

## Effects of seed treatment with cold plasma, vacuum and electromagnetic field on growth and production of secondary metabolites of industrial hemp.

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In this study the effects of seed treatments with vacuum (V, 100 Pa, 3 and 5 min.), electromagnetic field (10 kHz, EMF), and two types of cold plasma (low pressure cold plasma, CP and atmospheric dielectric barrier discharge plasma, DBD plasma) on germination, growth and content of cannabidiol (CBD) in flowers and leaves of two cultivars of industrial hemp (cv. 'Futura 75', cv. 'Santhica 27') were determined. Seed treatments with V did not have significant effect on germination and plant growth for both cultivars but increased content of CBG. EMF treatment increased biomass production in two cultivars of industrial hemp but changes in secondary metabolism are cultivar dependent and were observable only after longer seed exposure to EMF (3 min).

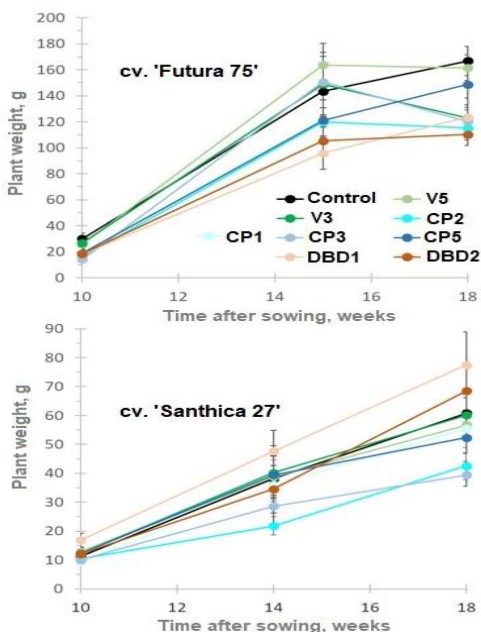


Figure 1. Changes in female plant weight induced by seed treatment with V (3 and 5 min), CP (1,2,3,5 min) and DBD (1 and 2 min) plasma.

Effects of CP on hemp germination were positive, however growth of female plants was inhibited both for cv. 'Futura 75', cv. 'Santhica 27'. Seed treatments with DBD plasma reduced growth of 'Futura 75', but strongly stimulated biomass gain in cv. 'Santhica 27', while changes in biomass of flowers and the amounts of secondary metabolites were dependent on the cultivar. The obtained results confirmed findings obtained by using seed treatment equipment (V, CP, EMF) with of different construction and parameters [1] and provided evidence for the potential of Plasma in Agriculture technologies.

### Reference

[1] A. Ivankov et al, *Applied Sciences*, 10(23), 8519, (2020).

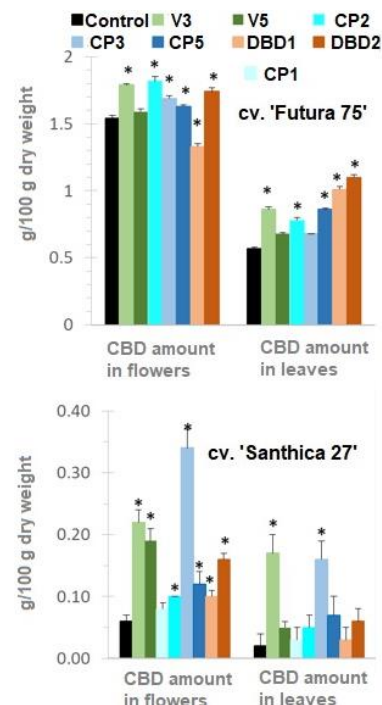


Figure 2. Changes CBD content in flowers and leaves induced by seed treatment with V (3 and 5 min), CP (1,2,3,5 min) and DBD (1 and 2 min) plasma.