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Don't Neglect The Root Zone

When using controlled-release fertilizers, growers must remember to monitor electrical conductivity and pH. Researchers study these factors in fertilizer programs for poinsettias, bedding plants and during propagation.

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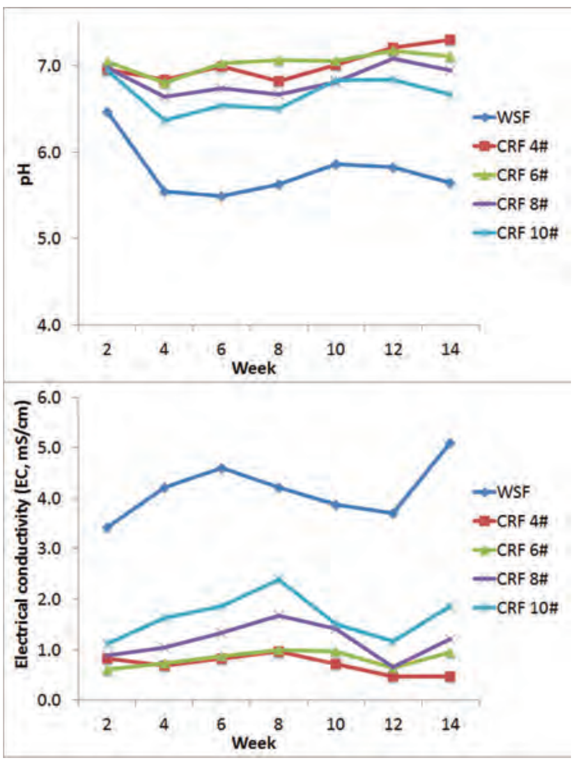
BEDDING and potted plants are traditionally fertilized daily or several times a week with water soluble fertilizer (WSF) applied in the irrigation water. With WSF, the fertilizer components are in a form that can be directly absorbed by the plant. This also means the fertilizer components can immediately impact the soluble salts and the pH of the substrate. WSF are also in a form that can readily be leached from the root zone.

When using controlled-release fertilizers (CRF) the nutrients are primarily held within the CRF prills and are not available for plant absorption until they are released slowly over time. Thus, when a CRF is added to the substrate, its effects on pH and salts are not immediate. Instead, they occur slowly over time as nutrients diffuse from the prills. Use the results from three studies to better manage the root-zone pH and electrical conductivity (EC) when using CRFs.

Both Fertilizer Treatments Affect Root Zone EC And pH

The EC guidelines that are widely used by the greenhouse industry were developed for WSFs. Following these guidelines, a Pour Thru EC of 1.0 to 2.6 milliSiemens per centimeter (mS/cm) is desirable to supply adequate fertility for low-to-medium vigor bedding plants. For heavy feeding plants such as poinsettias, garden mums and vigorous petunias, an EC of 2.6 to 4.6 mS/cm is desirable.

Methods for conducting each experiment are described in the sidebars on the following page. In the poinsettia experiment, the WSF treatment resulted in an EC within 3.5 to 4.5 mS/cm for most of the crop period. By the end of the experiment when plants were absorbing less nutrients, EC rose to potentially harmful levels in the WSF treatment. For CRF, the EC values were always below 2.6 mS/cm, and for the lower application rates, these were always below 1.0.



These graphs indicate the Pour Thru pH and EC of poinsettias grown with WSF or CRF.

'Peterstar Red' poinsettias fertilized with WSF were about the same size as those receiving 6 lbs./yd³ or more CRF. Plants receiving 4 lbs./yd³ CRF were a bit smaller. For 'Prestige Red,' 10 lbs./yd³ was required to equal the size of liquid-fed plants, and lower amounts led to a smaller plant. The recommended substrate pH for poinsettia is between 5.5 and 6.5; this ensures that nutrients are soluble

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and readily available. The pH of plants irrigated with WSF was within the recommended range throughout the experiment, whereas for all CRF treatments substrate pH quickly rose above 6.5 and remained there for the rest of the experiment.

In the bedding plant experiment, petunia, a moderately heavy feeder, with 200 ppm N from WSF produced the largest plants. The other treatments, including the 100 ppm N WSF, produced markedly smaller plants. Lantana and coleus are less vigorous feeders and responded well to CRF. For these two species, 8 lbs./yd³ CRF produced plants as large as the 200 ppm N WSF treatment. Plants irrigated with 100 ppm N WSF or 6 lbs./yd³ were intermediate-sized, and lower application rates of CRF (2 or 4 pounds) led to somewhat smaller plants.

During the six-week trial, only plants irrigated with 200 ppm N WSF had a pH of 6.5 or lower. This is due to the moderately acidic nature of 21-5-20 fertilizer. Neither the 100 ppm N WSF nor any of the CRF treatments supplied enough acidic nitrogen to keep pH less than 6.5. The EC of the WSF treatments was within the 1.0 to 2.6 mS/cm range, which is optimum for most bedding plants. In contrast, the CRF treatments had nearly constant EC, which varied from 0.4-0.6 mS/cm. In terms of nutrient leaching, CRFs are superior to WSF. CRFs leached 5 to 10

The Study: **Bedding Plants**

This experiment looked at the effect of CRF rates on pH, EC and nutrient leaching of *Petunia* 'Fame Blue,' *Lantana* 'Landmark Citrus,' and 'Electric Lime' coleus. Rooted liners were transplanted into 6-inch containers with a commercial soilless substrate. Plants were grown for six weeks and received either WSF or CRFs.

WSF was applied daily in the irrigation water at either 100 or 200 ppm N 21-5-20. Osmocote Plus 15-9-12 (3 to 4 month formulation) was applied as a top dress at rates of 2, 4, 6 and 8 lbs./yd³ of substrate, which roughly correlates to a low-label application rate up to a medium-to-high label rate. Again, substrate pH and EC was monitored periodically using the Pour Thru method.

The Study: **Poinsettias**

Rooted cuttings of 'Prestige Red' and 'Peterstar Red' poinsettias were transplanted into 6-inch containers filled with a commercial soilless substrate to see how pH and EC would respond to WSF and CRFs.

Throughout the 14-week production period, plants received either Jack's 21-5-20 at 250 parts per million (ppm) nitrogen, a WSF, or Osmocote Plus 15-9-12 (5 to 6 month formulation) applied as a top dress at rates of 4, 6, 8 and 10 pounds per cubic yard (lbs./yd³) of substrate. Substrate pH and EC was monitored periodically using the Pour Thru method.

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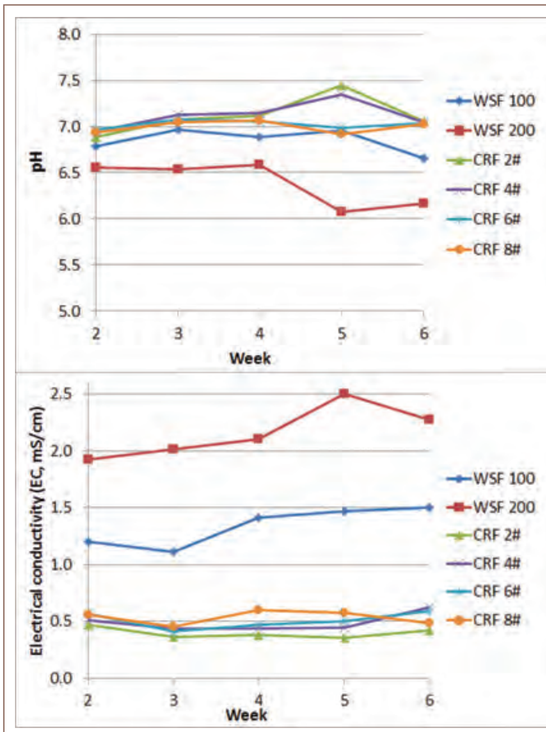
times less nitrogen, phosphorus and potassium than the WSF counterparts.

In the propagation experiment, one week after sticking cuttings there was little difference in both substrate pH and EC across our different fertilizer treatments. As time in propagation passed, the fertilizers had a greater impact on both pH and EC. Both CRF and WSF decreased pH and increased EC, although the amount of CRF incorporated affected the degree of influence. By mixing the CRF into the propagation substrate the day before sticking cuttings, the effect of CRF incorporation was negligible at first and increased over time. The release pattern of nutrients from CRF prills corresponds well to adventitious root development in cuttings, with a greater demand for nutrients as roots develop. This suggests that CRFs may be a valuable tool for cutting propagation.

The Study: **Propagation**

Cuttings of *Impatiens* 'Celebrette Apricot' were stuck in 105-cell propagation trays filled with soilless substrate containing no fertilizer charge or 5, 10, 20 or 40 lbs./yd^3 of Osmocote Plus 15-9-12 (3 to 4 month formulation) CRF of substrate (corresponding to roughly medium or 1, 2 or 4 times the high label rates).

Cuttings were placed under a clear acidified water mist, while another set of cuttings in the above substrate mix (without CRF) were placed under mist containing 50 ppm N from a balanced feed. The plug press or plug extraction method was conducted weekly to monitor the pH and EC of the propagation liners.



The Pour Thru pH and EC of bedding plants grown with WSF or CRF are illustrated in these two graphs.

Monitor EC And pH Regularly To Ensure Success

In our trials we found that EC guidelines for WSF cannot be directly extended to CRF. Because CRFs are slow-release fertilizer sources, the EC values we measured were much lower as compared to WSF. For CRF, however, a low EC does not necessarily indicate that the fertility level is insufficient for optimum plant growth. For example, the growth of 'Peterstar Red' poinsettia receiving 6 lbs./yd^3 CRF was similar to plants receiving 250 ppm N WSF. Yet, Pour Thru EC averaged 0.8 for CRF and 4.2 for WSF.

Monitoring EC is still important when using CRF. A stable EC indicates that nutrient release is in sync with plant needs. Excessively high EC, greater than 4.5 mS/cm, indicates that fertilizer salts are building up in the substrate and this can lead to plant damage from salt burn. Symptoms include death of root tips (which can provide an entry point to root diseases), wilting due to the inability to absorb enough water and browning of lower leaf edges as salts build up to harmful levels in the leaves.

With CRFs, a high EC may indicate that fertilizer release is greater than the plant needs, although this is not common. More commonly, high EC is found when hot growing temperatures cause a rapid release of nutrients from the fertilizer prill.

A high EC can also occur when CRF is incorporated into a substrate and held for a long time (more than two to four weeks) before transplanting, which leads to a release of fertilizer salts before the substrate is used. These cases illustrate the need to periodically measure EC when using CRF, especially during hot temperatures. Regardless of the cause of high EC, the remedy is the same — drench the substrate thoroughly with clear water to leach out excess salts. Monitor EC and repeat leaching as necessary.

Growers should also periodically measure pH when using CRFs. CRFs were more likely to result in plants with a high substrate pH than a moderately acidic WSF (21-5-20). When switching to CRFs, growers may find they need to be more proactive with pH control. To lower pH, sulfuric, phosphoric or nitric acids can be added to acidify the irrigation water or use periodic drenches with an acidic WSF (such as 21-7-7). More information on monitoring and adjusting root-zone pH is available at Greenhouse.cornell.edu and Flowers.hort.purdue.edu

CRFs can be a great tool to have in your fertilizer tool kit to reduce runoff of nutrients into the environment or to reduce the labor associated with mixing and applying WSF. Just don't lose sight of the details. Continue to monitor pH and EC and adjust growing practices when necessary to keep these in check. **GG**

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