Tropentag, September 17-19, 2018, Ghent

"Global food security and food safety:
The role of universities"

Biochar Soil Amendment Improves Wheat (*Triticum aestivum*) Resistance to Drought

Wesam Mansour[1], Bahaa Salim[2], Mohammed Abd El-Rasoul[3], Sayed Hussin[4]

[1]*Faculty of Agriculture, Ain Shams University Cairo, Egypt, Agricultural Botany, Egypt*
[2]*Faculty of Agriculture, Ain Shams University Cairo, Egypt, Agricultural Botany,*
[3]*Faculty of Agriculture, Ain Shams University Cairo, Egypt, Agricultural Botany,*
[4]*Justus-Liebig University Giessen, Inst. of Plant Ecology, Germany*

Abstract

Implementation of adaptive measures to resilience agroecosystems to drought is one of the key tasks of green biotechnology to sustain crop yields. Recently, biochar soil amendment has emerged as feasible win-win strategy to enhance crop productivity and mitigate greenhouse gasses emission. This study aimed, therefore, to determine the effects of biochar application on the growth, development and yield of wheat (*Triticum aestivum*) plants grown under different water regimes. A completely randomised greenhouse pot trial was conducted using three levels of biochar addition (0, 2 and 5 % BC) to a sandy soil under different water regimes [60 %, 30 % and 15 % of the soil water holding capacity (WHC)]. Drought severely affected wheat growth, with plant biomass reduced by roughly 67 % and 77 % at moderate and low water regime, respectively. Grain yield was also significantly reduced by 70 % and 96 % at moderate and low water treatment, respectively, compared to the respective controls. Whatever the soil water content, biochar generally stimulated the plant growth, the effect that was more pronounced at 2 % BC under deficit water regimes. At ample water regime, 2 % biochar increased the plant biomass and grain yield by 59 % and 57 %, respectively, while 5 % biochar led to increases of about 41 % and 17 % in plant biomass and grain yield, respectively. Furthermore, biochar could negate some of the detrimental effects of drought on wheat growth. Under constrained water condition (15 % WHC), plant biomass and grain yields were significantly increased by 64 % and 87 %, respectively, in response to 2%BC. This effect was however less obvious for plants treated with 5 % BC, where only 17 % and 62 % increases in plant biomass and grain yields were recorded. Biochar-mediated growth improvements were coincided with higher leaf numbers and areas, an improved plant water status (higher water content and higher osmotic potential in roots and leaves), enhanced K and N contents, lower proline contents and reduced Ch(a)/(b) ratio. Taken together, these results justify the potentials of biochar as an organic soil amendment and could be considered as a step forward for its use to sustain crop production, particularly, at drought-borne and marginal areas of Egypt.

Keywords: Biochar, drought resistance, grain yield, nitrogen content, plant growth, water relations, wheat

Contact Address: Sayed Hussin, Justus-Liebig University Giessen, Inst. of Plant Ecology, Heinrich-Buff-Ring 26-32, 35392 Giessen, Germany, e-mail: sayed.hussin@bot2.bio.uni-giessen.de