Advanced Engineering Days

aed.mersin.edu.tr

The effect of biochar on the plant under stress conditions

Ceren Küçümen Aslan*[1], Furkan Ayaz[1, 2]

[1]*Mersin University, Biotechnology Department, Türkiye, 21020190001@mersin.edu.tr*
[2]*Mersin University, Biotechnology Research and Application Center, Türkiye, furkanayaz@mersin.edu.tr*

Cite this study: Aslan, C. K., & Ayaz, F. (2022). The effect of biochar on the plant under stress conditions. 3rd Advanced Engineering Days, 48-49

Keywords
Plant
Stress
Biochar

Abstract

Stress conditions such as drought and salt negatively affect plant growth and yield. Many methods are used to alleviate these negative effects. Biochar application is also a method used to eliminate the negative effects on the plants stimulated by the stress conditions. According to many studies, biochar application to the soil increases the yield of the plants under different stress conditions. Moreover, biochar increases photosynthesis rate, water usage efficiency and relative water content in the plants struggling with the drought stress.

Introduction

Plants, like other living things, do not have the ability to move under stress conditions or escape from the environment that have stress factors. Therefore, they have different mechanisms to survive under stress conditions. These mechanisms aim to keep plants alive and maintain their vitality. For example, when plants faced with a lack of water, they close their stomata as the first physical response. However, this causes the plants to perform less photosynthesis, and thus reducing its yield [1,2].

The protection mechanisms of plants under stress conditions also have negative aspects in terms of yield, and the decrease in yield is perhaps the most important of these negative aspects. In order to prevent the decrease in plant yield under stress conditions, many methods are tried to make the stress conditions less effective or to alleviate the response to stress [3,4].

One of these methods is application of biochar to the plant that are struggling with stress conditions. In these studies, researchers observed that the application of biochar mitigates the effects of stress conditions. However, there are researches who has shown that biochar has an important role in the plant growth and yield that are grown in the absence or presence of the stress conditions [5-7].

Results

In the literature, there are many studies showings that biochar has a positive effect on the response of plants to the stress conditions.

Akhtar et al. [8] observed that the biomass of the wheat plant in the region with the semi-arid Mediterranean climate increased with the application of biochar. In addition, they added to the literature that biochar significantly increased chlorophyll content, stomatal conductivity, photosynthesis rate, water use efficiency and relative water content in plants struggling with the drought stress.

Batool et al. [9] observed an increase in plant height and leaf area compared to the control groups when they applied biochar to okra plants under the drought stress. However, Haider et al. [10] reported in the literature that similar results are also valid for maize plants.

Kanwal et al. [11] investigated salinity stress on the wheat. They applied different concentrations of biochar. They observed that biochar alleviated the negative effects of the salinity stress such as water deficiency in the wheat. In addition, root and shoot lengths increased in the groups with the biochar application.

Discussion

In summary, it has been observed many studies suggest that application of biochar in the soil of the plants that are grown under stress conditions overcame the detrimental effect of the stress on the plant growth and immunity [5-7]. In line with these observations, biochar application in the absence of the stress conditions further stimulated the plant growth and yield.

References

1. Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. (2015). *Plant Physiology and development*. Ankara: Palme Yayıncılık
2. Levitt, J. (1972). Responses of plants to environmental Stresses. *New York, London: Academic Press,* 1972: 697.
3. Blum, A. (2011). Plant water relations, plant stress and plant production. In Plant breeding for water-limited environments (pp. 11-52). *Springer,* New York, NY.
4. Beck, E. H., Fettig, S., Knake, C., Hartig, K., & Bhattarai, T. (2007). Specific and unspecific responses of plants to cold and drought stress*. Journal of biosciences*, 32(3), 501-510.
5. Elad, Y., Cytryn, E., Harel, Y. M., Lew, B., & Graber, E. R. (2011). The biochar effect: plant resistance to biotic stresses. *Phytopathologia Mediterranea*, 50(3), 335-349.
6. Kammann, C. I., Linsel, S., Gößling, J. W., & Koyro, H. W. (2011). Influence of biochar on drought tolerance of Chenopodium quinoa Willd and on soil–plant relations. *Plant and soil*, 345(1), 195-210.
7. Thomas, S. C., Frye, S., Gale, N., Garmon, M., Launchbury, R., Machado, N., ... & Winsborough, C. (2013). Biochar mitigates negative effects of salt additions on two herbaceous plant species. *Journal of Environmental Management,* 129, 62-68.
8. Akhtar, S. S., Andersen, M. N., & Liu, F. (2015). Residual effects of biochar on improving growth, physiology and yield of wheat under salt stress. *Agricultural Water Management*, 158, 61-68.
9. Batool, A., Taj, S., Rashid, A., Khalid, A., Qadeer, S., Saleem, A. R., & Ghufran, M. A. (2015). Potential of soil amendments (Biochar and Gypsum) in increasing water use efficiency of *Abelmoschus esculentus* L. Moench. *Frontiers in plant science,* 6, 733.
10. Haider, G., Koyro, H. W., Azam, F., Steffens, D., Müller, C., & Kammann, C. (2015). Biochar but not humic acid product amendment affected maize yields via improving plant-soil moisture relations. *Plant and soil*, 395(1), 141-157.
11. Kanwal, S., Ilyas, N., Shabir, S., Saeed, M., Gul, R., Zahoor, M., ... & Mazhar, R. (2018). Application of biochar in mitigation of negative effects of salinity stress in wheat (*Triticum aestivum* L.). *Journal of Plant Nutrition,* 41(4), 526-538.