Producing Poinsettias Sustainably

Floriculture Sustainability Research Coalition

Researchers hone in on how to produce poinsettias sustainably with organic fertilizers.

by **KIMBERLY WILLIAMS, ROBERTO G. LOPEZ** and **DANIEL F. WARNOCK**

As more greenhouse producers consider implementing sustainable production practices, questions arise about the use of compostable/biodegradable pots, organic media, fertilizers and pest management methods for poinsettias. Organic media and compostable/biodegradable pots are available in the industry, and pest management practices using organic pesticides and biological control agents are being established.

However, cultural information about using organic fertilizers in a commercial greenhouse operation lags behind that available for other management areas. Specifically, information about organic fertilizer effects on substrate pH and EC and optimal rate of use compared to inorganic fertilizers is needed. With sustainable and low input production practices on everyone's mind, where should one begin?

Poinsettias can suffer a wide range of nutritional disorders if not properly managed, so making the jump from using conventional inorganic fertilizers to organic or organically based fertilizers can be fraught with challenges. In this article, we share some of our preliminary data, including the challenges and successes of growing poinsettias with some of these organic fertilizers.

Table 1. Tissue nutrient concentrations of youngest, fully-expanded poinsettia leaves at harvest.

		%			ppm			
Fertilizer source	**N rate**	**N**	**P**	**K**	**Fe**	**Mn**	**Zn**	**Cu**
Omega	100	4.5	0.7	2.3	114	92	36	5
	200	6.0	1.0	2.5	169	107	43	6
	300	6.5	1.0	2.8	155	95	34	5
Peter's 20-20-20	100	3.5	1.3	2.7	168	103	20	2
	200	5.3	1.2	2.6	138	83	29	4
	300	6.0	1.0	2.6	158	81	34	4
Fish Emulsion	200	5.3	0.5	1.7	164	101	24	6
Fish Hydrolyzate	200	5.8	1.8	1.2	195	129	31	6
Daniel's oilseed extract	200	5.4	0.9	1.7	181	116	34	4
Standard$_z$		4.0-6.0	0.3-0.6	1.5-3.5	100-300	60-300	25-60	2-10

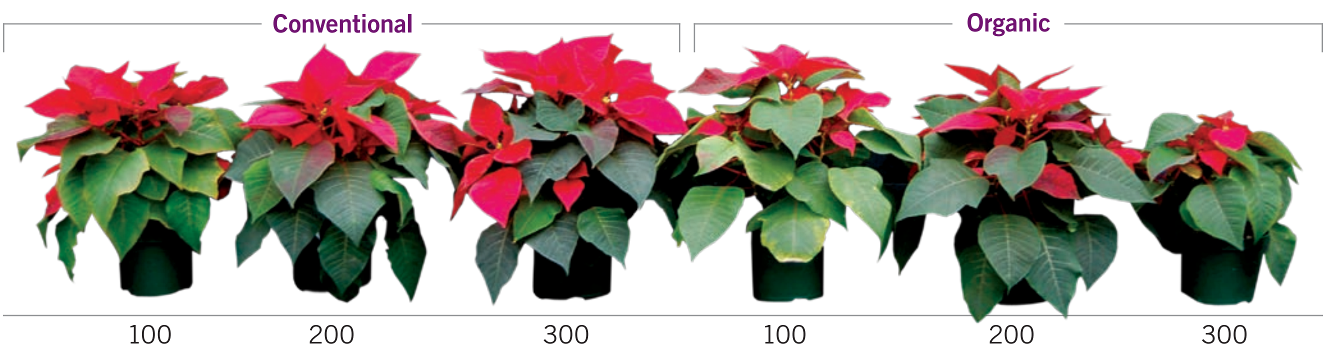
Sufficiency ranges for tissue nutrient concentrations as reported in Dole and Wilkins' Floriculture: Principles and Species (Pearson Prentice Hall, 2005).

Going Organic

What is so different about using these organic fertilizers? First, the nitrogen (N): phosphorous pentoxide (P_2O_5): potassium oxide (K_2O) ratios of organic fertilizers are sometimes higher in phosphorus and lower in potassium compared to conventional inorganic fertilizers. Research conducted by Paul Nelson at North Carolina State University and Roberto Lopez at Purdue University with Daniel's oilseed extract fertilizer (Daniel's 10-4-3 Professional) shows a wide range of species can be successfully grown with Daniel's fertilizer, despite the relatively low potassium component. These plants often have lower potassium tissue concentrations, but levels are still in sufficiency ranges and deficiency symptoms rarely occur with its use. A second difference is micronutrient cations such as iron, manganese, zinc and copper can be higher than desirable in some organic fertilizers.

A third difference between conventional and organic fertilizers is organic sources do not always result in comparable substrate

Figure 1. Poinsettia fertigated with Peter's 20-20-20 (conventional) and Omega 6-6-6 (organic) applied at different rates of ppm N.




Chasmanthium River Mist ppaf

Coreopsis Route 66 ppaf

Vinca minor 24 Carat ppaf
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pH and electrical conductivity compared to inorganic fertilizers. Unlike conventional soluble fertilizer, which provides inorganic nutrients in a form immediately available for plant uptake, organic fertilizers are broken down in the substrate to result in nutrient availability that can change over time.

Lastly, some organic fertilizers cannot be diluted much in advance of their application, otherwise they support the growth of a wide range of undesirable organisms.

The Research

Researchers at Kansas State University, the University of Illinois and Purdue University conducted side-by-side comparisons of poinsettias grown with both conventional and organic fertilizers. Kansas State and Illinois compared the conventional water soluble Peter's Professional 20-20-20 General Purpose to the organic Omega 6-6-6, which is derived from the microbial digestion of bloodmeal, bone meal and sulfate of potash.

What makes this comparison desirable is that both fertilizer sources contain the same ratio of N : P_2O_5 : K_2O, resulting in more of an "apples-to-apples" comparison of conventional to organic fertilization than is usually possible. Ferti-lome fish emulsion (5-1-1), Dramatic fish hydrolysate (2-5-0.2), and Daniel's soybean oilseed extract (10-4-3) were also evaluated at Kansas State. Purdue compared the conventional inorganic fertilizer Peter's Excel 15-5-15 Cal-Mag to Daniel's oilseed extract. Note that the last three organic fertilizers vary in their N : P_2O_5 : K_2O ratios compared to the conventional sources.

Kansas State and Illinois used Fafard organic root media and Purdue used Fafard rice hull media (1PRH) and Premier ProMix HP for the conventional crop. All three sites used biologically based pest management to produce either 5- or 6-inch poinsettias.

Purdue grew its sustainable poinsettia crop in Ball Circle of Life rice pots. Depending on the site, one rooted cutting of either 'Christmas Feelings,' 'EarlyGlory

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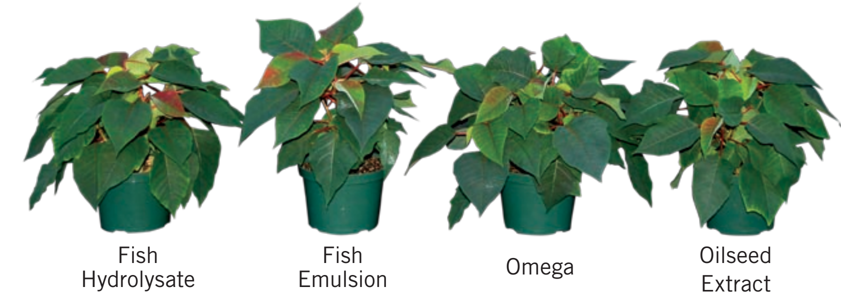
Figure 2. **Poinsettias were fertigated with 200 ppm Fish hydrolysate, Fish emulsion, Omega or Daniels oilseed extract.**



Red,' 'Orion,' 'Prestige Early Red' or 'Peterstar Red' was planted per pot and pinched. Both Peter's 20-20-20 and Omega 6-6-6 were applied at rates of 100, 200 and 300 ppm N. The additional three organic fertilizers and the Peter's Excel used at Purdue were applied at 200 ppm N only. Poinsettias were fertigated at all three locations. However, Kansas State discontinued fertigation in mid-November due to high-soluble salt levels and instead used clear water. At Illinois, clear water leaching occurred once every two weeks. At each irrigation, Kansas State leached less.

More Online
For EC information specific to each test site, visit **GreenhouseGrower.com.**

exception of the 300 ppm N rate from the Omega 6-6-6 treatment. High soluble salts resulted in diminished growth (Figure 1). Plant architecture was also affected.

The fish emulsion treatment (low in phosphorus and potassium), produced plants that were less branched than those in the other treatments (Figure 2). Final height for the four cultivars fertigated with Daniel's oilseed extract averaged 17.4 inches versus 18.3 inches for those grown with Peter's Excel (Figure 3).

Figure 3. **Poinsettia fertigated with Peter's Excel (left) and Daniel's oilseed extract (right).**

To monitor nutritional status during production, leachate was collected weekly or every other week using the PourThru method, and the pH and EC of the leachate were measured. Height data was collected throughout the experiments, and nutrient analysis of the youngest, fully-expanded leaves was conducted at Kansas State at the end of their experiment.

Results indicated plant height was comparable across the various treatments at both Kansas State and Illinois, with the

The acceptable pH range for poinsettias grown in soilless substrates is 5.6 to 6.3. Over the course of the production cycle, substrate pH over all fertilizer treatments was between 5.0 and 6.3 at Kansas State, 5.2 and 6.5 at Illinois and 4.3 and 6.5 at Purdue. Although the pH dropped below the acceptable range, we did not see any negative effects.

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However, soluble salts were a different story. At any given nitrogen rate, substrate EC levels were higher for plants fertilized with the Omega 6-6-6 compared to Peter's 20-20-20 at both Kansas State and Illinois. At Kansas State, leachate EC levels from pots fertilized with 200 ppm N from Omega 6-6-6 reached a staggering 7.0 to 9.0 mS/cm by late October, while the leachate EC levels from pots fertilized with the same rate of Peter's 20-20-20 were in the more acceptable range of 2.5 to 3.7 mS/cm.

At Illinois, substrate EC levels for the organic Omega 6-6-6 fertilizer were in the acceptable range. The EC range for the conventionally fertilized substrate, however, was below the acceptable range (1.1 to 1.4 mS/cm) due to more frequent leaching. Leachate soluble salt levels for plants fertilized with 200 ppm N from the fish emulsion fertilizer became precarious, reaching 3.0 mS/cm by the end of October and climbing to 4.4 mS/cm by harvest as nutrient release continued after fertilizer application stopped.

More Comparison

Soluble salt levels associated with the fish hydrolysate fertilizer were not problematic. At Kansas State, the Daniel's oilseed extract resulted in slightly higher EC readings than the same rate of conventional fertilizer. However, at Purdue, EC values on average were 2.9 and 3.3 mS/cm respectively for Daniel's versus Peter's Excel. It is always important for growers to monitor substrate soluble salts, as our results indicate. As organic fertilizers break down into mineral ions and organic matter, salt levels in the root medium can rapidly climb. In addition to a general high-salt toxicity, this can predispose plants to infection from root rot pathogens like Pythium.

At Kansas State, plant tissue nitrogen at harvest increased as nitrogen rate increased (Table 1). Plant tissue nitrogen rates were higher in plants fertilized with Omega 6-6-6 versus Peter's 20-20-20. Plants grown at the 100 ppm N rate were visibly lighter green in color than for the other nitrogen rates (Figure 1), indicating marginal nitrogen deficiency.

Phosphorus was adequate under all fertilizer treatments, but tissue potassium

Figure 4. Overall crop at Purdue. Plants on the left were fertigated with the conventional fertilizer and plants on the right were fertigated with Daniel's.

levels were at the lower end of the sufficiency range for plants fertilized with fish emulsion, fish hydrolyzate and oilseed extract. Remember, the formulations of the organic fertilizers used in this study have a lower potassium-to-nitrogen ratio than conventional fertilizers. Watch for subtle symptoms of potassium deficiency and consider supplemental potassium application if symptoms appear.

Conclusions

Finally, some organic fertilizers are suspected of providing higher-than-optimal concentrations of micronutrients. But in this experiment, tissue levels of iron, manganese, zinc and copper were all within optimal ranges (Table 1).

Our collective results indicate it is possible to produce high-quality poinsettias with organically based fertilizers. The nutrient management strategies, however, are not exactly the same compared to conventional inorganic fertilizers. As with any production system, monitoring both substrate soluble salts and pH are important. For more information on monitoring methods, visit: **https://sharepoint.agriculture.purdue.edu/agriculture/flowers/bulletins.aspx**. As always, it is a good idea to trial potential fertilizers and alternative substrates before committing fully to a new program. **GG**

About the authors: Kimberly A. Williams (**kwilliam@ksu.edu**) is a professor in the Department of Horticulture, Forestry, and Recreation Resources at Kansas State University. Roberto G. Lopez (**rglopez@purdue.edu**) is an assistant professor and floriculture extension specialist in the Department of Horticulture and Landscape Architecture at Purdue University. Lopez is also a member of the Floriculture Sustainability Research Coalition. Daniel F. Warnock (**dwarnock@uiuc.edu**) is an associate professor in the Department of Natural Resources and Environmental Sciences at the University of Illinois.

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