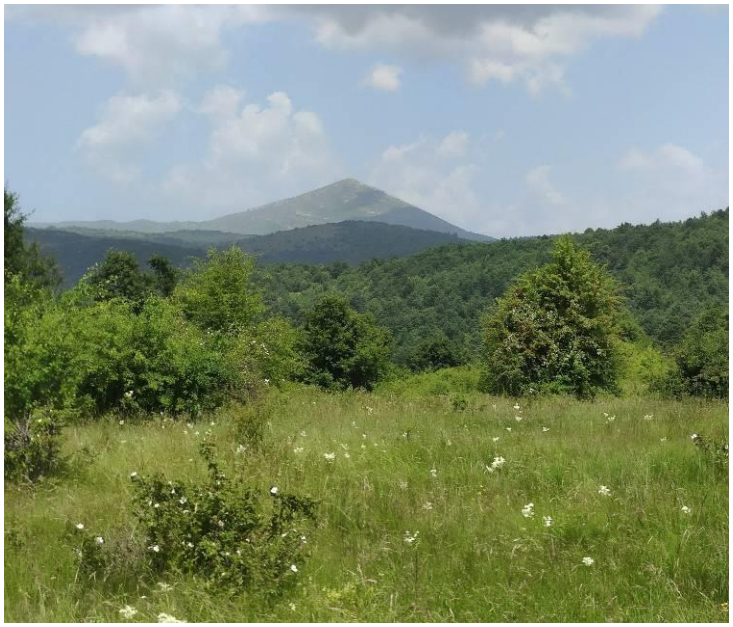
Serbian Society of Soil Science

University of Belgrade, Faculty of Agriculture

BOOK OF ABSTRACTS

3rd International and 15th National Congress

SOILS FOR FUTURE UNDER GLOBAL CHALLENGES



21–24 September 2021

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SYNERGISTIC EFFECT OF *BACILLUS* ISOLATES AND BIOMASS ASH ON SOIL AND BARLEY PLANT QUALITY

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Abstract

The production of heat and electricity through the thermal use of biomass has increased in the last fifteen years. In parallel with this way of energy production, there was a strong increase in the amount of combustion residues. The utilization of biomass ash in agriculture may have two advantages. It could contribute to the sustainable management of soil fertility and solve the problem of ash deposits. In combination with microbial inoculants, they can have a beneficial effect on plant growth. The research studied the influence of biomass ash and *Bacillus* inoculums on the quality of soil and barley plant. Biomass ash was collected after the combustion of soybean straw, while *Bacillus* sp. were isolated from the rhizosphere soil of alfalfa. The presence of PGP traits (Indole-3-Acetic Acid and siderophores) was confirmed by quantitative tests for the three *Bacillus* isolates used (B1, BS1, BMG1). Inoculation of seeds with *Bacillus* inoculums (*in vitro*) showed a significant effect on seedling growth compared to the uninoculated control. The greenhouse pot experiment included five treatments and two controls. Treatments included soil (3 kg/pot) and biomass ash (30 g/pot) with and without calcium ammonium nitrate (CAN, with 27% of nitrogen, 0.3 g/pot) or with bacterial inoculum (1 mL of overnight B1, BS1 or BMG1 culture), while controls included experimental soil with and without the addition of CAN. The ash, soil and plants (collected in crop maturity stage) samples were tested for: total N, C, S, and plant available P_2O_5 and K_2O and the content of potentially toxic and hazardous microelements (As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Zn). Biomass ash addition significantly reduced soil acidity and increased the content of available P and K compared to controls. In the treatments where ash and microorganism were added in combination, the content of available P increased compared to the ash treatment. The yield of barley biomass increased more than twice in ash treatment and 87.62 % in ash+BMG1 treatment compared to the control (without any additives). The lowest barely yield was obtained in control where CAN fertilizer was added. Content of potentially toxic microelements in soil and barley shoots were below the maximum allowed concentrations. Application of biomass ash alone was effective in terms of soil nutritional and physical properties resulting in yield increase. The addition of ash in combination with *Bacillus* isolates resulted in a higher barley biomass yield than the combination of ash with CAN. This study showed that the analyzed biomass ash could be used as a fertilizer on acid soils with low nutrients content alone or in combination with bacterial inoculants. This synergistic effect can give an eco-friendly approach in agriculture in order to reduce the need for chemical fertilizers.

Keywords: *Bacillus*, biomass ash, soil, plant, nutrient, trace elements.