How does your green roof garden grow?

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Growing plants on rooftops is an old concept that has evolved from simple sod roofing to roof gardens and new, lightweight "extensive green roofs". Modern green roofs have environmental and social benefits; they can reduce stormwater runoff, improve air quality, mitigate urban heat, reduce the demand for air conditioning and greenhouse gas emissions, and provide habitat for birds and wildlife. Long-used in urban planning in Europe, green roofs are becoming more popular in North America, and new research designed to promote the integration of green roofs into current and future buildings is burgeoning. Researchers from the Department of Horticulture at The Pennsylvania State University published a study in *HortTechnology* that evaluated the influence of substrate type and depth on establishment of five common green roof plants.

Plants suitable for extensive green roofs must tolerate extreme rooftop conditions, and the substrates in which they grow must meet both horticultural and structural requirements. Deeper substrates may retain more water for plants during dry periods, but they also weigh more, especially when near saturation. The study by Christine E. Thuring, Robert D. Berghage, and David J. Beattie was designed to evaluate the effects of substrate type and depth on the establishment and early growth of five plants popular in North American green roof designs.

The researchers hypothesized that early drought is more harmful for plants grown in shallow rather than deeper substrate depths, and that plants that survived early drought conditions would produce less shoot biomass than those subjected to late drought. Two stonecrops, one ice

plant, and two herbaceous perennials were planted in three depths (30, 60, and 120 mm) of expanded shale and expanded clay, two commercially available green roof substrates. Study flats inside a plasticulture tunnel received three drought treatments: no drought, 2 weeks early drought, and 2 weeks late drought.

The two stonecrops performed well under most conditions, although tasteless stonecrop was stunted by early drought. Ice plant performed erratically and, along with maiden pink, poorly in face of drought during establishment. When subjected to any drought, the herbaceous perennials had the fewest survivors in the expanded shale. The study plants were most affected by substrate depth, except for maiden pink, which responded solely to drought. When subjected to early drought conditions, the herbaceous perennials did not survive in 30 mm of either substrate, or in 60 mm of expanded shale; early drought appeared to be more harmful to plant survival and performance than late drought. Although the stonecrops performed well in 60 mm of substrate when subjected to drought, their performance was superior in the expanded clay compared with shale.

The three most resilient species used in the study—saxifrage pink, white stonecrop, and tasteless stonecrop—always produced more shoot biomass with increasing substrate depth, regardless of water availability. A standout performer was saxifrage pink, which had an attractive appearance and persistent flowering habit, making it an excellent choice as a green roof plant.

The experiment illustrates how appropriate species selection in the design of unirrigated extensive green roofs may be directed by factors such as substrate type and depth, as well as anticipated drought conditions. "This experiment revealed the variability among drought-tolerant species to various treatments, as well as the different plant responses to substrate type during drought", concluded the scientists.

More information: horttech.ashspublications.org/ … nt/abstract/20/2/395

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