Grower 101:

Top 10 Misconceptions of Plant Nutrient Management

Clear up some nutrient misunderstandings.

By Kimberly Willliams

Plant nutrient management requires a thorough understanding of the relationships between irrigation practices, fertilization programs and root medium selection. Everything is connected. Even a minor change in any of these cultural practices impacts plant nutrition; recognizing and manipulating these relationships is the key to successful plant nutrient management. Following are some top misconceptions, or inaccurate assumptions, of plant nutrient management that can lead to problems during production.

"What worked last year will work the same this year." You've hired new members of your watering crew. You purchased a different root medium that was more affordable. You are now adding water into your mix before sending it through the flat-filler. It was a dry spring, and the level of your well is low. And I won't even mention that the weather, and thus the production environment, is never the same from year to year. All of these changes, and hundreds of others, will impact plant nutrition and require that attention be paid to nutrient management. The work of a grower is never done!

"All I need to worry about in my fertilizer program is N-P-K." Actually, there are no fewer than 14 essential nutrients (17 if we count carbon, hydrogen and oxygen, which plants accumulate from gases in the atmosphere and water). The first step of nutrient management is to know where the plant is getting each of these 14 nutrients. For example, sulfur is variably available in water sources across the United States. If it's not in your water, fertilizer or root medium, it is important to plan for its supply to your crop. How do you know if it's in your fertilizer formulation? Just read the bag.

Certain crops are subject to more unique deficiencies, such as poinsettias' unusual requirement for molybdenum. So it is important to recognize the specific needs of a crop when developing its fertility program.

The flipside of the coin is the inadvertent over-application of one or more of the essential nutrients because you are not aware of all of the sources supplying the nutrient during production. For example, boron loads are high in some water sources, especially in the Southwestern United States and Chicagoland waterways. If a grower is not aware that boron is being provided in his water source and uses a fertilizer formulation containing boron as well as a manufactured root medium amended with micronutrients preplant, boron toxicity can occur.

"The pH of my water determines the pH of my mix." The pH of the root medium is so important because it controls the availability of nutrients for uptake by the plant by controlling whether or not they are soluble, or dissolved in water in the root medium. But it's not the pH of the water source that dramatically impacts the pH of the mix; it's the alkalinity of the water source. An unbuffered water pH will quickly change to the pH of the mix; however, high alkalinity must be neutralized, otherwise the pH of the mix will inevitably increase during production.

"All forms of nitrogen are equal." There are two forms of nitrogen that the plant absorbs — one is a cation (ammonium, or NH_4^+; urea, or $CO(NH_2)_2$, can be considered to behave like ammonium in the root medium) and the other is an anion (nitrate, or NO_3^-). Because this is the only essential nutrient that the plant can absorb as either a cation or an anion and because the plant absorbs more nitrogen than any other fertilizer nutrient (80 percent of the total anions and cations taken up by the plant are nitrogen), the form of nitrogen that is supplied as fertilizer is an important contributor to "pH drift," or the slow change in root medium pH over time.

Ammonium stimulates large leaves and long internodes, whereas nitrate stimulates the compact growth of smaller leaves and shorter internodes. Nitrogen applied as fertilizer can be a valuable growth management tool, though it is not as important as the concentration of nitrogen applied in controlling growth. Another consideration when determining the nitrogen form to apply is that high percentages of ammonium may contribute to "ammonium toxicity," especially during cool production seasons. Physiologically speaking, this occurs because most plant species are unable to store the ammonium-nitrogen form (it must be assimilated in the roots), but they can store nitrate-nitrogen. Thus, when the supply of ammonium in the root medium exceeds demand, plants are subject to potential ammonium toxicity.

"If 20-20-20 is best for my garden store customers, it's fine for production." There are two reasons why I do not advocate the use of 20-20-20 for general production: It has too much ammonium-nitrogen (60 percent, and the maximum should be around 40 percent); and it has too much phosphorus. Both factors contribute to soft vegetative growth and the development of reproductive growth — great for the home gardener, but pushing lush growth is not generally an ideal production strategy.

"Calcium behaves like all of the other cations." Physiologically speaking, calcium is special. As a component of cell walls (the cement between them, actually), it is difficult for the plant to move it around through those very cells. Calcium moves with some difficulty to the growing points of plants, where it is needed to lay down new cells, in water moved through the plant as driven by the transpiration stream. So you guessed it: If transpiration is minimized due to, say, cool temperatures, cloudy weather and / or high humidity, calcium deficiency can become a problem.

"My irrigation practices do not impact crop nutrition." Actually, irrigation practices are directly tied to the plant's ability to absorb nutrients as well as the health of the root system. There are three phases in a root medium: solid, liquid and gas. In situations of over-watering, the gas phase is flooded with water and oxygen deficiency becomes a problem. In situations of under-watering, "connections" between soil particles and the roots are missing, so moving nutrients to the roots is not possible. The plant thrives somewhere in between.

Top: If transpiration is minimized, calcium deficiency can become a problem; Bottom: High percentages of ammonium may contribute to "ammonium toxicity," especially during cool production seasons. (Photos courtesy of Paul Nelson)

Iron deficiency is most often encountered in high pH media, with iron solubility at least between a pH of 7.4-8.5. A disorder known as "lime-induced chlorosis" is aggravated under conditions of wet, poorly drained media; a chemical reaction resulting in the formation of bicarbonate from lime is promoted by the accumulation of carbon dioxide that occurs in over-watered media.

"If the plant has yellow leaves, it's a nutritional problem." Not so fast. Temperatures outside of the optimal range for a species can contribute to physiological disorders. Good examples are foliage "whiting" in ivy geraniums as the temperature exceeds optimum and the cupping, stunting and heavy zonation that occurs in zonal geraniums under cool-temperature production.

And then there are chlorotic leaves that develop during the occurrence of diseases such as Pythium, Alternaria and Xanthomonas. Yellow foliage that evolves during the progression of root rot pathogens is induced by dysfunctional roots, and thus decreases capacity for nutrient absorption, caused by the disease.

Chlorosis can also occur from over-applications of some plant growth regulators, including Cycocel and Florel.

"Nutritional disorders look distinctly different from each other." Don't we wish! Examples of three different nutrient problems resulting in the same symptom of marginal necrosis of the foliage are potassium deficiency, chlorine toxicity and boron toxicity, among other things. The only way to sort it all out is to run a tissue analysis to go hand-in-hand with the visual symptomology.

"Phosphorus fertilizer does not leach from soilless root media." This misconception is based upon the fact that phosphorus does not leach readily from most soils. Field soils consisting of clays, especially 1:1 types like kaolinite and / or available aluminum, will fix phosphates and remove them from the solution. Peat- and bark-based soilless media contain predominantly organic components that lack the ability to retain this macronutrient. Even the inorganic components of soilless media such as expanded, horticultural-grade vermiculite and perlite, and 2:1 calcined clays like arcillite, retain minimal phosphorus. So that triple super-phosphate that you mixed in pre-plant? It's gone after a couple of weeks and you probably cannot count on it to meet the phosphorous requirement for a cropping cycle longer than one month. GPN

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