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Entitled

Combined Impacts of CO_2 Enrichment and Water Stress on Growth and Physiology of Plants Inoculated with ACC Deaminase Producing Rhizobacteria

by

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Abstract

The aim of this study was to assess the combined impacts of elevated CO_2 and watering treatment (WT) interactions on different plant growth and ecophysiology related variables and how the addition of PGPR modifies the existing drought stress mitigation effects of elevated CO_2. For this, an ACC deaminase producing PGPR (isolate 22) and a non-ACC deaminase producing PGPR (isolate 5) isolated from the rhizosphere of *Zygophyllum* spp. were used. Two greenhouse experiments were conducted using twelve different CO_2*WT*PGPR treatment combinations to assess their effects on the growth and physiology of Rhodes grass (*Chloris gayana*) and Alfalfa (*Medicago sativa*) plants. Greenhouse experiments showed no change in whole plant biomass in water-stressed Alfalfa plants exposed to 1000 ppm CO_2 indicating water-stress mitigation by the elevated CO_2. However, in Rhodes grass, 1000 ppm CO_2 could not completely nullify water-stress effects on plant biomass. In presence of the ACC deaminase producing PGPR (isolate 22), water-stressed Alfalfa plants in 1000 ppm CO_2 showed further increase in growth. In Rhodes grass plants, the combination of 1000 ppm CO_2 and isolate 22 led to the mitigation of water stress effects on growth. Stomatal conductance decreased for the 1000 ppm CO_2 and water stress combination for both plant species. Addition of isolate 22 in combination with 1000 ppm CO_2 and water stress did not change stomatal conductance for both plants in both greenhouse experiments, except for Alfalfa plants in the second greenhouse experiment, where isolate 22 increased stomatal conductance. Accumulation of abscisic acid increased in response to 1000 ppm CO_2 and water stress combination for both plant species in both greenhouse experiments. In response to 1000 ppm CO_2, water stress, and isolate 22 combination, ABA content decreased for Alfalfa plants in the second greenhouse experiment. Rhodes plant in both greenhouse experiments and Alfalfa in the first greenhouse experiment were not affected by the 1000 ppm CO_2, water stress, and isolate 22 combination. Our results indicated that inoculation with ACC deaminase producing bacteria (isolate 22) could be a useful method, in combination with 1000 ppm CO_2, to mitigate water stress effects on plant growth. Future studies using different CO_2 concentrations at different water stress levels for multiple species of PGPR under different combinations of environmental conditions are recommended to assess the broad impacts of the CO_2*WT *PGPR interactions on plants growing in different environments.

Keywords: Elevated CO_2, water stress, ACC deaminase producing rhizobacteria, whole plant biomass, stomatal conductance, abscisic acid.