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CAUSES OF PALM NUTRITIONAL DISORDERS

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Abstract. **Although insufficient amounts of a given nutrient element in the soil can result in a deficiency of that element, most deficiencies are induced by external factors, which either render the element unavailable to the plant or the plant incapable of taking up the element in sufficient quantities. Common causes of nutrient deficiencies in Florida include cool temperatures, poorly aerated soils, root rot diseases, genetic differences among palms, mechanical root injury, planting too deeply, high soil pH, and nutrient imbalances.**

The most obvious cause of palm nutritional deficiencies, insufficient nutrients in the soil, may not necessarily be the most important cause of nutritional problems. In this paper the authors present results of their experiments and repeated observations, which suggest that environmental and genetic factors are important causes of palm nutritional disorders.

A complete fertilization program is essential for palms growing in containers since most container media are composed of organic or inorganic materials having little or no inherent fertility and often little capacity for nutrient retention. Any essential nutrient element omitted from the fertilization scheme in container production of palms can potentially become a limiting factor in the growth of that palm. In this respect, Mg deficiency symptoms are often observed on palms grown in a container medium to which no dolomite has been added, the grower assuming that dolomite amendment is unnecessary if the pH of the medium is appropriate. Similarly, S deficiency is not unusual among palms growing in container media to which no sulfate fertilizers or superphosphate has been added.

Under typical Florida landscape situations, elements such as N and Mg are readily leached from sand and coral soils. Many non-native palm species, which may not be well adapted to these particular growing conditions, regularly exhibit symptoms of N and Mg deficiency when grown without supplemental N and Mg fertilization.

In most situations, however, all essential elements exist in the soil in amounts adequate for normal plant growth. Nutritional deficiencies often occur despite this fact due to chemical interactions in the soil affecting the solubility and hence, availability of some essential elements. Copper availability, for instance, is greatly reduced in organic soils which complex Cu and render it unavailable (5).

Soil pH strongly affects the solubility of many essential elements (6). Many of south Florida's soils are neutral to alkaline in pH, a condition that greatly reduces the solubility of micronutrient cations such as Zn, Fe, Mn, and Cu, and is responsible for inducing Mn deficiency in many palms growing in coral-derived soils. Similarly, soluble phosphate fertilizers can form insoluble compounds with cations such as Ca, Fe, Mn, and Zn at neutral or alkaline pH's (6). In one unpublished study by the authors, the addition of superphosphate to the planting hole resulted in severe Mn deficiency for all coconut palms receiving that treatment. Soil amendment with composted manures and sludges also has induced severe Mn deficiencies in palms and other plants. The exact nature of this interaction is not yet known.

Balance among the various cations present in the soil is important in preventing deficiencies. Since most cations are actively absorbed by roots and the number of cation binding sites is finite, cations in the soil are in a sense competing for uptake sites on the root. The most important example in palms of nutrient imbalance is Mg deficiency induced by regular applications of fertilizers which are high in K, but devoid of Mg (5). Numerous other examples of imbalance induced deficiencies in plants exist in the literature (5) and some of these are undoubtedly important in palm nutrition, but have never been demonstrated in palms.

Some of the most common causes of nutrient deficiencies in palms are related to root problems (3). Root rot diseases caused by fungi such as *Pythium, Phytophthora,* or *Rhizoctonia* often severely damage roots of young container-grown palms. Root surface area of such infected palms is often reduced by over 95%. This not only reduces the surface area available for nutrient absorption, but also for water absorption. With less water taken up, container grown palms often stay too wet, which in itself can cause nutritional deficiencies. Waterlogged soils are oxygen poor and, since roots require oxygen for respiration in order to actively absorb nutrients, nutrient uptake can be reduced to insufficient levels under these conditions (7). Root anatomical changes under anaerobic conditions are known to allow leakage of nutrients from the roots into the soil (2). Among palms, Fe and Mn deficiencies are commonly caused by root related problems.

The factor of planting depth is related to the problem of waterlogged or oxygen poor soils. Palms and other tropical monocots planted too deeply often exhibit persistent symptoms of Fe or Mn deficiency (1). Planting palm seedlings in containers, as little as 1 cm deeper than the seedling was originally growing can cause nutritional disorders. For older palms, and particularly those growing in landscape situations, planting up to 15 cm too deeply may not cause much of a problem, but under poorly drained soil conditions, even this depth may reduce oxygen availability below that needed by the plant. Some palms have survived when planted a meter or more too deeply in very well drained, dry sites, but these are exceptional. Root respiration, and consequently, active uptake of nutrients is reduced when oxygen is limiting (7) and deficiencies of Fe and Mn often result.

Large palms which have recently been transplanted often exhibit Fe or Mn deficiency symptoms. Reduction of root surface area due to root severance is the primary cause of such deficiencies. If palms are transplanted into

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calcareous or poorly aerated soils prone to nutrient deficiencies, such plants, weakened by the loss of most of their root system, may never fully regain their former vigor unless an intensive program of foliar and soil fertilization is followed.

In many tropical plants, nematode damage to the roots can decrease the effectiveness of the roots in absorbing micronutrients (4). Deficiency symptoms of Fe or Mn are often the only visible symptoms of a nematode infestation. Although nematodes have been reported on roots of a few species of palms, they are usually not regarded as serious pests of palms and seldom cause the kinds of nutritional deficiencies so often observed on other tropical plants.

Temperature plays a major role in determing the rate of active nutrient absorption (8). Many micronutrient deficiencies are transient in Florida for this reason. The most common temperature induced nutritional problem in palms is Mn deficiency. During cool winter months root activity, and hence nutrient and water uptake, is greatly reduced. Shoot growth is also reduced and often ceases altogether. In the spring when warm air temperatures return and growth resumes, new leaves often exhibit severe Mn deficiency symptoms since the supply of micronutrients needed for production of these leaves was absorbed primarily during the cooler winter months. Only after several months of growth in warm soil will the roots have absorbed sufficient micronutrients to produce healthy leaves.

Palms also vary genetically in their ability to extract various nutrients from the soil, both among species and among individuals within a species. For example, palms of the genus *Phoenix* are the most susceptible of all palms to Mg deficiency, whereas others such as *Washingtonia sp.* have never been observed with Mg deficiency (3). Within coconut palms (*Cocos nucifera*), 'Jamaica Tall' coconuts are fairly resistant to Mg deficiency in south Florida, but 'Malayan Dwarf' coconuts are fairly susceptible. Even within the 'Malayan Dwarf' cultivar, plants with golden petioles and fruits are much more susceptible to Mg deficiency than those with green petioles and fruits.

In conclusion, the presence of recognizable nutritional deficiency symptoms in palms does not necessarily imply that the soil is deficient in that particular element or that application of a fertilizer containing that element will alleviate the symptoms. It is essential for effective treatment of palm nutritional disorders that any cultural or environmental causes of the deficiency be corrected prior to applying any corrective fertilizers.

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COMPARISON OF COOL-SEASON TURFGRASSES FOR OVERSEEDING PUTTING GREENS

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Abstract. **Overseeding putting greens with cool-season turfgrasses is a recommended practice in warm-season turfgrass areas during the winter months to improve and protect the playing surface. Simultaneous experiments compared cool-season turfgrass cultivars and species suitability for overseeding bermudagrass putting greens. Fifty-six cool-season turfgrasses were evaluated at Gainesville, Fla. for turf quality, color, texture, and wear tolerance. Twenty-one of these had equal seasonal quality ratings, while 33 had above average mean scores. Turf color, texture, and wear tolerance differences were also noted. Turfgrasses established at Longwood, Fla. compared species and seeding rates. Aggressive bermudagrass growth late into winter effectively competed with cool-season turfgrass establishment. Perennial ryegrass was found to provide excellent quality turf with faster establishment and more effective competition against the semidormant bermudagrass.**

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