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Session: WATER

Water Stress Response of Different Quinoa Genotypes Grown with and without Woody Biochar

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Drought stress due to current climate change scenarios poses a significant threat to crop production, necessitating the adoption of efficient strategies to meet global food demand. Soil application of organic amendments, such as biochar, could be a viable agronomic option to face the adverse effects of drought on plant growth and yield, particularly in arid and semi-arid agricultural areas. Biochar is extensively reported to improve soil's characteristics including structure, porosity, water-holding capacity and hydraulic conductivity, cation and anion exchange capacity, nutrient retention, and its availability. Quinoa (*Chenopodium quinoa* Willd.) is a grain crop that has gained worldwide attention over the past decades, due to its nutritional and functional properties and its ability to adapt to adverse growing conditions (marginal soils, drought, salinity and cold). However, quinoa genome displays a wide degree of variability in abiotic stresses tolerance, including drought. Therefore, the present study aimed at investigating the response of different quinoa genotypes to water stress conditions during the vegetative growth phase, through biochar application. In a greenhouse pot experiment, quinoa genotypes of different origins, including the Danish Titicaca, the Italians Quipu and Regalona, and the Pakistani UAFQ7 and Q126, were grown without and with woodchip biochar at 0% (B0) and 2% (B2) rates (dry weight basis), under well-watered conditions (WW; restitution of 100% ET losses whenever soil was at 70% of the AWC) and water-stressed conditions (WS; by withheld watering until soil reached the permanent wilting point in two consecutive stress cycles). Each treatment was replicated thrice, and plant response was assessed by monitoring a set of growth attributes, i.e. plant height, number of leaves and branches, fresh and dry biomass production. A statistical factorial CRD (three way) analysis was applied to experimental data by using RStudio software. Overall, the results showed a significant reduction in plant growth under water stress conditions in all quinoa genotypes grown on both B0 and B2. However, under WS conditions, biochar application significantly increased the number of leaves (NL) and leaf area (LA) of UAFQ7 plants, with increase of 36% and 15%, respectively, compared to UAFQ7 ones grown on B0, which in turn were not statistically different from those grown without biochar and in WW conditions. Still under WS conditions, the Italian Quipu showed 16% and 7% increases of NL and LA, respectively, in B2 compared to B0. The Danish variety Titicaca appears to be more sensitive to drought due to significant growth reduction compared to other genotypes. These first findings suggest that the amendment of soil with

woodchip biochar could be a successful strategy to promote the quinoa's vegetative growth, although its efficiency depends upon the chosen genotype. Moreover, the tested genotypes could represent valuable resources for further investigations on quinoa plant tolerance to water stress in open field and during all growing cycle.