Biostimulants Enhance the Nutritional Quality of Soilless Greenhouse Tomatoes

Hayriye Y. Dasgan[1*], Kahraman S. Aksu[1], Kamran Zikaria[1], and Nazim S. Gruda[1,2,3]

[1] University of Cukurova, Adana, Turkey
[2] University of Bonn, Bonn, Germany and Academy of Sciences of Albania, Tirana, Albania

*Corresponding author: dasgan@cu.edu.tr

Keywords: antioxidants; fruit quality; hydroponics plant growth; produce quality; *Solanum lycopersicum* L.; yield.

The application of biostimulants in vegetable cultivation has emerged as a promising approach to enhance the nutritional quality of crops, particularly in controlled environment agriculture and soilless culture systems. Although much research has focused on improving growth and yield through environmental adjustments, there is limited investigation into how biostimulants affect the nutritional quality of tomatoes in soilless systems. Given the critical importance of tomato quality for human health and overall produce value, this research aims to address this gap. We hypothesize that specific biostimulants can improve the physical fruit properties and enhance the nutritional quality of tomatoes without compromising yield. Here, we employed a rigorous methodology, applying various biostimulants amino acids, Plant Growth-Promoting Rhizobacteria (PGPR), fulvic acid, chitosan, and vermicompost along with mineral fertilizers, both foliar and via the roots, to soilless greenhouse tomatoes during spring cultivation. The experiment, conducted in a coir pith medium using the 'Samyeli F1' tomato cultivar, demonstrated that plants treated with biostimulants performed better than control plants. Notable variations in nutritional components were observed across treatments. PGPR had the best effects on the physical properties of the tomato fruit, showing the highest fruit weight, fruit length, equatorial diameter, fruit volume, fruit skin elasticity, and fruit flesh hardness while maintaining high color parameters L, a, and b. PGPR and fulvic acid demonstrated significant enhancements in total phenolics and flavonoids, suggesting potential boosts in antioxidant properties. Amino acid and vermicompost notably elevated total soluble solids, indicating potential fruit sweetness and overall taste improvements. On the other hand, vermicompost stood out for its ability to elevate total phenolics and flavonoids while enhancing vitamin C content, indicating a comprehensive enhancement of nutritional quality. In addition, vermicompost had the most significant impact on plant growth parameters and total yield, achieving a 43% increase over the control with a total yield of 10.39 kg/m2. These findings underline the specific nutritional benefits of different biostimulants, offering valuable insights for optimizing tomato cultivation practices to yield produce with enhanced health-promoting properties. The novelty lies in evaluating their effects under controlled conditions, specifically targeting nutritional enhancement. The results highlight the potential for practical applications in modern agricultural systems, offering growers innovative strategies to improve nutritional quality, apart from yield. Future research should focus on in-depth mechanistic studies of individual biostimulants to further elucidate their specific modes of action at the molecular and physiological levels. Additionally, investigating the synergistic effects of combining different biostimulants, such as PGPR and vermicompost, could reveal interactions that further optimize tomato quality. Examining how these biostimulants interact with genetic, environmental, and agronomic factors will be essential to fully leverage their potential in improving the nutritional value and overall productivity of soilless culture tomato systems.

For the complete publication, please see:
Dasgan HY, Aksu KS, Zikaria K, Gruda NS 2024. Biostimulants Enhance the Nutritional Quality of Soilless Greenhouse Tomatoes. Plants 13(18):2587. https://doi.org/10.3390/plants13182587