Response of Selected Wildflower Species to Saline Water Irrigation

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Abstract. Wildflowers are good candidates for water-wise landscapes because many of them are drought-tolerant after establishment. Little information is available regarding whether these herbaceous wildflowers are tolerant to salt stress. Container experiments were carried out in a greenhouse and a shadehouse under semiarid climate conditions to investigate the salt tolerance of six native wildflowers: Salvia farinacea (mealy cup sage), Berlandiera lyrata (chocolate daisy), Ratibida columnaris (Mexican hat), Oenothera elata (Hooker’s evening primrose), Zinnia grandiflora (plains zinnia), and Monarda citriodora (lemon horsemint). In the greenhouse experiment, mealy cup sage, Hooker’s evening primrose, and plains zinnia were irrigated with a saline solution with an electrical conductivity (EC) of 6.5 (control, nutrient solution), 2.8, 4.1, 5.1, or 7.3 dS·m⁻¹ for 45 days. All plants survived except for plains zinnia at EC of 7.3 dS·m⁻¹. Shoot dry weights decreased as EC of irrigation water increased for all three species. In the shadehouse experiment (second year), plants of all species (plains zinnia was not included) were irrigated with saline solutions at EC of 0.8 (control, tap water), 2.8, 3.9, 5.5, or 7.3 dS·m⁻¹ for 35 days. Plants were fertilized with slow-release fertilizer in the shadehouse experiment. After 5 weeks of treatment, all plants of lemon horsemint in the elevated salinity treatments, regardless of EC levels, were dead. The visual foliar salt damage rating was lowest for lemon horsemint. Chocolate daisy had low survival percentages and low foliar ratings at EC of 5.5 dS·m⁻¹ and 7.3 dS·m⁻¹. For the other three species, survival percentages were 80% and 90% at EC of 7.3 dS·m⁻¹. Hooker’s evening primrose and mealy cup sage had similar low foliar visual ratings regardless of salinity treatment. All species had similar high uptake of Na⁺ in shoots, whereas Hooker’s evening primrose had slightly higher Cl⁻ concentrations compared with other species. Based on these results, lemon horsemint was most sensitive to salinity stress followed by chocolate daisy. Hooker’s evening primrose and mealy cup sage were moderately tolerant and may be irrigated with low salinity water at EC of less than 3.9 dS·m⁻¹. Mexican hat was the most tolerant among the six species.

Materials and Methods

Greenhouse experiment. Seeds of selected wildflowers were sown in mid-Jan. 2009. Because three species (chocolate daisy, Mexican hat, and lemon horsemint) did not germinate with an insufficient number of seedlings, they were dropped from the greenhouse experiment. Uniform seedlings of the other three wildflower species, mealy cup sage, Hooker’s evening primrose, and plains zinnia, were transplanted on 14 Apr. to 2.6-L containers filled with Sunshine Mix No. 4 (SunGro Hort., Bellevue, WA). A week after transplanting, saline water irrigation treatment was initiated. Saline solution treatments (greenhouse experiment). Saline solutions at EC of 1.5 (nutrient solution, control), 2.8, 4.1, 5.1, and 7.3 dS·m⁻¹ were created by adding calculated amounts of sodium chloride (NaCl), magnesium sulfate (MgSO₄·7H₂O), and calcium chloride (CaCl₂) at weights to create a range of salinity levels. These solutions were used to irrigate the plants for 45 days. All plants survived except for plains zinnia at EC of 7.3 dS·m⁻¹. Shoot dry weights decreased as EC of irrigation water increased for all three species. In the shadehouse experiment (second year), plants of all species (plains zinnia was not included) were irrigated with saline solutions at EC of 0.8 (control, tap water), 2.8, 3.9, 5.5, or 7.3 dS·m⁻¹ for 35 days. Plants were fertilized with slow-release fertilizer in the shadehouse experiment. After 5 weeks of treatment, all plants of lemon horsemint in the elevated salinity treatments, regardless of EC levels, were dead. The visual foliar salt damage rating was lowest for lemon horsemint. Chocolate daisy had low survival percentages and low foliar ratings at EC of 5.5 dS·m⁻¹ and 7.3 dS·m⁻¹. For the other three species, survival percentages were 80% and 90% at EC of 7.3 dS·m⁻¹. Hooker’s evening primrose and mealy cup sage had similar low foliar visual ratings regardless of salinity treatment. All species had similar high uptake of Na⁺ in shoots, whereas Hooker’s evening primrose had slightly higher Cl⁻ concentrations compared with other species. Based on these results, lemon horsemint was most sensitive to salinity stress followed by chocolate daisy. Hooker’s evening primrose and mealy cup sage were moderately tolerant and may be irrigated with low salinity water at EC of less than 3.9 dS·m⁻¹. Mexican hat was the most tolerant among the six species.