How Much Does Your Plug Mix Nutrient Addition Influence Your End Product?

by
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What does it take to make a complete plug mix for vegetable transplants? Most growers will tell you: lime to counter the low pH of the peat moss, phosphorus to encourage healthy root growth, fritted trace elements to supply necessary micronutrients and a wetting agent. These additions are standard throughout the industry and are based on sound research used to develop the Cornell Mix. Yet have these additions been thoroughly tested under south Florida's environmental conditions, high bicarbonate irrigation water and stress management?

Bicarbonates, plentiful in the irrigation water of South Florida, tend to drive plug pH up over the course of production. Plug pHs over 8.0 are common in the finished product and can cause nutrient deficiencies, especially of iron and phosphorus, during the latter stages of the crop. Growers, in an effort to thwart these deficiencies, often go to great expense installing acid injection systems. However, even with acidified irrigation water the "super buffering" nature of bicarbonate still tends to drive the pH up if all the bicarbonate has not been neutralized. Therefore is lime really necessary when aqueous bicarbonate will increase the initial peat pH?

New evidence has shown that phosphorus, long held as "the" builder of roots, may actually inhibit root growth in seedling crops at high levels! Also considering the highly leachable nature of P in organic soils, such as peat, is it necessary in the media?

No one disputes that trace elements are required for good plant growth. Deficiency symptoms from a lack of these elements are readily expressed and easily seen. However the amount of any particular trace element required for adequate growth is minuscule, so is it really necessary to put them in the media?

We felt these nutritional media additions needed to be revisited in light of new research findings and prevailing conditions in Southwest Florida. Together with Verlite (Tampa, Fla.) plug mixes were designed to determine how Ca, P, and micronutrients affect tomato transplants in the house and subsequently in the field. Verlite supplied Vegetable Transplant Mix A (70% peat, 30% vermiculite) without nutrient additions to which standard amounts of Ca, P and micronutrients, alone and in combination were added until all blends of the mix and the amendments were made. The flats were seeded on September 24 to FTE 30 (Petoseed, Saticoy, CA) and grown for 4 weeks. All treatments received 50 ppm N from 20-20-20 five times over that 4-week period. All treatments were randomized and replicated in scientific fashion.

Prior to field setting, 10 plants from each treatment were assayed for plug pH, height, fresh and dry weight (stems, leaves, roots), stem diameter, leaf area, leaf number, root:shoot ratio, and leaf:stem ratio. Remaining plants were set in the field for growth analysis and yield determinations. Not all of the plant house growth parameters will be discussed here and field growth and yield data are not available yet.

Liming ($CaCO_3$) the media greatly increased plug pH compared to treatments without lime (Table 1.) Bicarbonate levels in SWFREC well water are typical of others in the area (200 to 400 ppm). Therefore the liming effect of $CaCO_3$ effectively increased plug pH 1.6 units, placing the plant in jeopardy of Fe and P induced deficiency. Without lime, plug pH stabilized around 6.5, an acceptable pH to any plant house grower.

Table 1. The effect nutritional additions to a standard peat/vermiculite vegetable mix.					
Treatment	**Plug pH**	**Plant Height (cm)**	**Stem Diameter (mm)**	**Leaf Area (cm)**	**Root Dry Weight (g)**
Peat	6.62 b	11.0 b-d	1.90	16.4 d	0.0186 c
Peat+CaCO3	8.28 a	10.1 d	1.93	17.1 b-d	0.0225 a
Peat+PO4	6.51 b	14.0 a	2.05	18.7 a	0.0209 ab
Peat+Trace Elements	6.48 b	11.0 b-d	1.95	18.1 a-c	0.0191 bc
Peat+CaCO3+PO4	8.20 a	11.6 b-d	1.90	17.3 a-d	0.0200 bc
Peat+CaCO3+Trace	8.28 a	10.5 cd	1.92	16.7 cd	0.0200 bc
Peat+PO4+Trace	6.55 b	12.4 b	1.99	18.4 ab	0.0194 bc
Peat+CaCO3+PO4+Trace	8.17 a	12.0 bc	2.01	18.1 a-c	0.0229 a
LSD0.05	0.20	1.6	NS	1.4	0.0021

Phosphorus was shown to dramatically increase plant height and leaf area. In each case where P was included in the mix one notes taller plants and/or greater leaf area. Growers looking for cultural methods to reduce plant height might consider reducing the level of P in the media or even eliminating it altogether.

Trace elements do not seem to impact plant morphology as strongly as CaC03 and P. They do seem to temper (lessen) the effect of P somewhat. None of these treatments employed in this study seemed to affect stem diameter.

Surveying these data, a question arises concerning root weight. Is it the high bicarbonate environment or the calcium that is contributing to the increased root weights exhibited by the addition of CaCO3? Treatments containing P tended to have greater root dry weight accumulation. However, CaCO3 alone certainly boosts root weight compared to the unamended peat! Further work must be undertaken in this area.

These results warrant the re-evaluation of media additions for small plug vegetable transplant production. Granted this is simply one trial, and the data should be viewed as preliminary- But other trials are underway to confirm or refute these findings. Still, this test seems to have revealed some tools which the grower can use while growing the crop that may offer greater control of plant growth and development.