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Optimizing Tomato Seed Performance Through Cold Atmospheric Plasma: Effects on Germination Rates and Early Biomass Development

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Atmospheric Cold Plasma – an Eco-Friendly Technology that can improve the early development of tomato plants (*Solanum lycopersicum*)



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In the context of the current challenges facing agriculture - including the growing demand for food, the degradation of natural resources, and the need to reduce the use of pesticides and chemical fertilisers - the effects of atmospheric-pressure cold plasma generated by dielectric barrier discharge (DBD) on tomato seeds (*Solanum lycopersicum*) were investigated.

Cold plasma is a partially ionised gas produced at temperatures close to ambient temperature, which allows biological material to be treated without causing thermal damage. In agriculture, this technology is used to treat seeds before sowing, a process known as seed priming. During treatment, reactive oxygen and nitrogen species are generated, altering the properties of the seed surface and promoting the activation of physiological processes involved in germination and seedling development.

The study evaluated two tomato genotypes - a common cultivar and an IdB hybrid - whose seeds were exposed to atmospheric-pressure cold plasma for 1, 2, 3, and 4 minutes. After 47 days of development under controlled laboratory conditions, the germination rate, fresh biomass, dry biomass, and mineral content of the seedlings were analysed.

The study results showed that the duration of tomato seed exposure to atmospheric-pressure cold plasma is the determining factor in the effectiveness of this non-thermal technology. Of all the experimental treatments analysed, the one-minute treatment produced the best results, stimulating early seedling development and increasing fresh, dry, and mineral biomass. These findings indicate that short-term exposure can activate physiological processes that promote germination and vigorous plant development from the earliest stages of growth. By contrast, longer exposure times of 3 and 4 minutes harmed seedling development, resulting in reductions in the analysed growth parameters. This response suggests that there is an optimal treatment duration beyond which the stimulatory effects of atmospheric-pressure cold plasma diminish. At the same time, excessive exposure may induce physiological stress and restrict normal plant development.

The scientific article is available open access here: <https://www.mdpi.com/2223-7747/15/13/2093>.



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