From Forest Nursery Notes, Summer 2013

4. © Biocontainer water use in short-term greenhouse crop production. Koeser, A., Lovell, S. T., Evans, M., and Stewart, J. R. HortTechnology 23(2):215-219. 2013.

Preliminary and Regional Reports

Biocontainer Water Use in Short-term Greenhouse Crop Production

Andrew Koeser[1,4,8], Sarah T. Lovell[1,5], Michael Evans[2,6], and J. Ryan Stewart[4,7]

ADDITIONAL INDEX WORDS. pots, total water use, sustainability, *Petunia ×hybrida*

SUMMARY. In recent years, biocontainers have been marketed as sustainable alternatives to petroleum-based containers in the green industry. However, biocontainers constructed with plant materials that are highly porous in nature (e.g., peat, wood fiber, straw) tend to require more frequent irrigation than conventional plastic products. As irrigation water sources become less abundant and more expensive, growers must consider water consumption in any assessment of their economic and environmental viability. This project evaluated plant growth and total water consumption for nine different biocontainers (seven organic alternatives, and two recently developed bioplastic alternatives) and a plastic control used to produce a short-term greenhouse crop, 'Yellow Madness' petunia (*Petunia ×hybrida*). Dry shoot weight and total water consumption differed by container type, with some of the more porous containers (wood fiber, manure, and straw) requiring more water and producing smaller plants by the end of the trial period. Intuitively, the more impervious plastic, bioplastic, and solid rice hull containers required the least irrigation to maintain soil moisture levels, though shoot dry weights varied among this group. Shoot dry weight was highest with the bioplastic sleeve and slotted rice hull containers. However, the latter of these two containers required a greater volume of water to stay above the drying threshold. Findings from this research suggest the new bioplastic sleeve may be a promising alternative to conventional plastic containers given the current production process.

Although biocontainers (i.e., plant material–based containers) have emerged as a response to excessive plastic landfill waste, their adoption in the green industry could significantly increase crop watering requirements. Water availability has traditionally been an issue associated with arid and semi-arid production sites (Fereres et al., 2003). However, this issue is quickly becoming a major environmental and economic consideration for all horticultural enterprises, regardless of climate. With demand, regulation, and cost of water all projected to increase (Beeson et al., 2004), growers will be subject to increasing pressure to assess their overall water use and identify areas to improve efficiency and reduce waste.

In their review of irrigation management techniques, Fereres et al. (2003) identified deficit irrigation [i.e., irrigation at a level below the rate of evapotranspiration (ET)], irrigation runoff reclamation, and the reduction of ET as the three main strategies for conserving water in horticultural production. Deficit irrigation is largely limited to field-grown crops and large-container production, given the ability of the plants to draw upon relatively large soil moisture reserves (Fereres and Soriano, 2007; Fereres et al., 2003). Compared with these production systems, the small volumes of pots and trays commonly used to produce floral and foliage crops limit their overall water-holding capacity and the rooting space available to the plant. Moreover, growers use deficit irrigation in times of limited water supplies to maintain survival rather than maximize growth (Fereres and Soriano, 2007). This loss in yield potential (i.e., biomass) is largely unacceptable when producing high-value ornamental greenhouse crops (Fereres et al., 2003).

Although deficit irrigation plays a very limited role in floriculture production, ET reduction and irrigation water reclamation may have important implications for greenhouse growers, especially those intending to adopt biocontainers in their operations. Although not the focus of this work, water reclamation in horticulture can be effectively implemented through the adoption of an ebb-and-flood (subirrigation) system which recirculates water and fertilizer runoff (Dole et al., 1994; Dumroese et al., 2006; Morvant et al., 1998). Ebb-and-flood-irrigated 'Florida Sun Jade' coleus (*Solenostemon scutellarioides*) shoot dry weight remained similar among seven different biocontainers (i.e., bioplastic, coir, manure, paper, peat, straw, and wood fiber) and a conventional petroleum-based plastic control (Koeser et al., 2013). However, the study found that the high rate of fertilization and container wetting–drying pattern associated with subirrigation can cause a significant loss of puncture strength

Units

To convert U.S. to SI, multiply by	U.S. unit	SI unit	To convert SI to U.S., multiply by
29.5735	fl oz	mL	0.0338
2.54	inch(es)	cm	0.3937
16.3871	inch^3	cm^3	0.0610
28.3495	oz	g	0.0353
1	ppm	mg·L^{-1}	1
(°F – 32) ÷ 1.8	°F	°C	(°C × 1.8) + 32