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Opinion Article

Impact of Nutrient Deficiency and pH on Biomass Yield and Steviol Glycoside Levels in Hydroponically Grown Stevia

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DESCRIPTION

The rise of *Stevia rebaudiana* Bertoni as a natural sweetener has been nothing short of remarkable. With its approval in Western countries and the increasing demand for healthier alternatives to sugar, Stevia has captured the attention of both consumers and the food industry alike. At the heart of this botanical wonder lie its sweet-tasting compounds known as Steviol Glycosides (SGs), with Rebaudioside A (Reb-A) reigning supreme for its superior flavor profile.

However, behind the scenes of this sweet success story lies a complex exchange of factors that determine the quality and quantity of SG production in Stevia plants. Among these factors, nutrient availability and pH levels play pivotal roles in shaping the growth and biochemical composition of *Stevia rebaudiana*. Understanding and optimizing these factors is essential for unlocking the full potential of Stevia cultivation and ensuring a sustainable supply of high-quality SGs.

In recent years, research efforts have focused on unraveling the effects of nutrient deficiencies on Stevia biomass production and SG concentration. Studies conducted under controlled hydroponic conditions have shed light on the impact of omitting specific macronutrients (such as nitrogen, phosphorus, sulfur, magnesium, and calcium) and micronutrients (including copper and iron) on plant growth and SG levels. The findings have revealed intriguing insights, showcasing how deficiencies in essential nutrients can significantly hinder both leaf yield and SG content in *Stevia rebaudiana*.

For instance, deficiencies in nitrogen and phosphorus have been found to lead to reduced leaf yield and SG content, highlighting the critical role of these macronutrients in Stevia growth and SG biosynthesis. Surprisingly, the lack of nitrogen has been associated with higher concentrations of stevioside in the leaves, albeit at the expense of overall SG production. Similarly, deficiencies in micronutrients like copper and iron have been shown to negatively impact SG yield, underscoring the importance of micronutrient management in Stevia cultivation.

Moreover, pH levels in the nutrient solution have emerged as another key determinant of Stevia growth and SG production. Stevia plants grown under neutral to alkaline conditions have exhibited poor growth compared to those cultivated in slightly acidic environments. This finding underscores the critical importance of maintaining optimal pH levels, preferably below 7, to maximize leaf yield and SG concentration in *Stevia rebaudiana*.

As it navigate the intricacies of Stevia cultivation, it is imperative to recognize the multifaceted nature of nutrient management. Achieving optimal growth and SG production requires a delicate balance of macronutrients, micronutrients, and pH levels tailored to the specific needs of Stevia plants. By meticulously fine-tuning these factors, growers can unlock the full potential of Stevia cultivation and ensure a bountiful harvest of high-quality SGs. According to understanding of Stevia nutrition continues to evolve, there is still much to learn. Further research, particularly in open-field conditions over multiple growing seasons, is needed to validate and refine the findings. By collaboratively advancing the knowledge and sharing best practices, we can pave the way for a thriving Stevia industry that meets the growing demand for natural, healthy sweeteners.

CONCLUSION

The study of *Stevia rebaudiana* Bertoni from obscurity to a prominent natural sweetener underscores the intricate relationship between nutrient management and the production of Steviol Glycosides (SGs). As search deeper into understanding the complex interplay of factors affecting Stevia cultivation, it becomes evident that optimizing nutrient availability and pH levels is paramount for fostering healthier and more productive Stevia plants. The research findings elucidate the profound impact of nutrient deficiencies, particularly nitrogen, phosphorus, and micronutrients like copper and iron, on both leaf yield and SG content. Moreover, the significance of maintaining optimal pH levels, preferably below 7, for maximizing Stevia growth and SG concentration cannot be overstated. While our understanding of Stevia nutrition continues

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to evolve, it is clear that collaborative efforts and further research, especially in open-field conditions, are essential to validate and refine existing findings. By embracing a holistic approach to nutrient management and sharing best practices, we can unlock the full potential of Stevia cultivation, ensuring a sustainable supply of high-quality SGs to meet the growing demand for natural, healthy sweeteners. Together, let us embark on this journey to harness nature's bounty and sweeten the world with Stevia's remarkable sweetness.