GROWERTALKS

Features

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CRFs for URCs

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It's common for growers to begin providing water-soluble fertilizer (WSF) during the first week of cutting propagation, either through mist application or substrate irrigation, increasing fertilizer concentration as propagation proceeds. Common concentrations range from around 50 ppm N from a complete, balanced WSF during callusing (Stage 2) up to 200 to 400 ppm N during toning (Stage 4). Lower concentrations are typically used in mist due to application frequency, while higher concentrations are used for substrate irrigation.

Commercial growers aim to provide a sufficient supply of mineral nutrients and an environment conducive to nutrient uptake and assimilation to minimize production time and maximize quality. Growers also want to limit excessive nutrient application and leaching in the propagation environment to minimize loss of fertilizer and runoff.

Controlled-release fertilizers (CRFs) are polymer-enclosed fertilizers that release nutrients based on the temperature and moisture status of the substrate, metering out mineral nutrients over time. While CRFs are commonly used in producing containerized bedding plants and flowering potted plants, we wanted to see if they could be used during cutting propagation. Therefore, the objectives in this study were to quantify the effectiveness of CRFs during herbaceous annual propagation compared to traditional WSF fertilization.

Our approach

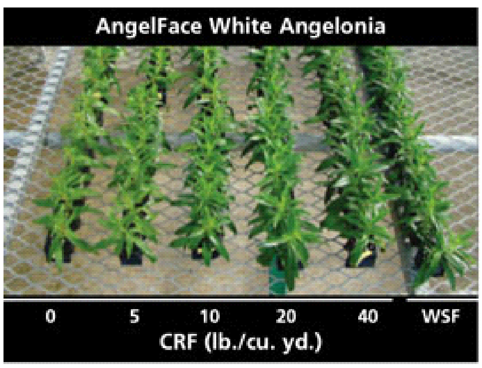
Unrooted cuttings of AngelFace White and Sundancer Pink Angelonia, Celebrette Apricot and Celebrette Hot Rose New Guinea Impatiens, Bluebird and Raspberry Sachet Nemesia, Savannah Red Zonal Geranium, and Cascadia Marshmallow Pink and Suncatcher Yellow Petunia cuttings were received from commercial stock plant facilities. For our study, we selected these annuals to represent the ranges of requirements of annual bedding plants, including fertilizer, pH and temperature requirements.

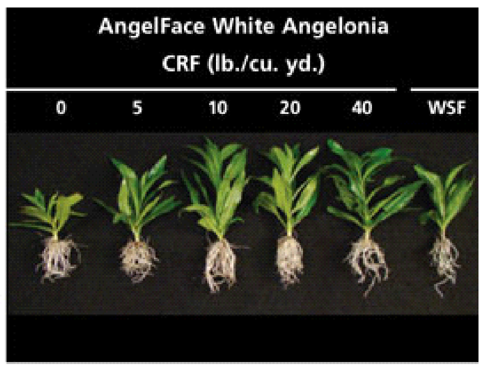
Cuttings were placed in 105-cell propagation trays filled with a propagation substrate composed of three parts soilless substrate and one part coarse perlite amended with 0, 5, 10, 20 or 40 lb./cu. yds. controlled release fertilizer (Osmocote Plus 15N-9P-12K 3 to 4 month; Everris NA). Cuttings in substrate containing a CRF (including the 0 lb./cu. yds. treatment) were misted with tap water supplemented with sulfuric acid to reduce total alkalinity and to maintain a water pH to a range of 5.8 to 6.2.

For our WSF control treatment, another group of cuttings were placed in a substrate containing no CRFs and were misted with acidified tap water supplemented with a complete WSF (Jack's LX Plug Formula for High Alkalinity Water; J.R. Peters) and micronutrient supplement (Compound 111; Everris) providing 60 ppm N with each misting event. After the use of mist was discontinued, cuttings grown with CRFs were irrigated with unfertilized water, whereas cuttings grown with WSFs were hand-irrigated with acidified water supplemented with a combination of two WSFs to provide the following 200 ppm N.

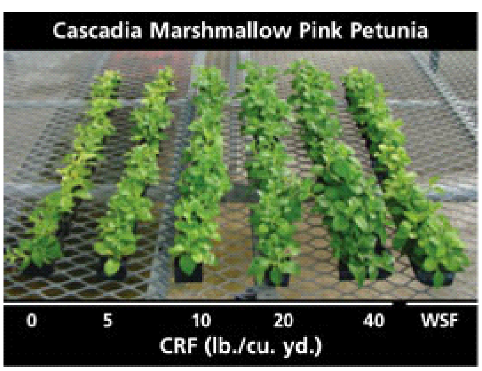
All cuttings were grown in a glass-glazed greenhouse with evaporative pad and fan cooling, and radiant hot water perimeter and bench-top heating. The target air and substrate temperature set point was 73F (22C), and a target daily light integral of ≈5 mol•m-2•d-1 for callusing and ≈10 to 12 mol•m-2•d-1 for rooting was maintained by using a combination of retractable woven shade cloth and high-pressure sodium lamps.

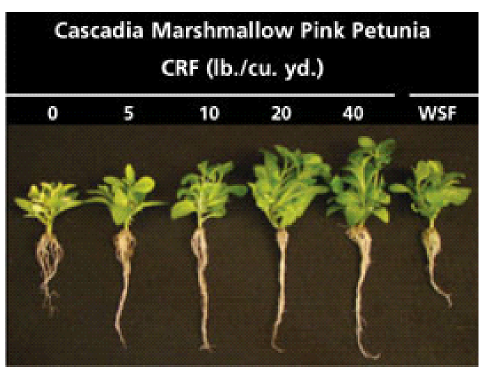
Four weeks after the beginning of the experiment, we collected data to characterize the growth responses to fertilization, including stem length, and root and shoot dry weights. We also submitted dried shoot tissue for mineral nutrient analyses. When available, tissue mineral nutrient concentrations were compared to published recommended ranges.





Figures 1 and 2. AngelFace White Angelonia cuttings grown with 0, 5, 10, 20 or 40 lb./cu. yds. CRF or 60 ppm N from WSF during propagation. Photos were taken four weeks after cuttings were placed into propagation.





Figures 3 and 4. Cascadia Marshmallow Pink Petunia cuttings grown with 0, 5, 10, 20 or 40 lb./cu. yds. CRF or 60 ppm N from WSF during propagation. Photos were taken four weeks after cuttings were placed into propagation.

What we saw

As CRF increased from 0 to 20 or 40 lb./cu. yds., shoot dry weights increased by 29% (Sundancer Pink Angelonia) to 121% (Raspberry Sachet Nemesia), while WSF increased shoot dry weights by 39% (Bluebird Nemesia) to 150% (Suncatcher Yellow Petunia) compared to unfertilized cuttings. The shoot dry weights of AngelFace White Angelonia and the zonal geraniums were unaffected by fertilizers.

The root dry weights for both angelonia and nemesia cultivars receiving WSFs decreased by 30% (Sundancer Pink Angelonia) to 41% (Raspberry Sachet Nemesia) compared to unfertilized cuttings. Similarly, root dry weights for Sundancer Yellow Angelonia, and Bluebird and Raspberry Sachet Nemesia decreased by 35%, 46% and 45%, respectively, as CRF increased from 0 to 40 lb./cu. yds. Alternatively, both New Guinea impatiens and petunia cultivars, and zonal geraniums were unaffected by fertilizers. Though root dry weights decreased with fertilization for some species, all cuttings were still fully rooted and “pullable.”

We compared tissue mineral nutrient concentrations to species-specific published recommended sufficiency ranges to better evaluate the effectiveness of CRFs to deliver nutrients in propagation. For primary macronutrient concentrations, species varied in the fertilizer required to achieve sufficient tissue values. We saw a broad range in primary macronutrient tissue concentrations across species and fertilizer treatments. Using 10 lb./cu. yds. CRF resulted in adequate tissue concentrations for N, P and K across species.

Tissue Ca levels of Bluebird Nemesia were below recommended values, while only Raspberry Sachet Nemesia fertilized with WSF had sufficient Ca. Sulfur and Mg were sufficient for all cuttings, regardless of fertilizer, for all other secondary nutrients. Similarly, tissue levels of micronutrients were in the sufficient range for all other species and cultivars, regardless of fertilization, save for angelonia (WSF or CRF was required).

When the short timeframe for propagation is taken into consideration, maintaining and/or restoring tissue nutrient concentrations to published sufficient ranges may be difficult to achieve given the lack of sufficient roots during the first stages. Alternatively, these ranges may not be appropriate for this crop stage, i.e. recently rooted cuttings. Any of the cuttings receiving WSF or ≥ 10 lb./cu. yds. CRF appeared healthy and marketable.

Opportunities for greenhouse application

CRFs generally increased tissue levels of macronutrients for most species in this study and, at the highest rates, were comparable to cuttings receiving WSF with respect to growth, morphology and tissue nutrient concentration. Specifically, incorporating 6 to 20 lb./cu. yds. CRF results in shoot tissue nutrient concentrations similar to cuttings propagated using WSF and minimizes some of the excessive growth associated with the highest rate of CRF.

Although incorporating large amounts of CRF into substrate may initially induce ‘sticker shock’, the cost of providing CRF during propagation must be considered relative to the value of the cuttings. Using an average wholesale price for the cost of the CRF used in our experiment, it would cost ~$0.30 per tray of cuttings to provide 40 lb./cu. yds., while a tray of rooted cuttings may cost from $65 to $75. Additionally, CRFs may add value when rooted cuttings must be held if planting is delayed or as an additional source of nutrients following transplanting. **GT**

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