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BENCHMARKS

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Vic Klassen shows a sample of the "shrink wrapped" European-Type cucumbers.

Grower Profile: Burnac Corporation

By: Dr. Ray Sheldrake & Neal Dixon

The Bumac Corporation located near Ft. Pierce, Florida, has a magnificent facility for the production of the European "seedless" or "burpless" cucumbers as they are often called in this country.

Burnac has about 21 acres of double layer poly houses specifically for production of these high-quality cucumbers. The greenhouses are heated with large, oil-fired boilers and the climate is controlled with modern pad and fan systems. The humidity can be increased when needed by use of mist-type nozzles.

The crop is grown in Grace Plant'n Bags — plastic bags filled with Terra-Lite vermiculite and sphagnum peat plus a specially designed nutrient package developed through the Grace research team. The bags are about 48 inches long and 16 inches wide and contain approximately two cubic feet of the growing mixture — which is very similar to Redi-earth.

Burnac's principal manager is Vic Klassen. He is quick to credit the beautiful looking crop to the expertise of young, Danish-born head grower Ole Nielsen. Ole knows his cucumbers and has been a pleasure to work with for the Grace Horticultural Products team who have been assisting in the project from the start.

You may wonder — why bags? Ole will tell you that when they tried to grow in the local soils they really had troubles. The bags give them a "systems approach" to production that can be reproduced time after time. They just lay out the bags — end to end — down the row; put a dripper tube by each plant and set in the plants that are then about 2 weeks old. You cannot believe how fast they grow in that bright St. Lucie County sunshine. From a 4-6 inch plant we saw them up to seven feet tall, loaded with yellow blooms and baby cukes, in just four weeks.

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Research Report

Effects of pH Upon Nutrient Availability in a Commercial Soilless Root Medium Utilized for Floral Crop Production

By John C. Peterson
Assistant Professor, The Ohio State University
and Ohio Agricultural Research and Development Center
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Abstract

Availability of ten plant nutrients in a high-organic commercial soilless medium (Metro-Mix® 300) was quantified at seven pH levels. Results indicate the optimum pH range for nutrient availability, a range of compromise for nutrients which become more or less available as pH is altered, was 5.2 to 5.5 This range is a whole pH unit or more lower than the optimum pH characterized for mineral field soil. Findings suggest that cultural recommendations and production techniques based upon the relationship between pH and nutrient availability in mineral field soil may need to be modified for production of floral crops in this and other organic root media. (Editor's Note: Metro-Mix® growing media are now formulated for pH levels within the optimum range for soilless media as defined in this study.)

Introduction

The composition of root media utilized for floral crop production has changed dramatically in recent years. Production techniques have shifted from the use of mineral field soil to organic media composed primarily of peatmoss, pine bark, and/or hardwood bark. In short, there has been a shift from soil to soilless media.

Despite significant modifications in root media composition, many of the fundamental concepts of soil chemistry used to develop cultural recommendations and production techniques continue to be based upon research conducted with mineral field soil. One concept in particular relates to the influences of pH upon availability of plant nutrients in root media.

pH is the negative log of the hydrogen ion concentration. It quantitatively describes the acidity or basicity of a substance. The pH scale covers a range from one to fourteen, with seven representing a neutral value. The portion of the range from seven to one represents an increasing acidity and from seven to fourteen indicates an increasing alkalinity.

Research has demonstrated that pH greatly influences the availability of elements in root media. As pH changes,

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some elements become more available while others become less available.

Generally, the optimum pH range for soil has generally been accepted as 6.5-6.8. Consequently, floral crop production efforts are usually directed toward establishing and maintaining root medium pH in this range.

This optimum pH range was identified from research conducted with mineral field soil (2,1). As seen in Figure 1, pH values from 6.5 to 6.8 are a range between which a compromise in availability was evident for those elements which became more available with increasing pH and those that increase in availability with decreasing pH.

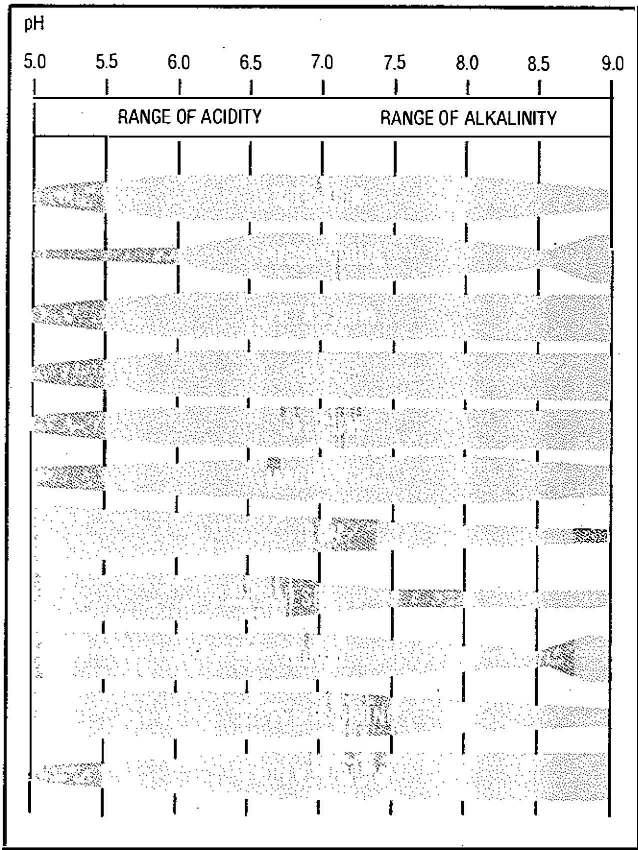

Figure 1. Availability of plant nutrients at different pH levels for a mineral soil (18).

Research has also been conducted in which investigators evaluated nutrient availability in an organic field soil often referred to as a muck peat and comprised of highly decomposed organic matter. The findings of this work are represented in Figure 2 and indicate that the optimum pH range for this organic field soil, a compromise region for those elements available at higher pH values and those more available at lower pH values, is about 5.5 to 5.8. This range is one full pH unit lower than that identified for a mineral field soil.

This information has stimulated questions about the optimum pH range for producing floral crops in soilless media, composed principally of organic substances and containing no mineral field soil.

In an effort to explore the relationship between pH and nutrient availability in a soilless medium, typical of that used for producing floral crops, the following research was conducted.

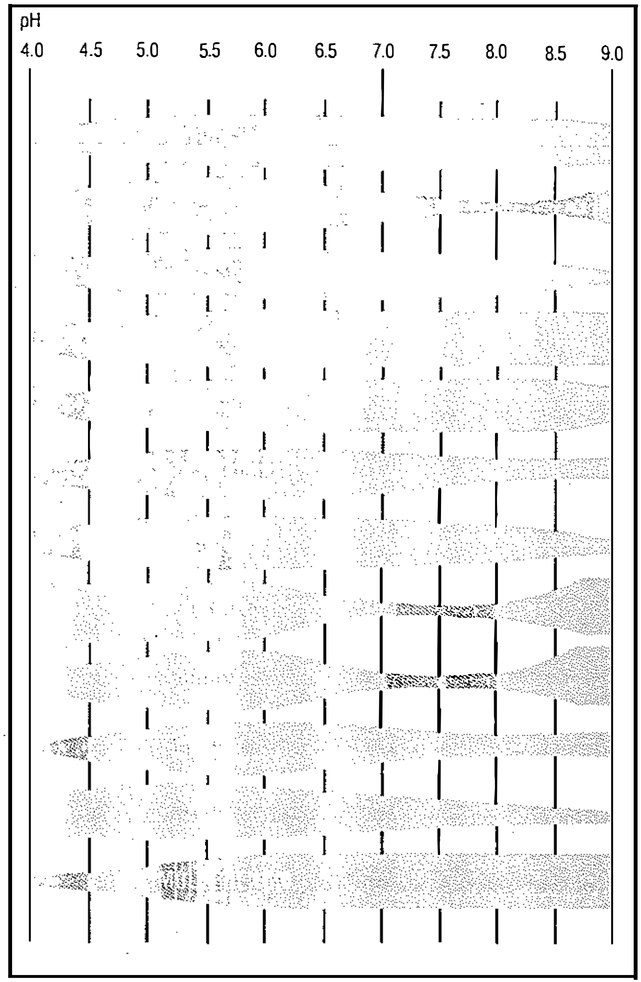

Figure 2. Availability of plant nutrients at different pH levels for an organic field soil (14).

Materials and Methods

A widely used commercial soilless potting medium, Metro-Mix® 300 (a product of W.R. Grace & Co.), was supplied by the manufacturer. This medium contains sphagnum peat moss, vermiculite, perlite, granite sand and composted pine bark (exact proportion of components is proprietary information not available for publication). The medium was specially prepared so as not to contain any of the normally-incorporated nutrient additives.

First, this medium was amended with potassium nitrate (770 grams/cubic meter), ammonium nitrate (367 grams/cubic meter), pulverized treble phosphate (0-44-0, 770 grams/cubic meter) and Peters® S.T.E.M. (soluble trace element mix) (72 grams/cubic meter). Care was taken to assure uniform distribution of amendments within the medium.

Next, the medium was divided into seven treatment batches and amended with iron sulfate [$FeSO_4$] or calcium hydroxide [$Ca(OH)_2$] at one of the following rates: 1. $FeSO_4$, 10.84 kilograms/cubic meter; 2. $Ca(OH)_2$, 2.81 kilograms/cubic meter; 3. $Ca(OH)_2$, 4.46 kilograms/cubic meter; 4. $Ca(OH)_2$, 6.70 kilograms/cubic meter; 5. $Ca(OH)_2$, 8.91 kilograms/cubic meter; 6. $Ca(OH)_2$, 17.82 kilograms/cubic meter; or 7. $Ca(OH)_2$, 35.64 kilograms/cubic meter.

Medium from each treatment batch was then placed in 15.2 cm plastic pots, saturated with distilled water with no leaching permitted, then placed in flats with the exposed surface covered with plastic film to minimize evaporative moisture loss and incubated at 21°C (70°F).

After four weeks, five pots from each treatment batch were removed and the medium in each pot analyzed for pH, soluble salts, nitrate nitrogen, phosphorus, potassium, calcium, magnesium, iron manganese, boron, zinc, and copper.

Analysis samples were prepared using the saturated soil extract method. Measurements of pH were made on the medium/distilled water mixture and the extracted solution was analyzed with a conductivity meter, nitrate electrode and inductively coupled plasma spectrograph, to quantify the other parameters measured.

Results and Discussion

Amendment with iron sulfate or calcium hydroxide enabled us to examine nutrient availability over a pH range from 4.32 to 7.83 (Table 1). Results indicate that availability of most nutrients was altered as pH increased from 4.32 to 7.83 (Figure 3). Phosphorus, iron, manganese, boron, zinc and copper all show a trend of decreasing availability associated with increasing pH. Calcium and magnesium increased in availability with increasing pH. Nitrate nitrogen and potassium availability appeared to be relatively unaffected by pH differences.

Despite the fact that there was some variability in soluble salt values, which may cause some slight aberrations in Figure 3, an important perspective was evident. The optimum pH range for nutrient availability in Metro-Mix 300 appears to be 5.2 to 5.5. This is a whole pH unit or more lower than the optimum for a mineral field soil.

Optimum pH range differences between mineral field soil and the soilless medium examined in this research may be the result of differences in cation exchange reactions.

Two types of negative charges are responsible for the retention of exchangeable cations in soil: 1. a permanent charge due to ion substitution and mineral structures, and 2. a pH-dependent charge which varies with changes in pH. In mineral soils these negatively-charged sites result from exposed oxygen and hydroxyl groups on the edges of clay particles. In contrast, the major source of negative charge sites on organic colloids are carboxylic and phenolic sites. In mineral soils a large portion of cation ex-

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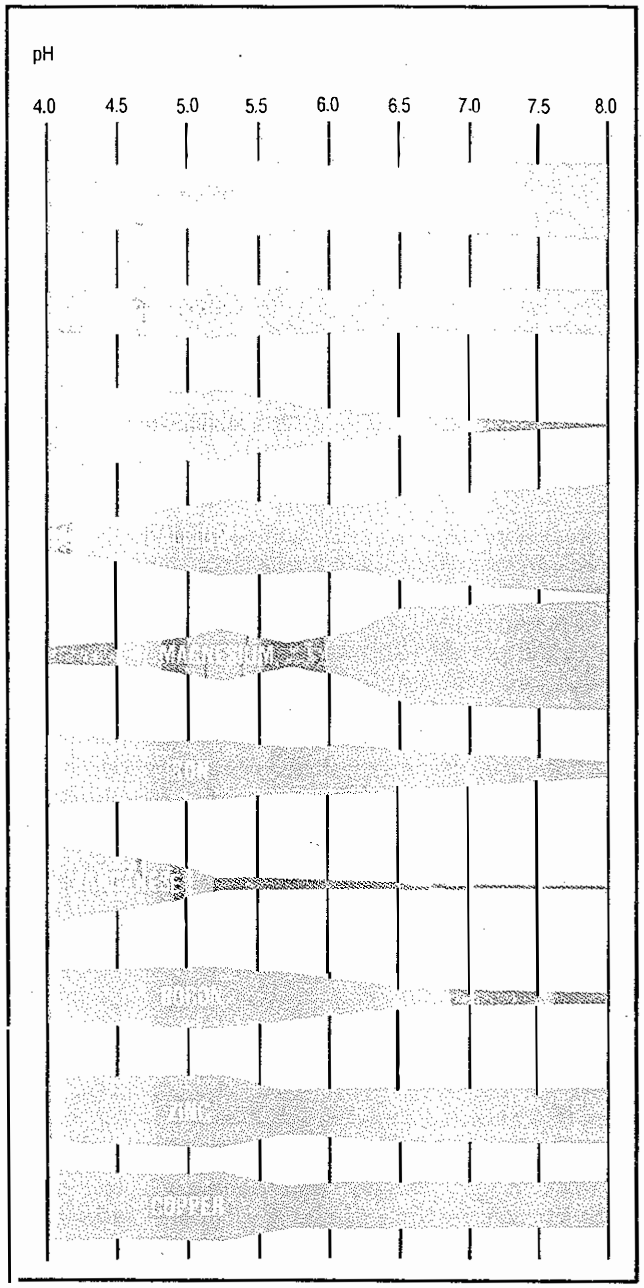

Figure 3. Availability of plant nutrients at different pH levels for Metro-Mix® 300.

Table 1. Conductivity values and concentration of various elements in saturated soil extract solutions obtained from samples of Metro-Mix 300 soilless medium amended with iron sulfate or calcium hydroxide to establish a range of pHs.

		Conductivity millimhos/cm	Plant Nutrients, Parts Per Million									
Treatment	pH	Soluble Salts	NO_3-N	P	K	Ca	Mg	Mn	Fe	B	Zn	Cu
1.	4.32	5.35	556	76	340	154	125	4.10	.66	.80	.67	.09
2.	4.80	4.70	544	69	375	257	164	2.70	.61	.92	.61	.09
3.	5.17	5.19	607	75	414	300	324	.84	.57	.93	.44	.10
4.	5.58	4.51	567	55	367	299	135	.39	.42	.70	.21	.06
5.	6.03	3.94	484	34	332	263	308	.20	.52	.52	.21	.07
6.	6.45	4.30	549	7	349	354	720	.06	.23	.29	.18	.07
7.	7.83	4.34	619	2	347	422	753	.01	.15	.17	.07	.07

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change is due to permanent charges, but organic colloids are wholly pH-dependent. These differences in basic chemistry probably account for the different optimum pH ranges for mineral field soil and the high organic soilless medium studied in this research.

The findings of this research are very similar to the research conducted with an organic field soil (14) and provide evidence for modifying perspectives and fertility programs for the production of floral crops in organic soilless media. Results suggest that growers should be striving to maintain a medium pH of approximately 5.5 rather than 6.5 when growing crops in soilless media.

Results, as they relate to availability of one element in particular, phosphorus, seem extremely significant. Above a pH of 5.2, availability of this element decreased dramatically. Between a pH of approximately 5.2 and 6.5, availability was reduced over tenfold. Since phosphorus is a major plant nutrient required in relatively large quantities for plant growth, these findings are very meaningful.

Overall, these results indicate that perspectives relating to pH may need to be modified. All factors which affect root media pH should be assessed. Liming procedures should be evaluated and adjusted where appropriate, and influences of alkaline fertilizers as well as of high-pH, highly-buffered water should be carefully examined.

Ramifications of these research findings are no doubt much more complex and broad-reaching than this study alone can reveal. Questions remain to be answered concerning optimum pH values for media consisting of a mixture of field soil and organic components. Also the effect of root media pH on plant growth may need to be carefully reassessed.

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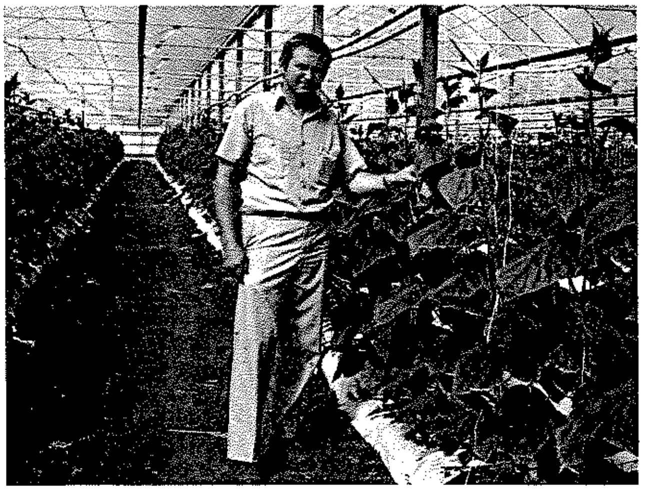
The first bags were made with white-pigmented polyethylene. Many developed cracks in the top from the intense sunshine. The new approach is with a brown bag made with ultra-violet-resistant film. The same bag will be used for at least two years, with three to four crops grown in it. Each bag has three cucumber plants.



Ole Nielsen, Head Grower, admires plants in bags after just two weeks.

Vic Klassen began growing this type of European cucumber up in Leamington, Ontario about 11 years ago. Cucumbers like warm temperatures and Ontario is not known for its warm climate.

Burnac's Florida operation started in the spring of 1978 with seven acres. About 14 acres were added in September, 1979. Now, Bumac produces about 90 percent of the European cucumbers for the U.S. market — mostly sold through the Calavo marketing group.

Interestingly, the oil-fired boilers are really quite necessary down in the Ft. Pierce area. Ole told us that they get a few nights down to 28°F but this year experienced a low of 20°F. During the summer, temperatures can hit 95°F every day for three months!

In addition to the 21 acres of plastic houses, they have modern "shrink wrap" machines (from Holland) that wrap each cucumber in film - and shrink it tight.

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