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How to help woody plants to overcome drought stress?-a control study of four tree species in Northwest China.

Xiaozhen Liu (1) and Shuoxin Zhang (2)

(1) University of Natural Resources and Applied Life Sciences, Vienna (liuxiaozhen99@gmail.com), (2) Northwest Agriculture and Forestry University, China

Water is essential for plants and involves most physical and chemical processes within their lifecycles. Drought stress is a crucial limiting factor for plant growth and production. 48% of the land in China is arid and semi-arid, and non-irrigated land occupies approximately 51.9% of the total cultivated areas. Therefore, studies on plant drought resistant mechanisms have great significance for improving water use efficiency and thus increasing productivity of economical plants.

Prior research has shown that the application of nitrogenous fertilizer affects the drought-resistant characteristics of plants. This study aimed to reveal the effect of nitrogenous fertilizer on physiological aspects and its impact on the drought resistance of four tree species (Robinia pseudoacacia L., Ligustrum lucidum Ait., Acer truncatum Bge. and Ulmus pumila L.) in northwest China. Three levels of nitrogen fertilization (46% N based of urea adjusted to: 5g/15g soil, 15g/15g soil and 25g/15g soil) and an additional control study were applied to 2-year-old well-grown seedlings under drought conditions (30% field moisture capacity). Stomatal conductance, transpiration rate and net photosynthetic rate were measured by a LI-6400 photosynthesis system, while water use efficiency was calculated from net photosynthesis rate and transpiration rate. The results revealed that as the amount of urea applied was raised, stomatal conductance, transpiration rate and net photosynthetic rate decreased significantly, and thus water use efficiency significantly increased. It is therefore concluded that the application of nitrogenous fertilizer regulated physiological parameters by reducing stomata conductance to improve water use efficiency. In addition, among the four tree species, U. pumila had the maximum value of water use efficiency under the same drought condition. The outcome of this study provides a guided option for forest management in arid and semi-arid areas of northwest China.