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Floriculture and landscapes: Perspectives and challenges

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Floriculture science

The floriculture is an agricultural sector characterised by the use of innovative and advanced technologies. The floriculture products include cut flowers and foliage, potted plants, bedding/garden plants, and propagation materials. At economical level, floriculture products are non-essential goods, and their commercialization is tightly correlated with the economic well-being of the consumer. The quality is extremely important, and it is defined by the visual appearance that can be obtained in growing environments and preserved during postharvest. The floriculture market is worldwide, experiencing fierce competition, hence logistic and postharvest technologies play an important role as they can allow reaching long-distance and highly remunerative markets.

Cultivation systems

The quality of floriculture must be obtained in the cultivation stage. Most of the ornamental crop cultivations occur in protected environments with diverse technologies. Cut flowers or potted plants are grown in heated greenhouse equipped with innovative soilless cultivation systems with or without recycling of the nutrient solution (closed or open loop systems). Hydroponic systems can be a solution for avoiding soil-borne diseases and soil disinfection. The greenhouse environment must be carefully monitored and controlled for modulating the crop growth and production. The main factors that regulate the growth and flowering are represented by temperature, light intensity, and relative humidity. Temperature in winter can be adjusted to crop needs by heating. Selecting an appropriate heating system is very important and must consider the fuel costs and power of the heating station. Nowadays, the international crisis and the high price of methane or diesel can rapidly price the floriculture out of the market. Research activities should consider developing integrated production system that can lower the heating costs. Lighting is another important factor and innovative lamps such as LEDs have gained a large application in all ornamental production systems. Lighting can be applied for enhancing photosynthesis and/or for regulating the photoperiodic responses in several flowering species. The light use efficiency is an important parameter for scheduling production and products onto the market price is the maximum.

Greenhouses must be coupled with biofuel production or other heat generating systems. Greenhouse frame and cover materials if appropriately selected can help in the reduction of production costs. Mathematical models should be developed that can consider jointly agronomic and economic factors (fuel price, flower price on the market, logistic,

etc.) for identifying the optimal conditions to ensure adequate income for the floriculture grower.

Agronomic managements

Selecting the best genotypes for individual species can help in reducing the negative effects of biotic and abiotic stresses. The genetic improvement for increased tolerance to abiotic and biotic stresses may allow the cultivation in sub-optimal conditions or exposed to attack by fungi and insects. It is well known that in the ornamental sector the visual appearance is the most important parameter that defines the quality. Therefore, no damage or colour changes associated with biotic or abiotic stresses can be accepted. The reduction in the number of agrochemicals registered for ornamental protection is an agronomic problem in many countries. Research activities are currently taking into consideration the tolerance traits in the genetic improvement programmes. However, the correct agronomic management can reduce the effects of stresses.

Crop performance can be improved using functional fertilizers, biostimulants or biological control agents that can enhance nutrient use efficiency or tolerance to abiotic or biotic stresses. Biostimulants are innovative agronomic tools that can help in increasing the environmental and economic sustainability.

Logistic and postharvest strategies

The production costs are different in diverse geographical regions considering the environments and socio-economic situations. Several companies concentrate production in countries with optimal environmental conditions and with low cost of labour. The floriculture products then must be transported to long-distance markets. The harvesting time and postharvest handling are important for ensuring the best quality preservation of ornamental products. The storage of cut flowers or foliage must be properly carried out at low temperatures to minimise respiration and ethylene production, especially in sensitive flowers. High produce quality, during the long storage or transportation, can be ensured by specific postharvest treatments that can provide energy source (sugar), ethylene inhibition, leaf yellowing inhibitor, transpiration reduction. Beside temperature, packaging is also an important aspect that should be optimised for prolonging storage.

Current research needs

There are several research areas that should be considered in the floriculture chain:

- -Increasing tolerance of ornamental crops against biotic and abiotic stresses
- -Exploring new wild species by exploiting nature biodiversity
- -Optimising of mineral nutrition and soilless cultivation in protected environments
- -Testing the natural derivate products such as biostimulants or biocontrol agents for increasing crop tolerance against biotic or abiotic stresses
- -Improving and optimization of postharvest treatments for reducing the postharvest disorders
- -Developing a new packaging by testing new materials for long storage or long transportation
- -Improving the vase life of cut flowers or foliage or post-production ornamental display at the consumer.

Floriculture is a sector that is highly competitive, with a worldwide market. The economic success can be achieved if the whole production chain is optimised starting from the genetic potential of planting material, the new cultivation strategies and opportunities, the postharvest storage and marketing logistics. The future of floriculture is tightly connected with research and innovation, leading growers to high production quality and a higher level of market competition.

Urban forestry and landscape architecture

Urban forestry is a specialization within the forest sciences that includes the management of trees naturally present or planted in urban areas. Various definitions have been given to the term urban forestry. The most common one defines “urban forest” as the vegetation found in and around population centres, from small settlements to metropolitan regions. According to this definition, urban forestry is the planting and management of wooded areas in urban and peri-urban environments. Others refer to urban forestry as to the art, science, and technology of managing plants and forest resources in and around urban communities for the physiological, social, economic, and aesthetic benefits that trees provide to society. Urban and peri-urban ornamental plants can provide several ecosystem services including climate mitigation, pollution reduction such as heavy metal removal, and air cleaning.

Landscape architecture by definition is the design of outdoor areas, landmarks, and structures to achieve environmental, social-behavioural, or aesthetic outcomes and it involves the systematic design and general engineering of various structures for construction and human use, investigation of existing social, ecological, soil conditions and processes in the landscape, and the design of other interventions that will produce desired outcomes. It regards planning and designing public spaces as well as small-scale private projects.

It also means to design spaces for diverse species of plants and animals, taking into consideration the anthropology and human diversity aspects when designing spaces for people. The aim is to design safe places defined by landscape heterogeneity, something that communities tend to lack when a singular approach is taken to designing within a community with rich cultural diversity. Landscape architecture must also ensure that there is a proper balance of landscape heterogeneity within our cities and that designs are influenced by all sectors of the community that are impacted by it.

The strategic issues surrounding landscape architecture research are neither new nor marginal. There have been intense debates within the discipline over the last few decades about the legitimacy of different research paradigms. Each paradigm carries its own assumptions, and generally each researcher argues for its own position. Interdisciplinary inquiry is increasingly common, but the boundaries between fields of knowledge and the validity of using different ways of creating knowledge are increasingly controversial, particularly in relation to landscape architecture.

From the point of view of knowledge, since the discipline is extremely transversal (it ranges from knowledge on plants, to that on the landscape, to the history and evolution of the different landscapes, to civil and environmental engineer – i.e. paving and construction material, stormwater management, up to involving socio-psychological and economic aspects), this has led to the production of research that only rarely includes the various sectors and has led to gaps in knowledge and research activity. This raises further questions: How does the question of 'how do we know what we know' shape the discipline? What questions, evidence and ideas are excluded? And what are the implications for practice?

There is much common ground between the research categories used in applied design disciplines (such as landscape architecture) and those commonly used in more traditional research fields. Developing a flexible and inclusive classification for landscape architectural research does not require reinventing new research strategies. The journal section aims at positioning, expanding, and augmenting existing practices and procedures in a way that integrates different traditions and attitudes from many fields of study into a framework of research strategies for landscape architecture. The final scope is to strengthen knowledge, while also allowing for greater tolerance and freedom in the choices that individuals, companies, and landscape architecture institutions can pursue.

This will eventually allow developing decision support tools for creating circular urban metabolism, resource-sensitive urban and landscape design and to deal with the expected periods of serious droughts due to climate change, which will hit several areas in the world.

Current research needs

-Increasing the research on the multiple roles of biodiversity in the urban landscape in providing habitat for a wider range of organisms, increase resilience to pests and disease and in contributing to local biodiversity protection

-Quantifying the benefits of trees and urban wooded areas

-Exploring new methods for pest management in the urban environment

-Promoting the role of urban forest in improving human and community health

-Investigating the role of different species in bioremediation to mitigate toxins and pollutants

-Expanding knowledge of nature and community well-being and economy (such as crime prevention, transportation safety, and business and worker attraction).

-Enhancing knowledge on tree selection, placement, and growth factors (including soils), to increase urban ecosystems resilience (especially in response to climate change).

-Developing models and decision tools also by using AI to support optimal urban forest, other green infrastructure, and gray infrastructure integration and configurations

-Assessing urban forest threats and impacts from local to national scales, to include invasive plant species, insect pest invasions, land use development, urban wildfire, and climate scenarios.

Author contributions

AF wrote the Floriculture Science section. FF wrote Urban Forestry & Landscape Architecture. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note