

## Comparison of Extraction Methods for Testing pH and Electrical Conductivity of Substrates Amended with Different Phosphorus Sources Used to Grow Marigolds<sup>©</sup>

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Phosphorus (P) is one of the major elements essential for plant growth. Commercial P fertilizers are typically derived from phosphate rock, but the world's supply of mined phosphate is limited. Biosolids and animal manures are rich in P that can be reclaimed to produce struvite (magnesium ammonium phosphate hexahydrate). Struvite has the potential to replace mined fertilizer P in the soilless substrates used for container plant production. Utilizing struvite from wastewater could enhance nutrient use efficiency and sustainability of container production systems.

Electrical conductivity (EC), a measure of soluble salt levels, and pH are two important chemical properties of plant growth substrates that influence plant nutrition and growth. Substrate pH and EC should be tested prior to planting. In order to measure pH and EC, liquid must be extracted from container substrates. There are several commonly used extraction methods and they typically give different results. Using one substrate amended with different P sources, we compared three common methods for liquid extraction: the saturated media extract (SME) method and the 1:2 and the 1:5 dilution by volume methods. There were four replicate samples of each method. This comparison will provide useful information for interpreting pH and EC results.

The container growth substrate was made by thoroughly mixing peat, perlite, and vermiculite (2:1:1, by vol.) along with 1.75 lb/yd<sup>3</sup> (1.04 kg·m<sup>-3</sup>) Micromax micronutrient mix and 8 lb/yd<sup>3</sup> (4.75 kg·m<sup>-3</sup>) dolomite. This was the no pre-plant P mix (NoP). The other two mixes with pre-plant P were made by incorporating either triple superphosphate [TSP, (0-45-0)] at a rate of 1 lb/yd<sup>3</sup> (0.59 kg·m<sup>-3</sup>) or struvite at an equivalent rate into the substrate. Struvite (0-25.4-0) was obtained from the Yakima, Washington municipal wastewater treatment plant (<http://www.multiformharvest.com/>). In spring 2014, uniform marigold (*Tagetes patula* 'Little Hero Flame') seedlings were transplanted into 0.75 qt (0.7 L) square containers. After transplant, liquid fertilizers containing 200 ppm nitrogen (N) and 200 ppm potassium (K) were applied twice weekly at two rates of P: no P or 100 ppm P. All plants received same amount of N and K. Stem height and the widest and narrowest canopy width were measured. Shoot visual quality was rated.

Results indicated ECs of substrates extracted with the SME method were approximately twice that of the 1:2 dilution method. The 1:2 method ECs were about twice that of the 1:5 dilution method. Measured pH of substrates extracted with the SME was somewhat higher by 0.3 to 0.7 units than pH of the 1:2 or 1:5 methods. Struvite produced marigolds similar to the TSP-incorporated controls in shoot growth and visual quality. The addition of liquid fertilizer with P did not improve plant growth and quality in the struvite and TSP amended substrates. In the NoP substrate post-plant addition of P in liquid form significantly increased growth and quality of the marigold plants. Leaves of marigolds in the NoP substrate without liquid P developed the purple coloration associated with P deficiency in some species. These plants were not salable. Results indicated struvite can be a suitable TSP replacement for container-grown greenhouse plants.

