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Effects of high-pressure plasma treatments on the germination of barley seeds under stressful environments

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Cold plasmas treatments on biological and organic materials are widely recognized in applications ranging from activation to sterilization. Within plasma technology in agriculture, one of the most outstanding results is the influence of the plasma treatment of seed surfaces in the germination rate. Germination is influenced by the state of the seed and also by its interaction with the environment. Environment, starting with the consequences of climate change, determines from the type of crop that can be produced to the irrigation method or the appropriate fertilizers among other factors. Consequently, plasma discharges can trigger the tolerance of plants to various abiotic and biotic stress. In this work, we explore the effect of a high-pressure air plasma treatment on the surface of barley seeds when they are grown under several environmental conditions simulating the climate change. We have studied the barley germination in substrate under drought, salinity and cold conditions after being exposed to the plasma discharge. Analysis of the water uptake has been performed for the plasma treated seeds comparing the influence in the different environments. Moreover, chemical and morphological changes in the treated seed surfaces under stressful germination conditions were studied with techniques such as Scanning Electron Microscopy, Energy Dispersive X-Ray Spectroscopy or X-ray Photoelectron Spectroscopy. The results show that the plasma treatment enhances the germination factors in unfavorable environments without significant alterations of the water uptake capacity and the height of the developed plants. These studies have been complemented with the determination of pigments (chlorophylls and carotenoids) and proline content in leaves of the barley that emerges after being treated with plasma as indicators of stress level and plant development under different culture conditions. The results indicate a better development and photosynthetic productivity after the plasma treatment and points to a decrease of the osmotic stress in plants.

Biography

Perea-Brenes holds a Master's degree in Agronomic Engineering from the University of Seville with complementary training in quality control, aid management and advice to farms. My main motivation and objective is to make agriculture as sustainable an activity as possible, reducing the use of phytosanitary products and potentially polluting inputs in the agricultural field, with the introduction of processes and techniques that favor productivity and are more respectful of the environment ambient. In 2020 I begin my stage as a Research Graduate at the Institute of Materials Sciences in Seville, under the project "Development of new cold plasmas to accelerate germination under abiotic stress conditions". Currently, I am a doctoral student and I am part of the research staff of the University of Seville in the project "Surface functionalization and diffusion models of germination factors in plasma-treated seeds - PLASMASEED".

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