various stakeholders, namely flower growers, field workers, supervisors, horticulture officials, supervisors and plant propagators are not familiar with the cultivation and management practises. These functionaries can be trained in knowledge centres like ICAR-NRC for Orchids, Sikkim, for cultivation of temperate and sub-tropical orchids, College of Horticulture, KAU, Thrissur, Kerala for tropical orchids and for other flower crops at ICAR-DFR, Pune, Maharashtra and ICAR-IIHR, Bengaluru.

Ensuring the product quality

Buyers and consumers demand a constant supply of high-quality products. Corresponding external and internal quality characteristics must be met,

which can vary depending on the target market. Colour, texture, size, freshness, fragrance and shelf-life are the most important quality characteristics that are important for successful marketing of flowering plants.

Use of certified quality planting material

Quality seed and planting material is an essential input in floriculture for obtaining the desired quality of the produce. The quality of the planting material is determined by its origin, the authenticity of the variety and stock, vegetation development, and the state of health. At present, the planting material of various ornamental crops including orchids, is imported in tissue culture bottles or hardened seedlings or plants just before flowering. Only a few tissue laboratories in Maharashtra produce certified quality planting material of some ornamental plants as per the guidelines of National Certification Systems for Tissue Culture Raised Plants (NCS-TCP). There is no commercial tissue culture laboratory supplying quality planting

material of ornamental plants in the Northeastern states.

Creation of post-harvest management infrastructure

Post-harvest management helps to maintain product quality by minimising losses caused by physical, biological and environmental factors. Post-harvest losses occur in the value chain at the farm, wholesaler and retailer levels. The unit operations involved in the post-harvest handling of flowers include harvesting, grading, pre-treatment/pulsing, tubing, sleeving or pre-packaging, packaging, storage and transport. The lack of post-harvest infrastructure deteriorates the quality of perishable commodities. The region has inadequate post-harvest and marketing infrastructure and therefore needs to be developed as soon as possible.

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Movable screens in rose production

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