Effect of Substrate Type and Fertility Level on Growth of Swamp Rosemallow (**Hibiscus grandiflorus** Michx.)

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Swamp rosemallow is a native wetland plant that adds beauty and interest to rain gardens, wetland restoration sites, and other areas with damp soils. Native plant growers wish to offer swamp rosemallow to clients, but little is known regarding optimum nursery and greenhouse culture requirements for this species. In these experiments, we evaluated the effect of four different substrates and three levels of controlled release fertilizer on a number of growth parameters. A destructive harvest after 8 weeks of culture revealed that fertility level had a significant effect only on stem diameter, but substrate type had a strong influence on stem diameter, plant height, dry biomass, and bud production. Plants grown in flooded sand yielded the lowest values in all four of these parameters. This information provides growers with guidelines to economically produce this attractive native hibiscus under greenhouse and nursery conditions.

Swamp rosemallow, also called pink swamp hibiscus, large-flowered hibiscus, giant rosemallow, great rosemallow, and velvet mallow, is an attractive perennial wetland plant that is native to the southeastern United States (Godfrey and Wooten, 1981). The species is broadly but sporadically distributed in wetlands, marshes, and the margins of lakes, streams and ponds (Floridata, 2013), with populations documented throughout Florida, Georgia, Alabama, Louisiana, Mississippi, and Texas (IRC, 2013; USDA NRCS, 2013). Swamp rosemallow is a member of the Malvaceae and bears showy, five-petaled pink to white flowers that may be up to 25 cm across and are characterized by a deep red center (Fig. 1). Plants may reach up to 3 m in height and die back to the ground during the winter; new stems are pubescent and emerge from root crowns in spring. The three-lobed leaves are velvety and densely pubescent (Fig. 2). Leaf blades are up to 18 cm long and 16 cm wide and are borne on petioles that are up to 10 cm long (Godfrey and Wooten, 1981). The 3-cm-long capsule of swamp rosemallow is tomentose (Fig. 3) and contains as many as 60 hard, smooth, dark-brown seeds that are ≈ 3 mm in diameter.

Because swamp rosemallow is a showy native perennial plant, it has the potential to be a highly desirable component of wetland restoration and mitigation projects and as an ornamental addition to water gardens and ponds. However, little information is available regarding the cultural requirements of this species, which may limit the ability of aquatic plant nurseries to produce sufficient numbers of swamp rosemallow to meet potential demand.

Materials and Methods

Seeds were collected from a population of swamp rosemallow maintained at the University of Florida Fort Lauderdale Research and Education Center in Davie (FLREC) and sown on propaga-
tion flats filled with a blend of perlite and vermiculite (50/50 by volume). Propagation flats were placed in a greenhouse under mist and maintained under natural daylength until germination (Fig. 4). After germination, seedlings were transferred to nursery containers with dimensions of 10-cm top diameter, 8-cm bottom diameter, and 10-cm depth that were filled with MetroMix® 500, a commercially available growing substrate that contains 40% to 50% composted pine bark, 20% to 35% horticultural grade vermiculite and 12% to 22% Canadian sphagnum peat moss by volume with a nutrient charge and pH adjustment (SunGro Horticulture, Bellevue, WA). Each planted container was top-dressed with 5 g of controlled-release prilled fertilizer (Osmocote Plus 15N–9P₂O₅–12K₂O plus minor elements; southern formula formulated for 8- to 9-month release at 70 °F, hereafter referred to as OP; The Scotts Co, Marysville, OH) and kept in the greenhouse under mist until mean seedling height was ≈50 cm (≈3 weeks after transplanting). Seedlings then were moved into experimental containers.

Four substrate treatments and three fertility levels were examined in these studies. Substrate treatments consisted of growing plants under conditions that caused the root zone to be either flooded or drained. Flooded conditions were maintained by using containers without drainage holes. These containers were filled with coarse builder’s sand as a rooting substrate, and water level was maintained at a depth of 2.5 cm above the surface of the sand to simulate flooded conditions. Containers with drainage holes were used to simulate non-flooded conditions and were filled with coarse builder’s sand or one of two commercially available growing substrates: MetroMix® 500 or AtlasMix, which contains 50% composted pine bark, 40% Florida sedge peat, and 10% sand by volume with 890 g per cubic meter of Micromax (Scotts-Sierra, Marysville, OH) and 7.12 kg per cubic meter of dolomitic limestone (Atlas Peat and Soil Inc., Boynton Beach, FL). Containers used in all treatments had dimensions of 20.5-cm top diameter, 17-cm bottom diameter and 20.5-cm depth. All containers were filled to within 2.5 cm of the top. OP was incorporated in the lower third of the substrate in each experimental container at a rate of 40, 66.7, or 80 g per container. All experimental containers were placed outdoors at the FLREC and irrigated with ≈4 cm of pond water per day using an overhead irrigation system. Four replicates were prepared for each combination of factors and arranged in a randomized block design (Fig. 5). A destructive
harvest was employed after 8 weeks of culture; data collected at harvest included plant height, stem diameter 15 cm above the surface of the substrate and number of buds plus open flowers. Shoot dry mass was determined by collecting all above-ground plant material and placing it in a forced-air oven at 75 °C for ∼1 week. Data were analyzed using a general linear model in SAS 9.1 (SAS Institute, Cary, NC) and means were separated using least significant differences to identify treatment effects.

Results and Discussion

No significant interactions among main effects (i.e., substrate type and fertility level) were detected. Therefore, data were pooled across fertility levels to evaluate the effect of substrate type and across substrate type to evaluate the effect of fertility level. Substrate type had a highly significant effect on all parameters measured in these experiments ($P < 0.0001$). Plant height, stem diameter 15 cm above the surface of the substrate, number of buds and flowers, and shoot dry mass were lowest in plants cultured in flooded sand (Fig. 6a–d). There was no difference among drained treatments in height or bud and flower production (Fig. 6a and c). There was no difference in stem diameter of plants grown in MetroMix® 500 and those cultured in AtlasMix; there was also no difference in stem diameter of plants grown in AtlasMix and those grown in drained sand, but plants cultured in MetroMix® 500 had greater stem diameters than plants cultured in flooded sand (Fig. 6b). There was no difference in shoot dry mass of plants grown in MetroMix® 500 or AtlasMix, but dry mass was greater in these groups than in plants cultured in drained or flooded sand (Fig. 6d). Fertility level had a significant effect ($P = 0.0495$) only on stem diameter; there was no difference in stem diameter of plants cultured with high or medium levels of fertilizer (80 and 66.7 g per container, respectively), but stem diameter of plants in these groups was greater than in plants cultured under the low (40 g per container) fertilizer regime (Fig. 7). Fertility level had no effect on plant height ($P = 0.353$), number of buds and flowers ($P = 0.499$), or shoot dry mass ($P = 0.085$).

The USDA NRCS (2013) classifies swamp rosemallow as an obligate wetland plant, meaning the species almost always occurs in wetlands under natural conditions. However, our research revealed that the flooded conditions associated with the species’ natural habitat are not necessarily optimal for greenhouse production. Biometric characters in swamp rosemallow—plant height, stem diameter, bud and flower production, and shoot dry mass—were
higher when plants were cultured under drained conditions than when plants were grown under flooded conditions. In addition, stem diameter and shoot dry mass were greater when plants were grown in substrates with organic material as opposed to culture in sand. Fertility level had a negligible effect on growth of swamp rosemallow, with larger stem diameters produced by plants fertilized at medium or high levels. This obligate wetland species can be cultured in a variety of substrates with moderate amounts of fertilizer alongside terrestrial plants and does not require the specialized aquatic culture systems needed to produce some obligate wetland species. The information provided in this study can be useful to growers who wish to produce swamp rosemallow under greenhouse conditions without modifications to existing production infrastructure.

Literature Cited


