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Influence of reactive nitrogen species generated at low-pressure RF plasma on the seedling growth

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Plasma agriculture has been gaining tremendous attention in recent years to increase seed germination, seedling growth, and yield [1-3]. Although in some cases, the negative or no effects of plasma treatment was also observed [1]. Several factors influence the negative and positive effects of plasma on seeds, but plasma generated reactive species are crucial in plasma agriculture. To unlock the role of mores especially reactive nitrogen species (RNS) species, on the seeds, we treated the radish seeds with low-pressure RF plasma with N_2 feed gas for various time intervals (Figure 1). Additionally, we used the radish seeds with two different seed coat colors and treated them under two other conditions (dry and wet treatment). We can understand the possible role of seed coat color and the effect of humidity on seed germination, seedling growth, and changes in phytohormone (Abscisic acid) and antioxidant (γ-tocopherol) levels after plasma treatment. Further, we also performed the electron paramagnetic resonance spectroscopy (EPR) analysis to find any possible changes in the paramagnetic species of the radish seeds under low-pressure plasma. We also included 1D simulation using COMSOL Multiphysics® software to determine how the potential RNS (especially the N-species like NO, NH, N, etc.) generated using low pressure plasma (Figure 1). Our results clarify that seed coat color and humidity influence plasma effects on seed germination, phytohormone, and antioxidant levels.

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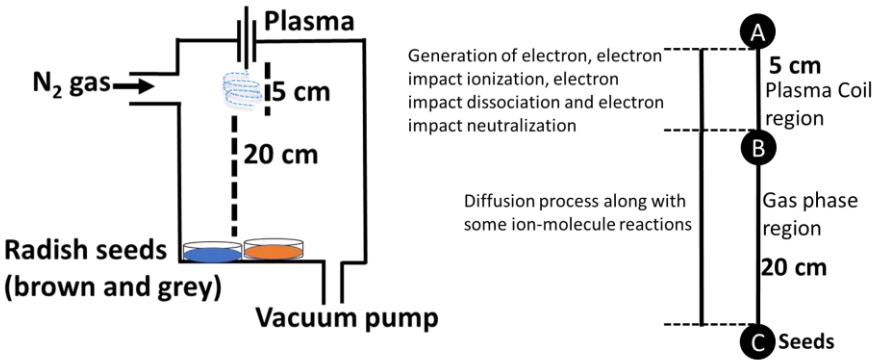

Figure 1. Schematic diagram of low-pressure plasma treatment conditions and 1D-simulation of reactive species using COMSOL Multiphysics® software.