Resumos do VI SBGMP • 28 de maio a 2 de junho de 2017
Parque Metalúrgico Augusto Barbosa Centro de Artes e Convenções da UFOP • Ouro Preto • MG
www.sbg.org.br - ISBN978-85-89109-06-2

PHYSIOLOGICAL AND MOLECULAR RESPONSES TO A HUMIC ACID BIOSTIMULANT TREATMENT IN MAIZE PLANTS

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Palavra-chave: root morphology, gene expression, auxin, ATPase, plant growth regulators

Humic substances (HS) have been widely used as plant growth promoter as it changes root morphology, which result in increased root surface area and branching. A mechanism for HS bioactivity based on the classical acid growth theory described an auxin-like induction of protein synthesis and activation of the plasma membrane H^+-ATPase in maize roots. Biostimulants benefit plant productivity by interacting with plant signaling processes thereby reducing negative plant response to stress and enhancing nutrition efficiency, and/or crop quality traits, regardless of its nutrients content. Produce more in a same area and reduce the environmental impacts is fundamental for sustainable agriculture and understand the biostimulant effect on plants is key for the establishment of a legitimate regulation. In this context, this study aimed to investigate the physiological and molecular responses to a commercial based-HS biostimulant treatment in maize plants grown in nutrient solution. Maize seeds L521274/CMSM033 from Embrapa Maize and Sorghum were sterilized, germinated for four days and transferred to ½ Hoagland´s nutrient solution (pH 5.65) in a floating system for acclimation for seven days. The Black Gold® (Fortgreen) biostimulant (54, 4 µL L^{-1}) was added to the nutrient solution and the plants stayed at the growth chamber in controlled conditions for more seven days. Root morphology traits, dry weight and macro and micronutrients content were assessed in the root and shoot of maize plants treated with the biostimulant and control. Seventeen genes related to auxin, cell differentiation, cell elongation and ATPase pathways were profiled with real time PCR using SYBR method. The plants treated with the biostimulant showed a significant increase in total root length, root surface area, surface area of roots with diameter 0-1 mm, 1-2 mm and >2 mm, in root, shoot and total dry weight. There was an increase in sulfur and manganese content and a reduction in copper content in the shoot of treated plants when compared to the control. ZmPIN9 gene was more expressed in the root of plants treated with the biostimulant while ZmPIN1c, ZmPlt1 and ZmNrt2.1 were repressed. Our results so far indicate the based-HS biostimulant increases root surface not due to nutrient uptake but due to a cell division stimulation and cell elongation, involving auxin regulation.

Supported by EMBRAPA, FAPEMIG and UFSJ