Role Of Plant Growth Regulators In Enhancing Flowering In Commercial Floriculture

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Abstract
The goal of commercial floriculture is to optimize flower production to satisfy the demand of customers for advantage, attractive flowers. Plant growth regulators are essential for controlling the flowering processes that improve the quality, quantity, and marketability of crops used for ornamentation. Gibberellins, auxins, cytokinins, and abscisic acid are examples of PGRs that intimately interact with endogenous hormonal pathways and affect the induction, transition, and development of flowering. PGRs provide direct control over flowering timing and duration by modifying physiological processes such as bud initiation, differentiation, and maturity. Technological developments in biotechnological methods, PGR formulations, and application methods keep floriculturists supplied with a wider range of devices that are designed to meet particular crop needs and environmental conditions. In addition, we are learning more about PGR-mediated flowering control and discovering new regulatory pathways because of interdisciplinary investigations that integrate genetics, and physiology.

Keywords: Flower, PGRs, Quality, Flowering, Control.

Introduction

Plant growth regulators (PGRs) are synthetic compounds that control plant growth at low concentrations, distinct from natural plant hormones. They play a vital role in modifying plant growth processes. PGRs are classified into six main classes, including gibberellins, auxins, cytokinins, ethylene generators, growth inhibitors, and growth retardants. Additionally, polyamines and vitamins are also considered PGRs due to their impact on plant growth. The application of PGRs in floriculture can enhance the productivity and quality of ornamental plants, making them essential for commercial growers in the industry. In the field of floriculture, the use of plant growth regulators (PGRs) has become increasingly important for commercial growers seeking to enhance the growth and development of ornamental plants (Dias et al, 2015). Plant growth regulators are organic compounds that play a crucial role in modifying plant growth processes at very low concentrations. These regulators can act as bio-stimulants or bio-inhibitors, influencing various aspects of plant growth and development. Flowering is of significant importance in commercial floriculture as it is the primary factor that determines the market value of ornamental plants (Meenakshi, et al, 2017). The demand for cut flowers, potted flowering plants, and other ornamental plants is increasing globally, and the quality of flowers is a crucial factor that determines the marketability of these products. The use of plant growth regulators in floriculture has become increasingly important for commercial growers seeking to enhance the growth and development of ornamental plants (Reid, et al 2012). PGRs can be used to regulate plant growth, improve flower quality, and increase yield. For example, the application of PGRs such as GA_3 and NAA has been found to enhance the productivity of Marigold plants. Plant growth regulators (PGRs) are essential in regulating flowering in ornamental plants. They influence flowering by promoting or delaying the process, enhancing flower quality, regulating flowering time, and inducing flowering in non-flowering plants. PGRs such as gibberellins and cytokinins promote flowering by stimulating flower bud development and accelerating the flowering process. Conversely, some PGRs can delay flowering, allowing growers to synchronize flowering for commercial purposes or extend the flowering period. Additionally, PGRs play a role in improving flower quality, affecting factors such as size, color, and longevity (Pal, 2019). By manipulating PGR levels, growers can regulate the timing of flowering in response to environmental cues, enabling precise scheduling of flowering events. Furthermore, PGRs can induce flowering in non-flowering plants, particularly useful for ornamental plants requiring specific conditions to initiate flowering.

Regulation of Flowering by Plant Growth Regulators

Plant growth regulators (PGRs) intricately regulate flowering in plants through the coordinated action of various classes of PGRs. Auxins control apical dominance and bud growth, impacting flower initiation. Gibberellins stimulate stem elongation and flower development, promoting the transition to flowering (Pal, 2019). Cytokinins promote cell division and delay senescence, influencing flower bud formation. Abscisic acid regulates seed dormancy and stress responses, indirectly affecting flowering time. Ethylene plays a role in flower development stages and flowering time regulation in response to environmental cues. The balanced interaction of these PGRs is crucial for precise flowering regulation. Growers utilize PGR applications to synchronize flowering, induce off-season blooms, increase flower production, and enhance quality. Understanding the complex mechanisms by which PGRs influence flowering is vital for optimizing plant growth and maximizing flower yield in horticulture. By manipulating PGR levels, growers can fine-tune flowering processes to meet market demands and improve crop productivity.

Promotion of flower bud initiation

Promoting flower bud initiation is a crucial aspect of flower production in horticulture and floriculture. Several plant growth regulators (PGRs) can be used to stimulate flower bud initiation in plants. Cytokinins are a class of PGRs that promote cell division and differentiation, making them effective in promoting flower bud initiation (Sharp et al, 2009).
By increasing the number of cells in the meristem, cytokinins can stimulate the formation of flower buds. Applying cytokinins to plants during the vegetative stage can increase the number of flower buds and improve flower yield. Gibberellins are another class of PGRs that can promote flower bud initiation. Gibberellins stimulate stem elongation and flower development, making them effective in promoting the transition to the reproductive phase. By applying gibberellins to plants during the vegetative stage, growers can promote the formation of flower buds and improve flower yield.

Control of flowering time

Plant growth regulators play a crucial role in controlling flowering time in floriculture plants. They can be used to advance or delay flowering, depending on the desired outcome. For example, the foliar application of Gibberellic acid (GA_3) has been shown to induce early flowering in some ornamental plants. Additionally, plant growth regulators like auxins, gibberellins, ethylene, and abscisic acid can influence the sex expression, morphology, growth, and development of plants, ultimately affecting flowering (Chen, et al, 2005).

Enhancing flower bud development and size

To enhance flower bud development and size in ornamental plants, plant growth regulators can be utilized effectively. For instance, Gibberellic acid (GA) at a specific concentration is superior in promoting early flower formation. Additionally, Maleic hydrazide at a certain concentration has been shown to increase flower diameter significantly. Furthermore, plant growth regulators like Ethrel, GA, thio urea, IBA, and Cytokinin can be used to induce the sprouting of buds, which can contribute to enhanced flower bud development. By carefully selecting and applying appropriate plant growth regulators, growers can effectively enhance flower bud development and size in ornamental plants (Plantenga, et al, 2019)

Case Studies and Experimental Results

Effect of different levels of Gibberellic acid (GA_3), spacing, and depth of planting on growth, flowering, and corm production parameters in Gladiolus cv. Candyman was assessed. The treatments included four concentrations of GA_3 (0, 100, 250, and 500 ppm) as a foliar spray, three plant spacings (20 x 20, 30 x 20, and 40 x 20 cm), and two depths of corm planting (5 and 10 cm). The results showed that Gibberellic acid at 100 ppm, a plant spacing of 30 x 20 cm, and a planting depth of 10 cm resulted in maximum plant height, number of leaves per plant, length of leaf, and corm production. Investigated the effect of salicylic acid on the growth and flowering of Gladiolus. The foliar application of 100 ppm salicylic acid increased the number of leaves, leaf length, leaf width, number of flowers, emergence of earlier spike, and flower opening. Additionally, plants treated with a 50 ppm foliar spray of salicylic acid exhibited maximum plant height, rachis length, and floret diameter (Ram et al. 2012). These experimental results demonstrate the significant impact of plant growth regulators on the growth, flowering, and overall performance of ornamental plants in floriculture. By carefully selecting and applying the appropriate plant growth regulators, growers can optimize plant growth and development, leading to improved flower quality and yield. One study investigated the effect of pre-plant soaking of corms with chemicals and plant growth regulators on dormancy breaking and corm and cormel production in gladiolus. The study found that soaking corms in GA_3, NAA, and KNO_3 solutions for 24 hours before planting significantly reduced the dormancy period and increased the number of corms and cormels produced per plant. The highest number of corms and cormels per plant was observed in the GA_3 treatment, followed by the NAA and KNO_3 treatments. The study concluded that pre-plant soaking of corms with PGRs and chemicals can be an effective method for breaking dormancy and increasing corm and cormel production in gladiolus. This case study demonstrates the potential benefits of using PGRs in flower crop cultivation and highlights the importance of proper application methods to achieve desired results.

Challenges

While the utilization of plant growth regulators (PGRs) presents various advantages in flower crop cultivation, several challenges accompany their application. Firstly, the use of PGRs is subject to regulatory oversight, with regulations varying by country or region. Growers must be cognizant of the regulations in their area and ensure compliance to avoid legal complications. Secondly, challenges related to the application process can impact the effectiveness of PGRs, influenced by factors such as method, timing, and dosage. Adhering closely to application instructions is crucial for growers to achieve the desired outcomes. Thirdly, environmental factors, including temperature, humidity, and light, pose challenges to the efficacy of PGRs. Growers may need to adapt their application strategies based on environmental conditions to optimize results. Lastly, resistance development is a concern, as the overuse or misuse of PGRs can lead to reduced effectiveness over time. To mitigate this, growers should use PGRs judiciously and incorporate rotation with other management strategies to prevent resistance. Overall, while PGRs offer benefits, careful consideration and adherence to guidelines are essential to navigate these associated challenges successfully.

Economic Implications

The economic implication of flower crops is significant. Globally, many countries, including India, are involved in the cultivation of floricultural crops. In India, a substantial area is dedicated to floriculture, and the production and export of flowers contribute to the country's economy. In 2017-18, India produced a large quantity of flowers, both loose and cut, and also exported a significant amount of floriculture products to various countries (Glaeser, et al, 2018).

Cost-effectiveness of PGR application in floriculture

The cost-effectiveness of plant growth regulator (PGR) application in floriculture depends on various factors. High concentrations of PGRs used in foliar sprays can increase input costs and may lead to stunted growth. However, the choice of application methods, such as foliar spray, drenching, or pre-plant soaking, also influences the overall cost. For example, foliar application and soil drenching are commonly used by commercial growers, with relatively higher concentrations of PGRs employed in foliar sprays. On the other hand, pre-plant soaking of plant material in PGRs is a labor-saving and accurate dosing method. Using PGRs in lower doses can be economically favorable on a large scale, and the effectiveness of low doses can be enhanced by increasing the duration of dipping. It's also worth noting that the cost-effectiveness of PGR application may vary depending on the specific flower crop being cultivated and the desired results. Overall, considering the various application methods, concentrations, and specific requirements of each crop, the cost-effectiveness of PGR application in floriculture can be optimized through careful planning and implementation (Kumar, et al, 2019).

Conclusion

It provides valuable insights into the role and application of PGRs in the cultivation and improvement of flower crops, emphasizing the importance of proper application methods and the different effects of PGRs on plant growth and development. They can enhance the quality and marketability of products while reducing the need for labor-intensive tasks like pruning and plant maintenance. However, it is important to use them in conjunction with proper cultural practices such as appropriate fertility and irrigation management. It is also emphasized that plant growth regulators cannot compensate for poor production practices.

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