Evaluating Physiological Responses of Viburnum Species to Salinity Stress

Dr. Youping Sun's lab at Utah State University is conducting various research projects to better understand plant responses to salinity stresses and select salt tolerant ornamental plants for nursery production and landscape use.

The dependence of green industry activities on high-quality ground and surface water supplies is jeopardized by climate change (e.g. severe and/or lengthy droughts), population growth, and competition from other preeminent human uses and allocations. Water conservation is becoming critically important throughout the United States (U.S.), especially in Utah and the Intermountain West, one of the driest and fastest growing regions in the U.S. Alternative water sources are becoming important 'new water' in green industry in the arid to semiarid Intermountain West. Treated and reclaimed sewage effluent (reclaimed water) has been used by a handful of large corporate and municipal parks and landscapes in arid and semi-arid urban areas across the desert southwest (Tanji et al., 2008). Reclaimed water has relatively high levels of salinity and contains undesirable specific ions; primarily sodium and chloride (Niu and Cabrera, 2010). This composition could impose salt stresses on a large number of nursery crops and landscape plants. Extensive utilization of alternative waters calls for salt-tolerant plants in green industry. Viburnums have been widely used in gardens and landscapes, and three million viburnum products are sold annually with a wholesale value of over $22 million in the U.S. (Pooler, 2010). Viburnums are sensitive to salt spray (Beckerman and Lerner, 2015). Additional information on the salinity tolerance of different viburnum species is needed.

Twelve different viburnum species grown in a greenhouse were irrigated weekly with a nutrient solution at an electrical conductivity (EC) of 1.25 $dS \cdot m^{-1}$ (control) or a saline solution at an EC of 5 $dS \cdot m^{-1}$ (EC 5) or 10 $dS \cdot m^{-1}$ (EC 10) for eight weeks. The nutrient solution was prepared by adding 0.8 $g \cdot L^{-1}$ 15N–2.2P–12.5K (Peters 15-5-15 Cal-Mag Special; Scotts, Marysville, OH) to tap water, while saline solutions were created by adding NaCl and calcium chloride ($CaCl_2$) to the nutrient solution. Gas exchange was recorded using a CIRAS-3 Portable Photosynthesis System (PP Systems, Amesbury, MA) when plants were irrigated for four weeks (*Fig. 1*) and eight weeks. In addition, morphological data and mineral nutrients in leaf tissue were taken to assess plant responses to elevated salinity levels.

Fig. 1. Ji-Jhong Chen, master student under Dr. Youping Sun, recorded the gas exchange data of viburnums using the CIRAS-3 Portable Photosynthesis System.

This research has showed that a large variation in the photosynthetic responses to salinity treatments occurred among 12 viburnum species and cultivars (*Fig. 2*). Elevated salinity levels decreased net photosynthetic rate (P_n) of all viburnum species and cultivars tested in this study (*Fig. 2*). Salt tolerant viburnum species or cultivars will be recommended for nursery production and landscape use when alternative water sources are used for irrigation, especially in salt-prone areas.

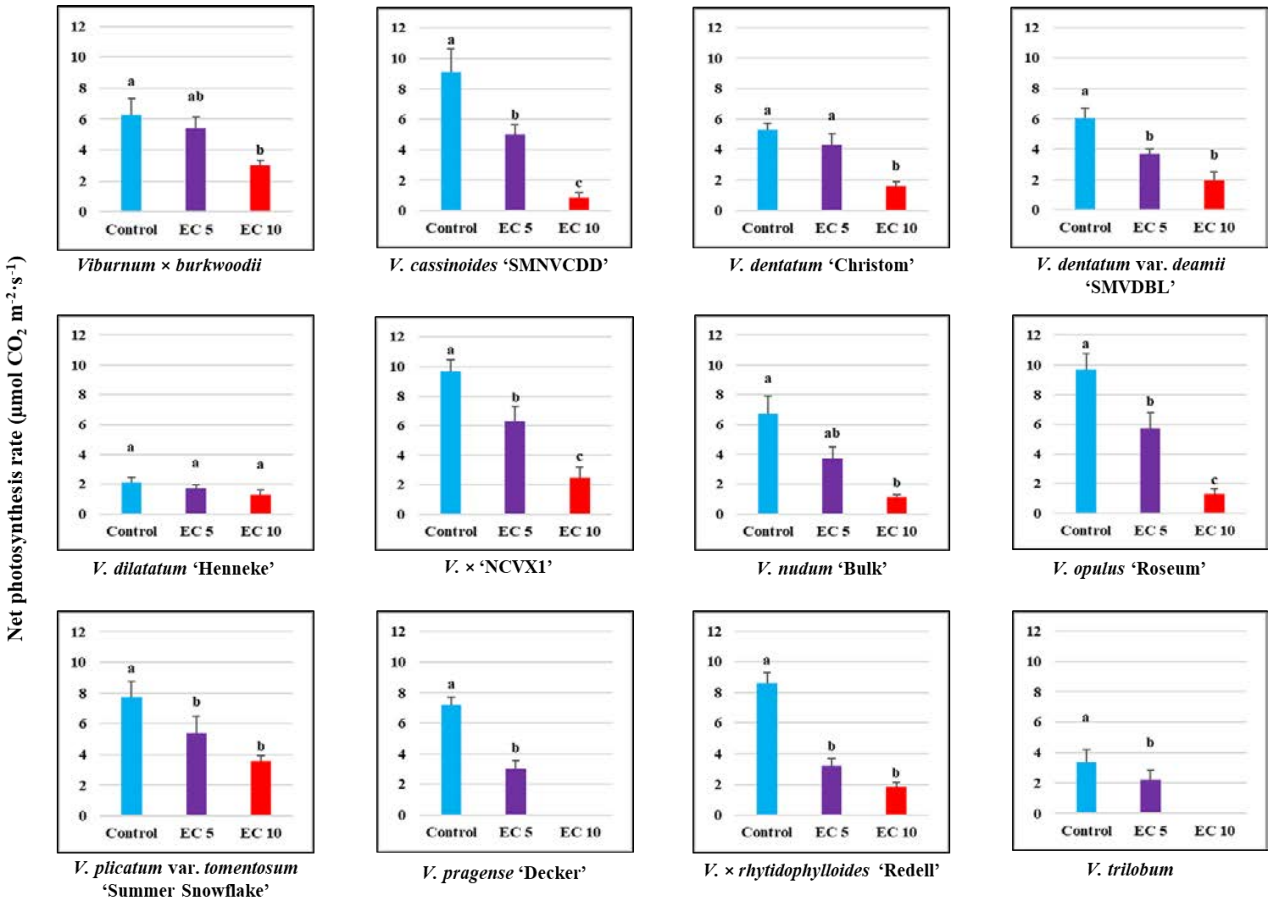

Fig. 2. The net photosynthesis rate (P_n) of 12 viburnum taxa irrigated with a nutrient solution at an electrical conductivity (EC) of 1.25 dS·m^{-1} (control) or a saline solution at an EC of 5 dS·m^{-1} (EC 5) or 10 dS·m^{-1} (EC 10) for four weeks. Gas exchange were not recorded for *V. pragense* 'Decker' and *V. trilobum* plants in the EC 10 due to severe foliar damage. Values were means of P_n of 12 viburnum taxa in the control, EC 5, and EC 10. The error bars indicated the standard errors. For each viburnum taxa, different letters indicated significantly different amount treatment by Tuckey's honestly difference multiple comparison at $P < 0.05$.

Literature Cited:

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To learn more about the Sun Lab visit: http://www.cwel.usu.edu/

If you would like to learn more about this application or speak with one of our experienced technical staff, please feel free to get in direct contact with us via any of the contact information listed below:

110 Haverhill Road, Suite 301
Amesbury, MA 01913 U.S.A.

Tel: +1 978-834-0505
Fax: +1 978-834-0545

support@ppsystems.com
ppsystems.com

@pp_systems
company/pp-systems
ppsystems.intl
ppsystemsinc