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Perspective

The crucial role of phytohormones in plant growth regulation

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INTRODUCTION

Phytohormones, also known as plant hormones or growth regulators, are signaling molecules that play a pivotal role in orchestrating various aspects of plant growth and development. These chemical messengers govern processes such as cell division, elongation, differentiation, and response to environmental stimuli. In this article, we delve into the diverse functions of phytohormones and their significance in the intricate web of plant growth regulation (Egamberdieva et al., 2009).

There are several classes of phytohormones, each with specific functions and influences on plant physiology. The major classes include auxins, cytokinins, gibberellins, abscisic acid, ethylene, and brassinosteroids. These hormones act individually or in concert to regulate plant growth at various stages of development (Depuydt et al., 2011).

Auxins, such as indole-3-acetic acid (IAA), are pivotal in controlling cell elongation and differentiation. They are primarily produced in the apical meristems and young leaves, influencing tropisms like phototropism and gravitropism. Auxins also play a role in root development and are involved in processes such as apical dominance (Panda et al., 2012).

Cytokinins, like zeatin, promote cell division and are crucial for shoot and root development. They counterbalance the effects of auxins, contributing to the maintenance of an optimal balance between cell division and elongation. Cytokinins are instrumental in the formation of lateral buds, preventing apical dominance (Santner et al., 2009).

Gibberellins (GA) are key regulators of stem elongation, germination, and flowering. They stimulate cell division and elongation in stems, promoting overall plant growth. Gibberellins are also involved in breaking seed dormancy and triggering the transition from the vegetative to the reproductive phase (Tassi et al., 2008).

Abscisic acid (ABA) functions as a stress hormone, regulating responses to environmental factors such as drought and salinity. ABA inhibits cell growth, promotes seed dormancy, and induces stomatal closure to minimize water loss. It acts as a crucial mediator in the plant's adaptation to adverse conditions (Alvey et al., 2005).

Ethylene is a gaseous hormone that plays a multifaceted role in plant growth and development. It regulates processes like fruit ripening, senescence, and abscission of leaves and flowers. Ethylene is also involved in responses to biotic and abiotic stresses, acting as a signaling molecule in stress adaptation (Javid et al., 2011).

Brassinosteroids contribute to cell elongation and division, impacting various aspects of plant growth, including stem elongation, vascular differentiation, and seed germination. They also play a role in the response to environmental cues and stress conditions (Gupta et al., 2011).

Phytohormones rarely act in isolation; rather, they engage in intricate cross-talk and synergistic interactions. The balance and coordination of these hormones are crucial for the precise regulation of plant growth. For instance, auxins and cytokinins work together to control cell division and differentiation, while the interaction between gibberellins and abscisic acid influences seed dormancy and germination (Guo et al., 2011).

As research in this field continues to advance, we gain deeper insights into the language of phytohormones,

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unraveling the mysteries of their impact on the flourishing world of plants. These signaling molecules play most important role in plant (Schäfer et al., 2015).

CONCLUSION

Phytohormones serve as the conductors of the symphony of plant growth, orchestrating a harmonious interplay of cellular processes. Understanding the roles and interactions of these hormones is essential for developing strategies to optimize crop yield, enhance stress resistance, and unlock the secrets of plant development.

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