Effect of drought stress on photosynthetic characteristics, phenolic compounds and radical scavenging activities in different chickpea (*Cicer arietinum* L.) genotypes in hydroponic conditions

M. Zare Mehrjerdi[1], A. Bagheri[1], A. R. Bahrami[2], J. Nabati[3]* and A. Massomi[4]

(Received : Dec. 13-2011 ; Accepted : Feb. 28-2012)

Abstract

Low photosynthetic rate is a major reason for yield reduction in drought-stress conditions. Therefore, a study was conducted in order to investigate the effect of drought stress on gas exchange, chlorophyll florescence, photosynthetic pigments, membrane stability, phenolic compounds and antioxidant capacity of leaves and their association with drought tolerance in 12 chickpea genotypes, which were stressed for two weeks. The split-plots experiment was conducted as a complete randomized blocks design with three replications. Drought stress (-3 and -6 bar) was the main plot and chickpea genotypes were the subplots, respectively. The results showed that with increasing drought stress, the photosynthetic rate, evapotranspiration, water use efficiency, chlorophyll a, chlorophyll b, total phenols and membrane stability index were significantly reduced. In contrast, drought stress did not impose any significant effect on quantum yield of photosystem II and radical scavenging activities of leaves. Genotypes varied widely in different studied traits. MCC753 genotype had the highest photosynthesis rate, evapotranspiration, chlorophyll b, and membrane stability index, MCC783 genotype had the highest water use efficiency, MCC759 genotype had the highest total phenols in leaves and MCC760 genotype had the highest radical scavenging activities. There was a positive significant correlation between photosynthesis and evapotranspiration with relative leaf water content and dry matter. In general, drought stress can reduce photosynthesis in chickpea genotypes, directly by reducing stomatal conductance and indirectly by oxidative stress and degradation of photosynthetic pigments and cell membrane. In this experiment, reduced stomatal conductance at more than five $\mu m/m^2$ photosynthetic rate and reduced membrane stability and degradation of chlorophyll at less than this range led to effective reduction in photosynthetic rate.

Keywords: Antioxidant, Quantum yield, Chlorophyll.

1. Dept. of Biotechnol., College of Agric., Ferdowsi Univ. of Mashhad, Mashhad, Iran.
2. Dept. of Sci., Faculty of Sci., Ferdowsi Univ. of Mashhad, Mashhad, Iran.
3. Dept. of Agron., College of Agric., Ferdowsi Univ. of Mashhad, Mashhad, Iran.
4. College of Agric., Payame Noor Univ. of Khorasan Razavi, Mashhad, Iran.
*: Corresponding Author, Email: jafarnabati@gmail.com

[Downloaded from jspi.iut.ac.ir on 2024-04-26]

[DOR: 20.1001.1.20089082.1391.3.4.9.3]