Journal of Horticultural Science
Vol. 30, No. 3, Fall 2016, P. 137
ISSN: 2008 - 4730

نشریه علوم باغبانی (علوم و صنایع کشاورزی)
جلد 30، شماره 3، پاییز 1395، ص. 137
شاپا: 2008 - 4730

Evaluation of Drought Stress Thresholds in Ornamental Barberry (Berberis thunbergii cv. Atropurpurea) Shrub in Mashhad Condition

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Received: 05-01-2016
Accepted: 14-05-2016

Introduction: The population growth and water requirement for domestic consumption, industry, agriculture and urban development in Mashhad megacity, increase pressures on freshwater resources. Therefore, planning for water use optimization is necessary. The new allocation of water resources for landscape greenish, especially in arid and semi-arid is difficult. Therefore, water allocation to landscape is valuable and should be used efficiently. According to water resource limitation, using drought-tolerant plant species and determine threshold of drought tolerance in landscape can improve water use management. Plants that naturally survive in your area are the ones best adapted to your soil, climate and rainfall. By selecting plants that either avoid or tolerate dry conditions, a beautiful, thriving landscape can be made possible. Drought-tolerant plants survive long periods of drought by storing water internally or by developing extensive root systems that sink deep into the soil. Many drought-tolerant plants have additional protection through a waxy coating that reduces evaporation or hairs on the leaf surface that reflect some of the light, insulating the plant. Most drought-tolerant plants use several of these features to survive on low amounts of precipitation. Japanese barberry is a compact woody deciduous shrub with arching branches. Leaf colours include green, bluish-green to dark red and purple. *B. thunbergii's* progress in the United States has, to date, been held in check to the south by, probably, its need for cold winter temperatures for stratification of the seeds, and to the west by, probably, drought conditions. Although very drought tolerant once established, a very dry terrain would tend to discourage its incursion. Rugged, adaptable, no serious problems or pests, easy to maintain, transplants readily, shade and drought tolerant, deer resistant is typical ad copy found at any site offering this shrub of colourful fall foliage. In this regard, drought stress tolerance thresholds of ornamental barberry plant in Mashhad landscape were evaluated.

Materials and Methods: In order to determine the qualitative and quantitative drought stress tolerance thresholds of ornamental barberry (*Berberis thunbergii*) plant an experiment was conducted basis on randomized complete block design with three replications in Plant Production Complex of Mashhad Municipality. Treatments included; 100, 80, 60, 40, and 20% of culculated water requirements based on evaporation pan data. Two years old plants with similar size were transplanted from pots to field in 16 March 2012. Treatments were applied after establishment in 28 April and sampling was arranged in 6 August, 23 August, 6 September, and 7 October. During the growing season, the evaporation level was daily measured from pan Class A. In each sampling two plants sampled randomly from each plot for measuring the plant height, highest branches, number of branches, fresh and dry weight, dry mater percentage, irrigation water use index and freshness index.

Results and Discussion: Results showed that with increasing severity of drought stress plant height of barberry reduced significantly, but there were no significant difference between 100 and 80% of water requirement treatments. The highest branches reduced by diminishing water application volume but there were no significant difference among 100, 80 and 60% of water requirement application. The maximum of branch number was observed at 60 percent water requirement, however, there were no significant difference between 100 and 60% of water requirement treatments. The number of branches in 60% was 26% lower than 80% of water requirement. Therefore, application of 60% water requirement with 23 branches per plant produced highest branch number. The highest and lowest plant fresh weight was measured in 100% and 20% water requirement application, respectively. Application of 60% of water requirement produced statistically on the same biomass production of 100% of water requirement application. The lowest freshness index was observed in 20 and 40% of water requirement, but there were no significant difference among 60, 80 and 100% of water requirement applications.

Conclusion: Generally, results showed that ornamental barberry plant is a drought resistant plant and it can be alive by only 20% of its water requirement application, but for having freshness ornamental barberry in urban landscape, at least 60% of its water requirement should be applied. Based on the present results, water application of ornamental barberry could be reduced to 60% of calculated water requirement. It could be saved

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water application of barberry up to 4400 $m^{-3}.ha^{-1}$ in a growing season in Mashhad condition.

Keywords: Freshness index, Irrigation water use index, Landscape, Water requirement