5th International Workshop on Plasma Agriculture

Ensuring Productivity, Food Safety & Environmental Sustainability

Drexel University Main Campus

Bossone Research Enterprise Center, 3140 Market St, Philadelphia, PA 19104

June 8, 2025 - June 12, 2025

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Welcome to IWOPA5!

Explore the latest insights, connect with global experts, and collaborate to advance agriculture and environmental sustainability through plasma technology.

Registration

Opening Ceremony Speakers

Alexander Fridman

Drexel University, USA

Christopher Sales

Drexel University, USA

Zdenko Machala

Comenius University Bratislava, Slovakia

“Plasma-Activated Water Applications For Plant Growth Enhancement: Seed Priming, Hydroponics, Aeroponics, And Outdoor Planting”

9:30 - 10:00 — Monday, June 9th, 2025

About the Speaker

Stephan Reuter

Polytechnique Montréal, Canada

10:00 - 10:30 — Monday, June 9th, 2025

About the Speaker

Katharina Stapelmann

North Carolina State University, USA

“Optimization of Generation and Transport of RONS for Efficient N Fixation in Plasma-Treated Water”

Session: Ensuring Productivity Plenary Talk.

Time: Monday, June 9th, 09:30 – 10:00.

Plasma-Activated Water Applications for Plant Growth Enhancement: Seed Priming, Hydroponics, and Outdoor Planting

Adriana Mišúthová, Ramin Mehrabifard, Mustafa Ghulam, Zuzana Lukačová, Božena Šerá, Zdenko Machala

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Cold atmospheric plasma generates reactive oxygen and nitrogen species (RONS), which are transported into water to produce plasma-activated water (PAW). The effects of PAW produced by various air discharges (transient spark, glow discharge, fountain dielectric barrier discharge, microwave plasma) were tested on various agricultural plants: e.g. pea, bean, lettuce. The RONS concentrations (H_2O_2, NO_2^-/NO_3^-) of each PAW type differ markedly.

The primary tests focused on seed germination parameters, did not show much effect of the imbibition in PAW with respect to control tap water. Using PAW for plant irrigation of foliar application proved effects on the plant growth, when cultured in soil both in laboratory and outdoor conditions. When PAW is used for priming, the oxidative-nitrative stress imposed to the seeds affects the following plant growth and development. This is expressed by modified plant and root length, fresh and dry weight, leaf characteristics, photosynthetic pigments, as well as multiple antioxidant enzymes. The priming effect of PAW was even enhanced by an additional foliar application. Most remarkable for agricultural production, PAW seed priming caused significantly higher yield of peas during outdoor planting.

Combination of PAW seed priming and hydroponic cultivation in PAW, represents a promising strategy e.g. for leaf-producing vegetables. In addition to the increased growth parameters, the sensory analysis indicated improved taste, odor, texture, and visual appearance of lettuce primed by and cultivated in PAW.

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