

Avenues in seed and planting material production in floriculture

Floriculture, a vital part of horticulture, involves cultivating, processing and marketing ornamental plants. This industry's heart lies in the production of high-quality seeds and planting materials, which are crucial for ensuring consistent quality, disease resistance and optimal yield. High-quality planting material in floriculture is required by commercial growers, nurseries, landscapers, researchers, amateur growers and the floriculture export industry. Techniques such as hybrid seed production, vegetative propagation and specialized structures like bulbs and corms are widely used, while advanced methods like micropropagation and genetic improvements enable large-scale, disease-free plant production. Though India imports much of its flower seed material, it has significant potential to boost domestic production and export capabilities. Beyond flowers, the production and marketing of seeds and planting materials present valuable growth opportunities. Key challenges, including genetic purity, disease management and adherence to phytosanitary regulations, must be addressed.

THE flourishing floriculture industry plays a pivotal role in enhancing landscapes, gardens and urban environments, driven by the cultivation and trade of ornamental plants. In recent years, floriculture has emerged as a significant economic contributor both domestically and internationally, driven by the growing demand for flowers and ornamental plants in landscaping, gardening and cultural events. Since the COVID era, the industry has evolved, extending beyond aesthetics to promote human well-being, with the demand for indoor plants increasing by 30% compared to the pre-COVID period. According to the International Market Analysis Research and Consulting (IMARC) Group, the Indian floriculture market reached a value of ₹ 262.1 billion in 2023. The production of seeds and planting materials is crucial to the success of ornamental plant cultivation, as high-quality inputs ensure that plants exhibit desired traits such as colour, shape, fragrance and disease resistance. Without proper seed and planting material production, the entire floriculture value ranging from nurseries to flower markets and landscape companies could face disruption.

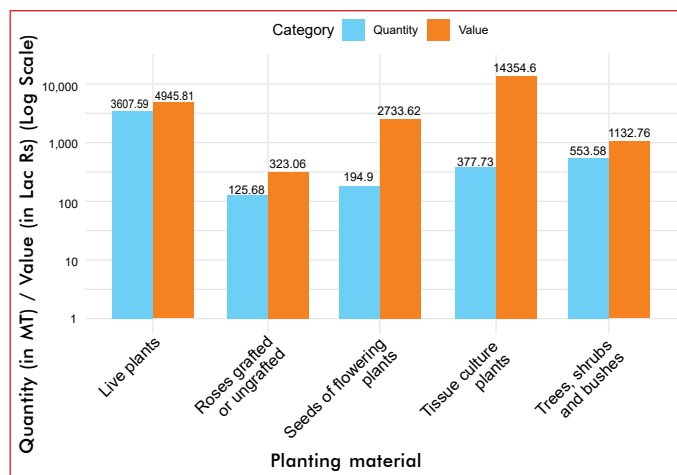
The marketing channels for nurseries include nursery growers, garden centres (where seeds available), wholesalers, and retailers. In cities like Bengaluru, Pune, and

Ahmedabad, garden centres have emerged as one-stop solutions for all gardening needs and inputs. Both private and public sector entities are engaged in seed production. The public sector includes two central corporations: the National Seed Corporation (NSC) and the State Farm Corporation of India (SFCI), along with 13 State Seed Corporations. In the private sector, approximately 150 seed companies are involved, encompassing both national and multinational companies, as well as other organizations focused on seed production and sales. Punjab and Karnataka are the key hubs for seasonal flower seed production in India. Punjab (Sangrur, Patiala and Ludhiana) accounts for about 60% of total seed production, while Karnataka (Bengaluru, Ranebennur and Koppal) contributes nearly 25%. Other regions, such as Srinagar, the Kullu Valley, Ranchi, Kalimpong and Terai areas, also produce seeds of winter annuals and temperate species.

There are untapped opportunities in various agroecological regions that could be leveraged based on crop-specific climate requirements. Crops like tulip, liliun and crocus, which thrive in cooler climates, can benefit from strengthening production in states such as Uttarakhand, Himachal Pradesh and West Bengal.



Open-pollinated seed production in ice plant at Plantsman's seed production farm at Patiala, Punjab
(Source: <https://plantsmans.com/our-farms/>)



Seed and planting material exports in floriculture during 2022-23 (APEDA)

Foliage plants, another rapidly growing category, are especially popular in urban landscapes, with unexplored potential in the Northeastern states. This article explores the prospects of seed and planting material production in floriculture; highlighting innovations, challenges, techniques, and future trends shaping this vital and growing sector.

Significance of quality planting material in floriculture

Quality planting material is fundamental to successful floriculture. A nursery stock contains trees, shrubs, climbers, conifers, deciduous plants, ground covers, vines, bedding plants, annuals, potted plants, herbs, bulbous plants, aquatic plants, bonsai plants and specific types of ornamental crops like carnation, rose, tuberose, gladiolus, orchid, chrysanthemum etc.

Flower growers must have access to high-quality seeds, bulbs, rooted cuttings, grafts and other propagation materials. This quality is defined by the authenticity of the variety and its freedom from pests and diseases, including viruses. However, planting materials, particularly for bulbous crops, are highly susceptible to fungal diseases such as *Fusarium* and *Botrytis* in gladiolus, stem rot in tuberose, and *Botrytis*, *Rhizoctonia*, and viral infections in liliu. Ensuring the large-scale production and availability of disease-free, high-quality planting materials is essential for the growth of the ornamental plant industry. Technologies that enable the production of clean, superior planting materials must be made accessible to growers to meet increasing market demand. Establishing quality standards for planting materials and fresh flowers will be crucial for the success of flower-based enterprises and the overall growth of the sector, as India has significant potential in floriculture. Quality planting materials ensure that ornamental plants meet market expectations for aesthetics, uniformity and resilience, further boosting the industry's prospects.

Major techniques for seed and planting material production

Several propagation techniques are used to produce high-quality seed and planting material in floriculture. These methods include both sexual propagation, such

as seed production and asexual propagation, including cuttings, grafting, division and tissue culture.

Seed production

The potential for annual flower seed production in India is significant, with approximately 600–800 ha currently under cultivation. High-quality seeds play a critical role in ensuring the profitability of farmers and growers. Seed production in floriculture can be broadly categorized into two main types each offering distinct advantages in terms of quality, diversity and market demand.

Hybrid seed production: Hybrid seeds have revolutionized floriculture by offering uniform plants with improved vigour, disease resistance, and superior ornamental characteristics. The pioneering efforts in hybrid seed production for ornamentals were undertaken by M/S Indo American Hybrid Seeds (India) Pvt. Ltd., Bengaluru. In the mid-1960s, the company began producing F_1 hybrid seeds of *Petunia* exclusively for export. Hybrid seed production requires careful selection of parental lines and controlled pollination to produce F_1 hybrids. These hybrids outperform their parent plants in terms of growth, flowering, and adaptability to different environments. To produce hybrid seeds, it is essential to maintain genetic purity in the parental lines. This is typically achieved through techniques such as hand pollination or the use of male sterility systems, including genetic male sterility (GMS) and cytoplasmic male sterility (CMS). In crops like marigolds and *petunia*, hybrids are preferred due to their compact growth, larger flowers, and superior overall performance.

Open-pollinated seed production: The production of seeds for open-pollinated flower crops was initiated by M/S Beauscape Farms, Sangrur, Punjab, which began large-scale flower seed production by involving local farmers. In the open field, seed crops are produced in blocks of one or more hectares. It is less labour intensive but more equipment and inputs are required. Most of the crops produced in the field are open-pollinated varieties, though hybrids with self-incompatible parents can also be produced. Unlike greenhouse production, which can be a year-round activity, outdoor production is seasonal. Identifying locations with suitable climate and producing the crops in the appropriate season are keys to reliable seed supply. These seeds tend to produce genetically stable plants that retain the characteristics of the parent plants. For floriculture, open-pollinated seeds are often used in the production of landscape flowers. Some common open-pollinated flowers include ice plant, cosmos, calendula, delphinium, portulaca, zinnias etc.

Vegetative propagation

Vegetative propagation is an essential method for producing uniform plants that retain the characteristics of the parent plant. This technique is particularly valuable for plants that do not produce viable seeds or whose seeds do not breed true-to-type. Vegetative propagation methods include cutting (*chrysanthemum*, *carnation*, *hibiscus* etc.), grafting and budding (ornamental trees and shrubs), division (herbaceous perennials) and

specialized structures like bulbs (tulip, liliun etc.), corms (gladiolus) and tubers (caladium, dahlia etc.). Saharanpur (Uttar Pradesh), Rajamahendravaram (Andhra Pradesh), Kalimpong (West Bengal) and Nainital (Uttarakhand) are the hub for ornamental plant production.

Micropropagation (Tissue culture)

Tissue culture, also known as micropropagation, is a modern technique used to produce large quantities of disease-free, genetically uniform plants in a short period. This technique involves growing plant cells or tissues in a controlled, sterile environment on a nutrient medium. Tissue culture is particularly useful for producing rare or difficult-to-propagate plants and for maintaining the genetic purity of elite varieties. In floriculture, tissue culture is widely used for the mass propagation of ornamental plants like gerbera, orchids, anthuriums and carnations. It allows the rapid multiplication of plants with desirable traits, ensuring that they are free from viruses and other pathogens.

Challenges in seed and planting material production

Despite the advancements in propagation techniques, several challenges persist in the production of seed and planting material for the floriculture industry. Some of the major challenges include:

Maintaining genetic purity: One of the primary challenges in hybrid seed production is maintaining the genetic purity of parental lines. Cross-pollination with other varieties or contamination during the production process can result in the loss of desirable traits in the offspring. Maintaining strict isolation distances and implementing controlled pollination techniques are crucial for preserving genetic purity.

Seed certification and nursery regulations: Seed certification standards are lacking for many crop species, which hampers the production and supply of uniform, high-quality planting material. While some states have introduced their guidelines, a consistent national framework for nurseries and planting material standards is absent. With the implementation of the Plant Variety Protection Act, safeguarding plant breeders' rights has become increasingly important. Without proper regulation and licensing of nurseries, enforcing varietal protection and maintaining breeders' rights will remain difficult. As new and innovative varieties are vital to the floriculture industry, addressing policy issues, nursery regulation and seed certification should be prioritized.

Challenges in bulbous crop propagation: Bulbs, corms, tubers and rhizomes, serve as commercial methods for propagating flower crops like tuberose, gladiolus, liliun, dahlia etc. However, challenges such as scarcity of quality planting material, the long gestation period for bulblets and cormels, low multiplication efficiency and spoilage during storage need to be addressed. There is a need for standardizing optimum storage conditions and packaging materials for short and long-term storage as well as for long-distance transport.

Pest and disease management: One of the most significant challenges in the production of planting materials is the management of diseases, particularly



Hi-tech nursery units of ornamental plants

fungal and viral infections. Bulbous crops, such as gladiolus, tuberose and liliun, are especially susceptible to fungal diseases like Fusarium, Botrytis and stem rot. These diseases not only affect the planting material itself but also reduce the quality and yield of the crops grown from infected materials.

Adhering to phytosanitary regulations: The export of seeds and planting materials is subject to stringent phytosanitary regulations to prevent the spread of pests and diseases. Ensuring compliance with these regulations requires careful inspection and certification processes. Countries with advanced floriculture industries have established strict protocols for the production, handling and export of planting materials. Developing countries like India must strengthen their phytosanitary infrastructure to compete effectively in the global market.

Environmental factors: Ornamental plants and their seeds are often highly sensitive to environmental conditions. Extreme temperatures, humidity, and precipitation can adversely affect pollination, seed set, and the health of planting materials. For example, high temperatures can reduce pollen viability, while excess humidity can encourage the growth of fungal pathogens. Climate change poses a growing threat to floriculture, as unpredictable weather patterns disrupt traditional growing seasons and increase the prevalence of diseases. Changing climatic conditions expose plants raised through cuttings to various biotic and abiotic stresses. Loss of vigour over generations is a matter of concern in many of the vegetatively propagated species, especially with the softwood cuttings.

Strategies for overcoming challenges in seed and planting material production

India has immense potential for producing seeds of various flowers due to its diverse climatic conditions and availability of affordable labour. Seed production should be carried out on a region-specific basis by identifying the most suitable areas from a climatic perspective. Since seeds are non-perishable, they can be produced in remote regions without concerns about post-harvest losses. This activity requires minimal capital investment,



Seasonal annual flowers grown in India

making it an ideal option for small-scale farmers. Adopting a cooperative model for flower seed production could further enhance profitability for farmers and help protect them from exploitation by corporate exporters. Research on the development of high-yielding varieties including FI hybrids, and agro-techniques for producing uniform seed meeting international certification standards requires strengthening.

To overcome challenges in planting material production, advanced techniques like tissue culture can ensure disease-free, high-quality stock, while improving traditional propagation methods can boost plant survival rates. Region-specific planting materials suited to local climates can enhance crop success and resilience. Additionally, investing in efficient storage solutions and fostering cooperative networks can improve access to planting materials, benefiting small-scale farmers and ensuring consistent production. This segment may not require much research but requires adequate dissemination for transferring the already developed technologies. On the research side, the propagation and seed production of ornamentals needs to be strengthened.

Future prospects and innovations in seed and planting material production

The increasing demand for ornamental plants, driven by urbanization and a post-COVID emphasis on home aesthetics, is creating significant opportunities for the floriculture industry. Consumers are prioritizing greenery in both indoor and outdoor spaces, leading to a rising need for high-quality seeds and planting materials. The

export market for floriculture products is also expanding, particularly in Europe, North America and Asia. The future of seed and planting material production in floriculture looks promising, with new technologies and innovations set to reshape the industry. Genetic advancements, such as genetic engineering, marker-assisted selection and CRISPR-based gene editing, are enabling the creation of ornamental plants with enhanced traits like disease resistance, drought tolerance and extended flowering periods, while also offering new flower colours and forms. Cryopreservation of pollen and seeds, which preserves viability at ultra-low temperatures, is emerging as a vital technique for maintaining genetic diversity, especially for rare or endangered species and reducing the reliance on male parental lines in hybrid production. Sustainability is also becoming a major focus, driving a shift towards organic propagation techniques, including organic seed production and natural biopesticides. Efforts to conserve water, energy and soil health are gaining importance.

Additionally, automation and precision agriculture are poised to transform floriculture by reducing labour costs and improving efficiency. Hydroponics is an innovative method for the mass production of disease-free vegetative propagules and should be fully explored to realize its full potential. Together, these advancements are set to enhance seed and planting material production, fostering the growth and sustainability of the floriculture industry.

CONCLUSION

High-quality planting materials, including seeds, bulbs and cuttings, are essential for the successful cultivation of flowers. Key techniques in seed and planting material production include hybrid seed development, vegetative propagation and tissue culture. Hybrid seeds offer uniformity and enhanced traits, while vegetative propagation ensures consistency in non-seed-producing plants. Micropropagation is vital for producing disease-free plants on a large scale. Challenges in this sector include maintaining genetic purity, complying with phytosanitary regulations, coping with environmental conditions, and managing pests and diseases. Advances in biotechnology, cryopreservation and sustainable practices hold promise for the future. India has significant potential to enhance its floriculture sector by adopting these innovations to meet both domestic and international demand.

For further interaction, please write to:

Dr Ramesh Kumar (Dean), School of Agriculture, Lovely Professional University, Ludhiana, Phagwara, Punjab 144 441.
*Corresponding author email: ramesh.19212@lpu.co.in