Assessment of Drought Tolerance using Chlorophyll Fluorescence Analysis in Garden Plants

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Extended Abstract

As the social demand for a beautiful urban landscape increases, urban horticulture and urban gardening are becoming more active. [1] However, due to the nature of the urban environment with many artificial structures, it is vulnerable to climate change, so wet and drought are occurring irregularly and repeatedly in urban gardens. [2] In this study, drought tolerance was assessed using chlorophyll fluorescence analysis on major garden plants used in urban gardening.

Drought stress treatment was carried out under conditions of irrigation (control group) and non-irrigation (treatment group) for 14 species in the greenhouse of Hankyong National University in September 2021. Chlorophyll fluorescence (OJIP) was measured 5 times at 0 hr, 24 hr, and 48 hr after dark treatment for leaf 30 minutes using a chlorophyll fluorescence analyzer (FP-100, PSI). [3]

It was confirmed that the photochemical performance index (PI ABS) decreased after drought treatment in most garden plants. So, the drought stress index (DFI) was calculated using PI ABS as follows (DFI = log(A) + 2log(B); A=24hr PI ABS treatment/PI ABS control, B=48hr PI ABS treatment/PI ABS control). In this study, DFI was classified into 4 groups, and the criteria were I≥0.5, II≥0, III≥-0.5, and IV≤-0.5. As a result of the grading assessment of drought stress of garden plants, the I Group of Carex maculata Boott, Aster sphathulifolius Maxim and the II Group of Gaura Lindheimeri Engelm, et A.Gray, Sedum kamtschaticum FISCH, Veronica linariaefolia Pall, Aquilegia oxysepala Trautv. & C. A. Mey, Pachysandra terminalis Siebold & Zucc, Potentilla fragarioides var. Major, Lilium lancifolium Thunb, Phlox paniculata L, Heuchera sanguinea are confirmed to have strong tolerance for drought stress. On the other hand, Cynara cardunculus var. Scolymus and Chrysanthemum indicum L. belongs to III Group and have relatively weak drought tolerance. Nandina domestica Thunb, a shrub of which is classified as Group IV, has has the weakest drought tolerance among the selected garden plants.

Therefore, it was clearly concluded that effective water management of garden plants using the drought stress index was possible for an urban garden management.

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References