Not All Landscape Palm Fertilizers Are Created Equal[1]

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Palms are widely planted in Florida landscapes throughout the state, especially in the central and southern parts, for their aesthetic effects. Their bold leaf textures create a tropical or Mediterranean look that is highly desired by residents and tourists alike. However, palms have very high nutritional requirements (see *Nutrient Deficiencies of Landscape and Field-Grown Palms in Florida*, http://www.edis.ifas.ufl.edu/ep273), and deficiencies of any nutrient element can result in highly conspicuous and unattractive symptoms on their large leaves.

Sixteen elements are required by palms for normal growth: carbon (C), hydrogen (H), oxygen (O), nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S), iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), boron (B), molybdenum (Mo), and chlorine (Cl). Of these, N, K, Mg, Fe, Mn, B, and occasionally P often are deficient in Florida's sandy, calcareous, and organic soils and must be added as fertilizers to prevent or correct deficiencies in landscape or field-grown palms (see *Fertilization of Field-Grown and Landscape Palms in Florida*, http://www.edis.ifas.ufl.edu/ep261). One of the problems encountered when fertilizing plants is that some nutrient elements are antagonistic to others, so that too much of one element could induce or exacerbate a deficiency of another.

The optimum amounts and ratios in fertilizers of the seven frequently deficient elements for landscape palms in Florida have been experimentally determined to be 8N-0 or $2P_2O_5$-$12K_2O$-4Mg plus about 2% Mn and Fe (0.1-0.2% if chelated), and 0.15% of B, Cu, and Zn (hereafter referred to as 8-2-12-4Mg), but note that 8-0-12-4Mg also is acceptable (Broschat 2009, 2015). However, just because a fertilizer has this analysis does not mean that it will be effective. The source of each individual element is just as important. Landscape fertilizers are mixtures or blends of 8 or more individual nutrient elements, and a number of different sources of each of these elements are available. Some of these sources are completely insoluble, some are slowly soluble or controlled release, and some are completely soluble. Thus a large number of possible combinations of these various elemental sources could be created. Some of these blends could do great things for your palms, some might do nothing at all, and some might induce or exacerbate deficiencies rather than correcting them and possibly kill the palm over time.

Plant nutrients must be in a water-soluble form for plant roots to be able to take them up, and their solubility often is regulated by soil pH. For example, the solubility, and thus plant availability, of micronutrients such as Fe and Mn drops off rapidly as pH increases (Lindsay 1972). Under these conditions, the most effective fertilizer sources for these elements are the most water-soluble ones. For Fe, Mn, Zn, and Cu, sulfates are commonly used and are effective, but chelates of Fe such as EDTA and DTPA are even more effective than the sulfate form (Broschat 1991; Broschat and Elliott 2005). Unfortunately, due to their lower costs, some fertilizer manufacturers use oxides or sucrates (essentially molasses-coated oxides) of these elements. These compounds have been shown to be almost completely insoluble

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in neutral to alkaline soils, and even in acid soils they are solubilized so slowly that they do not provide adequate amounts of these elements to palms (Broschat 1991; Broschat and Elliott 2005).

On the other hand, many commonly used fertilizer sources of N, K, Mg, and B are highly soluble in water and are thus highly leachable through Florida's sand and calcareous soils which lack significant cation-exchange capacity. For these elements, slow-release (slowly soluble compounds) or controlled-release (coated soluble compounds) sources help keep these nutrients available to the plant over a longer period of time under leaching conditions (see *Controlled-Release and Slow-Release Fertilizers as Nutrient Management Tools*, http://www.edis.ifas.ufl.edu/hs1255). For difficult-to-treat deficiencies such as K deficiency, simply increasing the amount of water-soluble K applied has not been effective, since large amounts of water soluble K are just as quickly lost to leaching as are smaller amounts. The only way that K deficiency can be eliminated in most Florida landscape soils is through the use of controlled-release K sources like sulfur-coated potassium sulfate. While resin-coated fertilizers generally are considered to be superior to sulfur-coated materials, the release of K and Mg from resin-coated sulfates has been shown to be too slow to be effective, compared to N sources prepared with the same coating (Broschat and Moore 2007).

Since oxides and carbonates of Mg are too insoluble to be useful sources of Mg, and resin-coated magnesium sulfate releases Mg too slowly, the best controlled-release source available at this time is kieserite, a naturally-occurring, slowly soluble form of magnesium sulfate (Broschat 1997). While soluble forms of B such as Borax® or Solubor® have been used in blended fertilizers, their high solubility makes them readily leachable under typical Florida landscape conditions. Furthermore, these materials are powders that quickly settle to the bottom of the bag when blended with granular fertilizers. This means that fertilizer taken from the top of the bag could contain too little B, while that taken from the bottom of the bag could contain toxic amounts of B. Studies evaluating a number of slow-release forms of B have identified Granubor® as the best material for blending since it has a granular form and releases over a three-month period, like sulfur-coated potassium sulfate (Broschat 2008).

While it is important to have the correct ratios of the various elements in a blended palm fertilizer, if the wrong sources are used those ratios can change over time due to differential leaching of the more soluble components. For example, an 8-2-12-4Mg palm fertilizer having N in controlled-release form but K in water-soluble form might initially have the correct N:K ratio, but over time the water-soluble K will be leached out of the root zone while the controlled-release N source continues to provide N to the palm. This N will stimulate new growth, but since there eventually will be no new K to support that new growth, the amount of K already in the palm will be diluted among a larger number of leaves, thereby reducing the concentration of K and resulting in more severe K deficiency symptoms than prior to fertilization. A similar situation could occur if the K source is controlled-release but the Mg source is water soluble. Over time, the water-soluble Mg will be leached out of the soil but K will still be available from its controlled-release source, upsetting the effective K:Mg ratio in the soil. Thus it is essential not only to provide the correct elemental ratios initially, but also over time by matching the release rates of the controlled-release sources of the N, K, Mg, and B (Broschat 2009).

How can you tell if you have an effective 8-2-12-4Mg palm fertilizer? Unfortunately, examination of fertilizer labels can be more misleading than helpful due to the terminology used and the types of testing done on fertilizers by state regulatory laboratories, all required by Florida fertilizer laws. For example, a fertilizer containing only coated N or K will appear on a Florida fertilizer label as being 100% water soluble due to the fact that water-soluble sources are enclosed within the coating and the coatings are crushed in the laboratory testing procedure.

Our research has shown that the most effective fertilizer has 100% of the N, K, Mg, and B sources in slow-release or controlled-release form and all of the Mn, Fe, Zn, and Cu sources should be water soluble (generally these will be sulfates, except for Fe, which can be chelated with EDTA or DTPA) (Broschat 1991a, 1996, 1997, 2009; Broschat and Elliott 2005). To determine if a fertilizer contains the correct nutrient sources, examine the ingredients section of a fertilizer label (it may be called "derived from" or something to that effect). Look for any source of N, K, Mg, or B that is water soluble. If any are present, then 100% of those elemental sources cannot be slow release and thus the fertilizer does not meet our specifications. Although activated sewage sludge is considered a slow-release form of N, it should never be used in palm fertilizers as it can induce severe Mn deficiencies in palms and other ornamental plants (Broschat 1991b). For the remaining micronutrients, look for water-soluble sources such as sulfates or chelates, but avoid oxides or sucrates if they are the sole or primary source of Mn and Fe. Table 1 lists the most effective sources for the seven critical elements in Florida landscape palm fertilizers.

For Mg, it can be difficult to tell if the magnesium sulfate listed on the label is the slow-release form called kieserite (magnesium sulfate monohydrate) or the very soluble form known as Epsom salts (magnesium sulfate heptahydrate) unless the manufacturer indicates this somewhere on the label. If this information cannot be obtained from the manufacturer, a simple visual examination of the material will reveal the presence of kieserite, since it will constitute a significant proportion of the blend. Kieserite is creamy white and is the largest granule in the blend, making it very conspicuous (Figure 1).

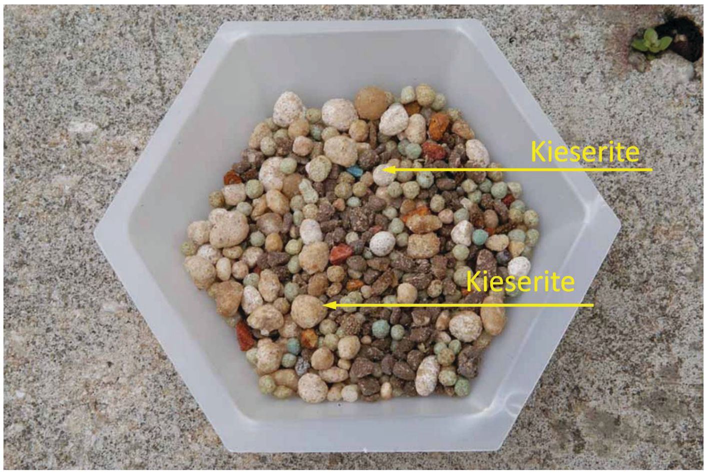

Figure 1. A sample of an 8-2-12-4Mg landscape palm fertilizer showing the conspicuous granules of kieserite, a slow release form of magnesium sulfate.
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Similarly, it can be difficult to determine if a powdered, water-soluble form of B like Solubor® or Borax® is used or if the product contains the slowly soluble Granubor®. All of these materials are sodium borates, so one must inquire about which form is included if the label does not indicate the source.

Finally, it should be apparent from the above discussion that 8-2-12-4Mg palm fertilizers can be formulated in more than one way. Unfortunately, the most effective sources of most of the critical elements in palm fertilizers also are more expensive, so some fertilizer companies make products which superficially meet our specifications (e.g., have the correct analysis), but upon closer examination do not. They have substituted some or all of the required controlled-release N, K, Mg, or B with water-soluble sources and have used insoluble micronutrient sources like oxides or sucrates to reduce costs. Thus if you request bids for the lowest-cost 8-2-12-4Mg palm fertilizer you likely will end up buying a formulation that will not be effective and may make your palms look worse than if they had never been fertilized. **The only way to ensure that you will be getting an effective fertilizer is to specify that 100% of the N, K, Mg, and B sources are slow release and that the Mn, Fe, and other micronutrients are present in sulfate or chelated form.**

Literature Cited

Broschat, T. K. 1991a. "Effects of Manganese Source on Manganese Uptake by Pygmy Date Palms." *HortScience* 26:1389–1391.

Broschat, T. K. 1991b. "Manganese Binding by Municipal Waste Composts Used as Potting Media." *J. Environ. Hort.* 9:97–100.

Broschat, T. K. 1996. "Release Rates of Soluble and Controlled-Release Potassium Fertilizers." *HortTechnology* 6:128–131.

Broschat, T. K. 1997. "Release Rates of Controlled-Release and Soluble Magnesium Fertilizers." *HortTechnology* 7:58–60.

Broschat, T. K. 2008. "Release Rates of Soluble and Controlled-Release Boron Fertilizers." *HortTechnology* 18:471–474.

Broschat, T. K. 2009. "Palm Nutrition and Fertilization." *HortTechnology* 19:690–694.

Broschat, T. K. 2015. "Fertilization of Landscape Palms to Reduce Nitrogen and Phosphate Impacts on the Environment." *HortScience* 50:469–473.

Broschat, T. K. and M. L. Elliott. 2005. "Effects of Iron Source on Iron Chlorosis Severity and Exserohilum Leaf Spot in *Wodyetia bifurcata*." *HortScience* 40:218–220.

Broschat, T. K. and K.A. Moore. 2007. "Release Rates of Ammonium-Nitrogen, Nitrate-Nitrogen, Phosphorus, Potassium, Magnesium, Iron, and Manganese from Seven Controlled Release Fertilizers." *Commun. Soil Sci. Plant Anal.* 38:843–850.

Lindsay, W. L. 1972. "Inorganic Phase Equilibria of Micronutrients in Soils." In *Micronutrients in Agriculture*, edited by J. J. Mortvedt, P. M. Giordano, and W. L. Lindsay. Madison, WI: Soil Science Society of America, 41–57.

Table 1. Effective fertilizer sources for blending Florida landscape palm fertilizers with three-month release rates.

Element	Recommended Sources[1]
N	Sulfur-coated urea, resin (or polymer)-coated urea or ammonium salts, urea-formaldehyde
P	Superphosphate, triple superphosphate, coated diammonium phosphate
K	Sulfur-coated potassium sulfate (may have additional polymer coating)
Mg	Kieserite (magnesium sulfate monohydrate) granules
Mn	Manganese sulfate
Fe	Iron sulfate, FeEDTA and/or FeDTPA
B	Granubor® (sodium borate)

[1] Based on data from Broschat (1991, 1996, 1997, 2008) and Broschat and Elliott (2005)