1. Common nutritional deficiencies on landscape palms
   a. Nitrogen—reduced growth rate; uniform chlorosis of older or all leaves
   b. Potassium—translucent yellow-orange or necrotic spotting, marginal necrosis, and frizzling on oldest leaves; more severe on leaf tips than bases; can be fatal; treat with sulfur-coated potassium sulfate
   c. Magnesium—marginal chlorosis on the oldest leaves; treat with coated magnesium sulfate or prilled kieserite
   d. Iron—interveinal or general chlorosis (sharply delimited green veins) on newest leaves; treat alkaline soils with soil application of chelated iron FeEDDHA (138) or Hampshire iron; treat acid soils with FeDTPA (330)
   e. Manganese—diffuse interveinal chlorosis accompanied by interveinal necrotic streaking on newest leaves; also causes reduced new leaf size and frizzling; more severe at leaf base than tip; often fatal on palms; treat with MnSO\textsubscript{4} (TechMangam)
   f. Boron—small, crumpled new leaves; may cause a sharp bend in the trunk and horizontal growth; can kill the bud

2. Causes of nutritional deficiencies
   a. Insufficient nutrients in the soil, usually due to leaching (e.g., N, K, Mg, B)
   b. High soil pH (e.g., Fe, Mn); can usually be decreased with elemental sulfur, FeSO\textsubscript{4}, or ammonium or urea fertilizers
   c. Complexation with organic matter (e.g., Cu; also Mn by composted sewage sludges)
   d. Nutrient imbalance—too much of one element can induce a deficiency of another element (e.g., N vs. K, K vs. Mg, etc.)
   e. Poor soil aeration (usually Fe)
   f. Excessive planting depth (essentially a poor soil aeration problem)
   g. Root rot diseases (reduce root surface area available for micronutrient uptake; usually expressed as Fe deficiency)
   h. Removal of K-deficient older palm leaves accelerates rate of decline from K deficiency
3. Importance of proper fertilization rates
   a. Too little results in deficiencies
   b. Excessive macronutrients can cause soluble salt injury
   c. Excessive micronutrients can cause nutrient toxicities

4. Prevention of deficiencies is much easier than correcting them after the fact

5. Treatment of deficiencies
   a. Identify and correct any cultural causes first
   b. Treat with appropriate fertilizers

6. Landscape fertilization
   a. Use 2N-1 P-3K-1 Mg ratio fertilizers (e.g., 8-4-12-4) that include all micronutrients
   b. 100% of N, K, and Mg should be in controlled release form
   c. Broadcast using a rotary spreader under the canopy of isolated palms or entire beds or landscapes
   d. Apply 1.5 lbs. of actual fertilizer (not N) per 100 sq. ft. every 3 months or 1 lb. per 100 sq. ft. every 2 months
   e. DO NOT USE TURF FERTILIZERS or landscape fertilizers with water soluble K within 30 ft. of any palm.
   f. USE CONTROLLED RELEASE LANDSCAPE FERTILIZERS described above for ALL plants in the landscape, including turf in mixed landscapes

   For more details, see EDIS DL#EP-052: Palm Nutrition Guide
   http://edis.ifas.ufl.edu/EP052