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Editorial

Trends in Ornamental Plant Production

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Growing ornamental plants is a dynamically developing and profitable sector of plant production. In 2019, the value of the flower market on the largest global flower exchange, Royal FloraHolland, reached 4.8 billion euros. In 2021, despite the problems related to SARS-CoV-2 and the global pandemic, the value of the annual flower trade increased to 5.6 billion euros [1]. The power of the market and the floriculture sector lies in the variety of the assortment offered for sale. This is why it is so important to constantly introduce new species and cultivars, especially those with the most environmentally friendly production process [2,3]. Other factors important for the constant expansion of the floriculture industry include implementing new strategies for plant reproduction, regulating their growth and development, adapting production technologies to fit the idea of sustainable development, and optimizing supply chain management [4,5]. All these aspects are discussed in seven papers published in this Special Issue on the 'Trends in Ornamental Plant Production'.

The modern production of ornamental plants requires solutions that combine improved production efficiency with a more rational and environmentally friendly use of resources. The principle of sustainable development is a perfect answer to these challenges, as it allows for more effective use of the means of production and better protection of the environment in which a production facility operates. One of the elements of sustainable development in floriculture is biological progress achieved by implementing the species with low thermal requirements and relatively good resistance to diseases and pests. This topic is discussed in depth in an interesting review article [6] that characterizes specialty cut flowers (SCF) and their increasingly important role in the global and local floricultural market. The SCF group is not homogeneous, and it includes annual species, biennials, perennials, bulbs, and woody plants. The main source of their genotypes is the endemic flora of South Africa, Australia, and America. In comparison with traditional cut flowers (TCF), such as roses, gerberas, or anthuriums, the production of SCF flowers is considerably less energy-consuming and safer for people and the environment. This aforementioned paper presents a SWOT analysis that comprehensively assesses the external and internal factors determining the development potential of SCF and TCF flower production. It also discusses the issues related to the harvest, storage, and extension of the vase life of little-known cut flowers.

The environmental management technique called 'life cycle assessment' (LCA) is a tool defined in ISO standards and recommended in many EU documents. It enables a comprehensive assessment of environmental hazards. LCA identifies and prioritizes individual risks and is therefore helpful in the search for technological solutions aimed at maintaining optimal environmental quality. The authors in [7] describe the use of LCA in assessing the environmental impact of *Cyclamen persicum* and *Pelargonium* ×*hortorum* production in 20 horticultural farms from the floriculture district of Treviso, Veneto region. LCA analysis showed that the production of *P.* ×*hortorum* more strongly affected the environment than that of *C. persicum*, mainly due to fossil fuel consumption for heating greenhouses. However, the production of C. persicum is more variable and affects the environment in a more diverse way, especially in the field of eutrophication, acidification, and human toxicity potential. The authors point out that growing *C. persicum* in accordance

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Citation: Salachna, P. Trends in Ornamental Plant Production. *Horticulturae* **2022**, *8*, 413. https://doi.org/10.3390/horticulturae8050413

Received: 1 May 2022
Accepted: 2 May 2022
Published: 6 May 2022

with the principles of integrated pest management and using compost to significantly limit the consumption of mineral fertilizers brings about measurable benefits for the environment and human health.

Plant growth regulators (PGRs) act at very low concentrations to stimulate, inhibit or otherwise modify plant growth. Although there are many research studies on PGRs, specific responses of individual plant species and cultivars make PGR use a still up-to-date and interesting topic. In [8], an international team presents the effects of abscisic acid, N-acetyl thiazolidine, gibberellic acid, salicylic acid, indole-3-butyric acid, and oxalic acid on the flowering and antioxidant potential of *Tagetes erecta*, a popular ornamental, edible, and medicinal plant. The authors demonstrated that PGRs effectively improved the flowering and antioxidant potential of *T. erecta* inflorescences depending on the genotype and type and concentration of PGR used. In *T. erecta* cv. 'Narangi', foliar treatment with different concentrations of oxalic acid considerably enhanced inflorescence biomass, the total content of polyphenols and flavonoids, as well as antioxidant capacity. As for *T. erecta* cv. 'Basanthi', the antiradical activity of the extracts was the most strongly influenced by spraying the plants with indole-3-butyric acid at 100 mg/l.

PGRs are commonly used for root induction and development in cuttings propagated in ornamental shrub nurseries. Auxins are particularly capable of stimulating simultaneous and steady root formation. This is especially important in the intensive reproduction of species with a poor ability to form adventitious roots on cuttings. Researchers in [9] present the impact of 1-naphthylacetic acid (NAA) on rooting effectiveness in *Syringa vulgaris* cv. 'Mme Lemoine', *S. vulgaris* cv. 'President Grevy', *Ilex aquifolium*, *Cotinus coggygria*, *Cotinus coggygria* cv. 'Kanari', and *C. coggygria* cv. 'Royal Purple'. All these shrub taxa, except for *Cotinus coggygria* cv. 'Royal Purple', positively responded to NAA application. A particularly beneficial effect of NAA on the rooting percentage of the cuttings, root volume, number of roots, and root length and diameter of the cuttings was observed in *Ilex aquifolium*.

PGRs are being increasingly replaced with biostimulants to improve plant growth and quality. A valuable source of biostimulants is natural polysaccharides and their derivatives. They are safe for the environment and therefore provide a perfect alternative to synthetic PGRs. The experiments reported in [10] investigated two types of biostimulant complexes, composed of depolymerized chitosan and carrageenan and depolymerized chitosan and xanthan, and assessed their stimulating effects on the growth and quality of *Eucomis autumnalis*. *E. autumnalis* is an endemic species grown as an ornamental and medicinal plant. The biostimulants were applied using a patented method of bulb coating prior to their planting. Both biostimulant complexes effectively improved growth and flowering, increased bulb yield, shortened the period of plant production, and enhanced the content of macroelements and total sugars in *E. autumnalis*. The coating of ornamental plant bulbs in biostimulants is an environmentally friendly biostimulation method with a promising future in sustainable cultivation systems.

The production of potted plants is developing very dynamically, and the practical aspects of their cultivation are always of great importance for producers. In [11], a group of researchers presents their findings related to the effect of temperature on the growth of hydroponically cultivated *Streptocarpus formosus*. This is still a little-known but very attractive plant, native to South Africa, and recommended for cultivation in pots, flower beds, and as a cut flower. A lower root-zone temperature (18 °C) increased the leaf number, leaf and root length, and fresh weight, while a higher root-zone temperature limited vegetative growth of *S. formosus*. Increasing the root-zone temperature during the plant dormancy did not stimulate flowering.

To streamline the supply chain in the floriculture industry, researchers from Ecuador and Spain developed the SCOR (Supply Chain Operations Reference) model and a multicriteria decision-making method [12] based on questionnaires filled by companies representing this sector. The model can be used to assess the performance of individual companies as well as the performance of the entire floriculture sector. The authors con-

cluded that Ecuadorian floriculture farms need to improve their planning, procurement, and manufacturing.

In summary, the production of ornamental plants, just as in other horticulture sectors, is subject to constant changes. The long-term development of this industry, faced with the current energy crisis, post-pandemic challenges, and threats to global geopolitical stability, is highly uncertain. Therefore, to continue its constant development, it is necessary to adapt cultivation methods to actual conditions and take into account the energy transformation and biological, technical, and organizational advances. It is also increasingly important that all flower companies systematically implement sustainable development strategies, which requires a favorable political and social atmosphere.

Acknowledgments: I am deeply grateful to the authors of the papers for sharing their research results in this Special Issue, to the reviewers for their unbiased and insightful reviews, and to the entire team of the *Horticulturae* editors I had the pleasure to work with.

Conflicts of Interest: The author declares no conflict of interest.

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