Proceedings of the 2nd World Congress on New Technologies (NewTech'16)
Budapest, Hungary – August 18 – 19, 2016
Paper No. ICEPR 130
DOI: 10.11159/icepr16.130

Sulfur Supply Attenuate Cd Damage on Photosynthetic Apparatus of Massai Grass Used For Phytoextraction

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Extended Abstract

The photosynthetic system of plants is greatly affected by cadmium (Cd) due to chlorophyll degradation, changes in electron transport process between the photosystems I and II, and decreasing of enzyme activities involved in carbon assimilation, among other factors [1]. So it's important to use strategies that attenuate the damage caused by Cd in plants with potential for phytoextraction of this metal. Sulfur (S) participates in chlorophyll synthesis and is a component of amino acids, antioxidants, iron-sulfur groups and thioredoxin system that are essential for the formation of the photosynthetic system [2]. Thus, our objective with this study was to evaluate if the S supply attenuates the damage caused by Cd in *Panicum maximum* cv. Massai through the evaluation of net photosynthetic rate - Pn, stomatal conductance - Gs, CO_2 internal content - Ci, carboxylation efficiency and shoot biomass production. The Massai grass was grown in nutrient solution under combinations of three S rates (0.1, 1.9 and 3.7 mmol L^{-1}) and three Cd rates (0.0, 0.1 and 0.5 mmol L^{-1}). Twenty-three days after sowing was started the supplying of nutrient solution with effective concentrations of nutrients, for nineteen days, and modified to meet the S rates. Then, the nutrient solution with effective concentrations of S and Cd was supplied for 7 days. The Pn, Gs, and Ci were measured with gas analyzer for infrared radiation (first recently expanded leaf), with photosynthetically active radiation fixed at 1,400 µmol m^{-2} s^{-1}, CO_2 atmospheric concentration of 400 ± 20 µmol mol^{-1} CO_2 and natural conditions of temperature (30.5 ºC) and air humidity (60.5%). Plants were harvested and leaves were placed in a leaf area (LA) meter to obtain Pn and Gs per plant (Pn x LA and Gs x LA) and right after, in a forced ventilation stove at 60 °C for 72 hours to determinate the biomass production (dry mass). The instantaneous carboxylation efficiency was obtained by dividing the Pn by Ci [3]. Data were submitted to analysis of variance (F test) and comparison of means by Tukey test ($p<0.05$). The higher Pn and Gs were observed in plants grown without Cd and with 1.9 mmol L^{-1} S and when there was availability of 0.1 and 0.5 mmol L^{-1} Cd, the supply of 1.9 mmol L^{-1} S increased Pn at 45 and 9%, and Gs in 49 and 12% in relation to the lowest S rate, respectively. The 3.7 mmol L^{-1} S supply increased Ci in plants grown without Cd and with 0.1 mmol L^{-1} Cd. Similarly, higher efficiency carboxylation occurs in plants supplied with 3.7 mmol L^{-1} S and exposed to 0.1 mmol L^{-1} Cd (0.55 µmol m^{-2} s^{-1} Pa^{-1}). The higher biomass production occurred in plants grown without Cd and supplied with 1.9 mmol L^{-1} S, but on the other hand, when Massai grass was exposed to higher Cd rate, S rate of 1.9 mmol L^{-1} also resulted in higher biomass production (52% higher compared to plants grown with lower S rate), suggesting that the S attenuates the Cd damage in Massai grass.

Financial support and scholarship: São Paulo Research Foundation (FAPESP, Grants 2014/16731-7, 2014/18735-0 and 2015/21562-2).

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