

# Sustainable Floriculture: A Step Towards a New Era of Creating the World We Want

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Floriculture is a significant sector within agriculture in India, holding a prominent position in the production of cut flowers, foliage, and ornamental plants, and is crucial for exports also. The Indian floriculture industry has seen a tenfold increase over the past decade, ranking it among the world's top ten flower producers, including roses, tuberose, anthuriums, marigolds, and others. With societal advancements, there is a heightened awareness of aesthetic beauty, leading to increased demand for flower production and ornamental gardening. However, this growth has also contributed to environmental degradation. Consequently, environmental protection has become a critical issue, necessitating sustainable initiatives within the sector.

The production of floriculture crops is highly input-intensive, necessitating the use of non-renewable and petroleum-based products such as pesticides, fertilizers, growth regulators, and materials for greenhouse heating, glazing, and packaging to ensure uniformity and consistently high quality (Krug *et al.*, 2008; Lopez *et al.*, 2008). The reliance on petroleum-based products in floriculture can have detrimental environmental impacts, prompting debates on sustainability within the industry (Krug *et al.*, 2008; Stewart, 2007).

The environmental impact of cut flowers throughout their lifecycle primarily stems from cultivation practices (Russo *et al.*, 2008), but transportation, especially by air from production countries to markets, also contributes significantly (Sahle and Potting, 2013). Sustainable practices in floriculture include the recycling of irrigation water and plastics, the use of biological control methods, and the adoption of alternative energy sources (Lopez *et al.*, 2008). Sustainable floriculture aims to minimize environmental degradation, sustain agricultural productivity, ensure economic viability, conserve resources and energy, and support stable communities and quality of life (Krug *et al.*, 2008). Consumers are estimated to be willing to pay up to 15% more for sustainably produced floricultural products compared to those produced conventionally (Behe *et al.*, 2010). A

major waste management challenge in horticulture arises from the common use of non-recyclable plastic containers for growing flower crops, which are often discarded by consumers (Evans and Hensley, 2004).

Flower growers stress the importance of sustainability in preserving the environment, viewing it as a valuable cause and investment, as well as their duty as business owners. The global agricultural systems are now subject to stringent regulations, compelling the floriculture industry to embrace eco-friendly practices.

Life Cycle Assessment (LCA) evaluates a product's life cycle, offering insights into the environmental contributions from production to handling and transportation, and identifies areas needing improvement. Analysing LCA results will facilitate the development of suitable protocols and methodologies to ensure the sustainability and production of eco-friendly floricultural products.

## Sustainability: A general view

- The 1992, United Nations Conference on Environment and Development, known as the 'Earth Summit', held in Rio de Janeiro, established the concept of 'sustainability.'
- The cultivation method employed is completely organic, excludes any hormonal treatments or chemical fertilizers.
- "Satisfying the needs of the present without jeopardizing the ability of future generations to meet their own needs."
- Sustainability involves developing agricultural systems that:
  - Minimize environmental pollution risks
  - Enhance water use efficiency etc.
- Initially an environmental sustainability to safeguard the planet, sustainability has since expanded to include social welfare and economic stability.
- The overarching goals include reducing environmental degradation, economic instability, and social insecurity.

### **Sustainability: what does it mean in floriculture? and why the floriculture sector needs sustainable initiatives?**

1. Intensive utilization of natural resources
2. Hazardous management of fertilizers
3. Irresponsible waste disposal system

The floriculture sector significantly contributes to environmental degradation in various ways. Intensive greenhouse cultivation, an energy and resource-intensive high-tech production system, utilizes non-renewable and petroleum-based substances for pesticides, fertilizers, growth regulators, as well as for greenhouse heating and glazing. The use of non-recyclable plastic in the propagation, production, packaging, handling, and transportation of various floricultural products, such as cut flowers, pot plants, and landscape plants, leads to greenhouse gas emissions. These practices not only have substantial negative impacts on the environment but also lead to issues such as soil-water degradation, waste generation, air pollution, and climate change.

#### **Climate change and flower production:**

Environmental degradation and climate change are adversely impacting the floriculture sector in several ways:

- Flowers fail to bloom in normal season.
- The blooming period has become shorter.
- Flowers are often improperly colored and smaller in size.
- Cold-dependent ornamentals, such as orchids and rhododendrons, are negatively affected.
- The volatile fragrances emitted by flowers are impacted.
- There is a deterioration in pigment quality.
- There are increased outbreaks of insects, pests, and diseases.
- Post-harvest life is reduced, along with poor pollination and poor seed set.
- The flowering pattern is getting disturbed, affecting both photoperiodism and hermaphrodism.

Hence, floriculturists are urged to adopt eco-friendly cultivation strategies and pay special attention to the environment to mitigate some of the major issues facing in the flower and nursery industries.

- Today, floriculturists, along with all other earth dwellers, must exhibit heightened awareness and increased responsibility towards the environment.

- They should also develop significant tools to address the pressing issues associated with the flower and nursery industry's contribution to environmental degradation.

### **An overview on sustainability in the floriculture industry**

#### **Aspects of sustainable floriculture; sustainable production approaches in floriculture**

- Urban floriculture reduces city pollution by absorbing emissions.
- Cultivation minimizes fuel and electricity use.
- Integrated Nutrient Management (INM).
- Integrated Pest and Disease Management (IPDM).
- Utilization of recyclable materials.
- Use of peat-alternative growing compounds.
- Recycling of irrigation water and plastics.
- Adoption of alternative energy sources such as solar and wind power.
- Support for local production.
- Cultivation of climate-adapted or native ornamental species.
- Development of sustainable cultivars.
- Focus on water conservation, management, and secure water supply.
- Wastewater treatment.

#### **Advanced approaches**

- Implementation of smart fertigation infrastructure.
- Deployment of an IoT-based irrigation system.
- Replacement of conventional nets with biodegradable low-density polyethylene nets.
- Substitution of conventional polyethylene sleeves with Kraft paper and low-density polyethylene sleeves.
- Enhancement of recycling capacity through mechanical and chemical processes.

#### **1. Integrated Nutrient Management (INM);**

- Indiscriminate fertilizer uses leads to soil health deterioration, impacting sustainable flower production.
- Integrated Nutrient Management;
  - ✓ Reduces fertilizer consumption.
  - ✓ Saves foreign exchange by decreasing fertilizer or raw material imports for fertilizer production.
- Enables efficient recycling of agricultural waste to enhance nutrition.

- Promotes soil health to achieve sustainable production.
- 2. Integrated Pest and disease Management (IPDM)**
  - IPM employs beneficial insects to control pests, rather than using pesticides.
  - For example, *Amblyseius californicus* is a macro-biological control method used to manage red spider mites in roses.
  - Basic strategies include crop rotation and weed control.
  - It represents a more responsible approach to pest control.
  - This method is cost-effective and better for the environment.
  - It prioritizes consumer safety.
  - The hazardous consequences of excessive pesticide reliance have prompted the development of IPDM concepts.
- 3. Efficient utilization of energy**
  - Temperature control and lighting are the two primary energy inputs.
    - Exploration of alternative energy sources is crucial as we face an energy crisis.
    - Light Emitting Diodes (LEDs);
      - ✓ LEDs represent the future of greenhouse lighting systems, emitting photons that align with the absorbance peaks of critical plant pigments, such as the red and far-red-absorbing forms of phytochrome, as well as the red and blue peaks of leaf photosynthetic action spectra.
      - ✓ The technical benefits of LEDs over conventional lighting sources include greater durability and a longer lifespan.
- 4. Urban floriculture; a sustainable approach to flower production**
  - Reducing harmful atmospheric gases
  - Increasing localized flower production
  - Creating local jobs
  - Lowering city pollution by absorbing emissions
  - Fostering a green economy
  - Enhancing residents' quality of life through a pleasant urban landscape
- 5. Slow flower movement; local field grown cut flowers (The benefits of sustainably grown flowers go beyond the environment!)**

- Slow Flowers: A dedication to cultivating seasonal, local, and sustainable flowers.
- Local production and distribution provide environmental benefits.
- This system of production harkens back to traditional methods, primarily relying on manual labour over machinery.
- Use of organic soil and natural fertilizers.
- Supports biodiversity, benefiting bees and other insects.
- Preference for domestically grown cut-flowers over imports.
- Transportation via walking, biking, cars, and public transport is eco-friendlier than importing flowers.
- Sourcing flowers locally and establishing a local brand bolsters domestic flower production.

#### Research themes relevant to different value chain stages of the floriculture sector

- Switching from PVC pots to pots made of recycled materials.
- Transitioning from diesel to renewable energy sources.
- Replacing polystyrene trays with biodegradable materials, such as starch-based polymers.
- Moving from peat, a non-recyclable organic material, to green composts derived from municipal garden green waste and pruning waste.
- Eliminating the use of fossil fuels in the floriculture industry.

#### Measures taken in the floriculture sectors regarding sustainability (water footprint and the emission of carbon dioxide) in 'Creating the world we want'

- Smart fertigation infrastructure.
- An IoT-based irrigation system.
- Substituted traditional nets with biodegradable low-density polyethylene nets.
- Switched from conventional polyethylene sleeves to sleeves crafted from Kraft paper and low-density polyethylene.
- Enhanced recycling capabilities via mechanical and chemical processes.

#### Future directions

- Adaptive control systems utilize sensor feedback to inform about the ambient solar

light conditions in greenhouses at different times and places. This information triggers the adjustment or dimming of supplementary LED illumination in the greenhouse as required.

- Extension workers ought to educate producers on sustainable practices that are harmless to both people and the environment.
- Promotion and marketing efforts are essential to attract consumers to these new products.
- There is a need to utilize biodiversity and identify native species that can be ornamental in their natural habitats and ecosystems.
- It is crucial to reduce medium and long-distance transportation to lower the emission of environmental contaminants.
- Supporting the regionalization of production by encouraging the use of locally grown, seasonal, and sustainably farmed flowers and greens is beneficial.
- Assessing the potential reduction in carbon footprint from urban floriculture projects and quantifying the carbon footprint of global floral supply chains is necessary.
- Investigating policy initiatives supported by advanced technological tools (such as green walls, green facades, and green roofs) through surveys and interviews with stakeholders involved in urban planning and policymaking is imperative.

## Conclusion

The urgency to develop alternative solutions for the escalating energy crisis is paramount as the situation deteriorating daily. The necessity to discover natural or alternative methods to improve soil is critical due to the degradation of its physico-chemical properties by synthetic fertilizers. It is vital to enhance public awareness of the causes, symptoms, and consequences of environmental degradation that

impacts soil, water, and other resources. Convincing farmers of the advantages of sustainable floricultural practices and underscoring the importance of coexisting with the environment is essential. The government's role in funding initiatives that promote sustainability in floriculture is crucial. Prioritizing environmental protection and biodiversity enhancement is fundamental, and this is achieved through sustainable farming practices.

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