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Artykuł:
Multimodal Spectroscopic Studies to Evaluate the Effect of Nod-Factor-Based Fertilizer on the Maize (Zea mays) Stem.

Abstract

Maize (*Zea mays*) is one of the most cultivated plants in the world. Due to the large area, the scale of its production, and the demand to increase the yield, there is a need for new environmentally friendly fertilizers. One group of such candidates is bacteria-produced nodulation (or nod) factors. Limited research has explored the impact of nodulation, factors on maize within field conditions, with most studies restricted to greenhouse settings and early developmental stages. Additionally, there is a scarcity of investigations that elucidate the metabolic alterations in the maize stem due to nod-factor exposure. It was therefore the aim of this study. Maize stem's metabolites and fibers were analyzed with various imaging analytical techniques: matrix assisted laser desorption ionization–mass spectrometry imaging (MALDI-MSI), Raman spectroscopy, attenuated total reflection Fourier transform infrared spectroscopy (ATR FT-IR), and diffuse reflectance infrared Fourier transform spectroscopy. Moreover, the biochemical analyses were used to evaluate the proteins and soluble carbohydrates concentration and total phenolic content. These techniques were used to evaluate the influence of nod factor-based biofertilizer on the growth of a non-symbiotic plant, maize. The biofertilizer increased the grain yield and the stem mass. Moreover, the spectroscopic and biochemical investigation proved the appreciable biochemical changes in the stems of the maize in biofertilizer-treated plants. Noticeable changes were found in the spatial distribution and the increase in the concentration of flavonoids such as maysin, quercetin, and rutin. Moreover, the concentration of cell wall components (fibers) increased. Furthermore, it was shown that the use of untargeted analyses (such as Raman and ATR FT-IR, spectroscopic imaging, and MALDI-MSI) is useful for the investigation of the biochemical changes in plants.