Potassium Deficiency of Palms in South Florida

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Potassium deficiency symptoms in palms have been documented for economically important food species such as coconut palm (Cocos nucifera) and African oil palm (Elaeis guineensis) (Broeshart et al. 1957, Bull 1961, Manciot et al. 1979) and for some ornamental palms (Broschat 1984). Yet even with this information on K deficiency symptomology available, the existence of widespread K deficiency in south Florida palms has gone undetected for decades. Marlatt (1980), Dickey (1977), and Street and Gamon (1983) point out that south Florida soils are extremely deficient in K, yet they do not report K deficiency on any ornamental plants in south Florida, much less on palms.

Palm growers have often wondered about the cause of the translucent yellow or orange flecking they observe on the oldest leaves of palms. Pathologists have never been able to isolate pathogens from these spots and unlike most biotic diseases, these symptoms are confined to the oldest leaves of the palm. Many people believed these symptoms were the result of natural leaf senescence and were therefore not preventable. However, palms growing in other parts of the world often do not show these symptoms. This fact, plus the restriction of these symptoms to the oldest leaves, suggests that the problem may be caused by a nutritional toxicity or a deficiency of a mobile element such as N, P, K, or Mg.

Deficiency symptoms of N, P, and Mg are well known in palms and do not include flecking on the foliage (Broeshart et al. 1957, Broschat 1984, Bull 1958, Manciot et al. 1979). The K deficiency symptoms described by Broschat (1984) for five species of ornamental palms included necrotic spotting and streaking, but no translucent yellow flecking. Potassium deficiency symptoms of most plants consist of a marginal necrosis of the oldest leaves, although Broeshart et al. (1957), Bull (1961), and Manciot et al. (1979) have described leaf spotting symptoms similar to those described in this paper associated with potassium deficiency in C. nucifera and E. guineensis.

Close examination of palms growing under field conditions at the Fort Lauderdale Research and Education Center showed a wide range of symptoms which varied among species. For some species, only translucent yellowish flecking in varying degrees of severity was observed and marginal and tip necrosis were rarely seen (upper left, Back Cover). In other species necrotic streaks, spots, or flecks exist, but chlorotic areas were not present (upper right, Back Cover). In still other species no flecking or streaking of any kind was observed, but marginal and/or tip necrosis were the primary symptoms (lower left, Back Cover). In most species, however, translucent yellow flecking appears to be the earliest symptom of K deficiency and occurs on mildly affected leaves or towards the base of more severely affected leaves. As the deficiency progresses, the spots may

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coalesce and marginal necrosis may appear on the leaflets. This intermediate stage appears on moderately affected leaves or on the middle leaflets of more severely affected leaves. The most severely affected leaves (the oldest on the palm) will often have entire leaflets withered and frizzled in appearance (lower right, Back Cover). These symptoms somewhat resemble those of Mn deficiency except for the lack of size reduction in affected leaves and the fact that these symptoms occur on the oldest leaves first rather than the newest. As with Mn deficiency, K deficiency is capable of killing palms if not treated. Severely affected palms of most species also tend to hold fewer leaves than healthy palms.

Potassium deficiency, like Mg deficiency, occurs on the margins of the oldest leaves of palms and from a distance the two deficiencies may sometimes be confused. However, Mg-deficient palms never show any flecking or marginal necrosis and symptoms usually appear as a distinct broad yellow band around the periphery of an otherwise green leaf. The discoloration sometimes associated with K deficiency may occur throughout the leaf, or if not, is never sharply delimited from a green leaf center as is the case with Mg deficiency. Unfortunately, both Mg and K deficiencies are widespread in south Florida and symptoms of both may occur on the same leaf, thereby making diagnosis more difficult.

Potassium deficiency was confirmed by leaf nutrient analysis for some of the species listed in this article. Comparisons of similar-aged leaves with and without symptoms for *Dictyosperma album* var. *conjugatum*, *Chrysalidocarpus lutescens*, *Howea forsteriana*, *Elaeis guineensis*, *Cocos nucifera*, and *Neodypsis decaryi* showed that leaves showing symptoms had less than half the K concentration of apparently healthy leaves. Comparison of K concentrations in leaves showing symptoms of *E. guineensis*, *C. lutescens*, *H. forsteriana*, and *Chamaedorea seifrizii* with standards established for those species showed all were deficient in K (H. Poole, pers. comm.) Established minimum K concentrations for recently matured leaves are 1.2% for *C. seifrizii*, 1.2% for *C. lutescens*, 0.59% for *H. forsteriana*, and 0.74% for *E. guineensis*. Leaf samples from palms showing symptoms averaged 0.45%, 0.88%, 0.55%, and 0.48% K, respectively for these species. Since specific symptomology varies widely among palm species, symptoms for 52 species of palms grown in south Florida are listed in the appendix.

As an element, K is highly soluble and is readily leached from the sandy soils of south Florida. Container media or soils having higher cation exchange capacities can retain K against leaching and for this reason, K deficiency is much less common in container-grown palms and in other palm growing regions of the United States. Imbalances between K and other nutrient elements such as N, Ca, and Mg can also cause K deficiency (Dickey 1977). In south Florida the problem of K deficiency is accentuated by the use of landscape fertilizers having slow release N fertilizer sources that last up to three or four months, but water-soluble K sources which can be completely leached through a sandy soil with one or two heavy irrigations or rains. At the FLREC, where such fertilizers have been used for years, the problem of K deficiency is much more severe than in landscapes which received no fertilizer at all.

Unlike Mg deficiency which is difficult to correct in palms, K-deficient palms respond rapidly to K fertilization. Addition of resin-coated controlled-release potassium sulfate to severely deficient *Hyophorbe verschafeltii* and *Chrysalidocarpus lutescens* resulted in a significant increase in the number of green leaves on the plants within four or five months. Controlled release K fertilizers are the best materials for preventing and correcting K
deficiency in south Florida since they are not readily leached by heavy rainfall or irrigation. Both sulfur-coated and resin-coated potassium sulfate are produced commercially and should be suitable for use on south Florida’s sandy soils. Foliar sprays with potassium nitrate, potassium chloride, potassium sulfate, potassium acetate, and potassium citrate on severely deficient C. lutescens did not significantly increase leaf K concentrations over that of control plants. Thus it appears that soil application of controlled-release K fertilizers is the most effective treatment for K deficiency in south Florida palms. As with Mg deficiency, however, old affected leaves will never recover from their symptoms.

**LITERATURE CITED**


**Appendix**

Potassium deficiency symptoms for 52 species of palms. All symptoms described pertain to oldest leaves on palms. Relative susceptibility is based on observations of palms growing under similar conditions at the FLREC.

*Acoelorrhaphe wrightii*—oldest leaves generally off-color with raised necrotic spots feeling like pustules. Some necrotic streaking. Moderately susceptible.

*Allagoptera arenaria*—some orange and necrotic flecking near leaflet tips followed by tip necrosis. Slightly susceptible.

*Archontophoenix alexandrae*—light yellow flecking becoming generally chlorotic with necrotic spotting and marginal and tip necrosis on most severely affected leaves. Slightly susceptible.

*Areca catechu*—translucent whitish flecking in longitudinal bands becoming necrotic with necrotic portions often falling out of leaf leaving holes or tears in leaflets. Moderately susceptible.

*Arenga australasica*—some very fine translucent light green flecking and very fine necrotic flecking. Considerable tip and marginal necrosis and necrotic streaking. Moderately susceptible.

*Bismarckia nobilis*—tips of leaflets have chlorotic streaks or longitudinal bands with broad necrotic bands within chlorotic areas. Slightly susceptible.

*Butia capitata*—oldest leaves generally off-color. Some translucent orange spotting, necrotic flecking, and marginal and tip necrosis. Moderately susceptible.

*Carpentaria acuminata*—oldest leaves generally off-color. Extensive yellow spotting and necrotic spotting with extensive tip necrosis giving frizzled appearance. Moderately susceptible.

*Caryota mitis*—foliage slightly off-color. Necrotic spotting with some marginal and tip necrosis. Moderately susceptible.

*C. rumphiana*—oldest leaves off-color with tip necrosis and some necrotic flecking. Slightly susceptible.

*Chamaedorea elegans*—slight discoloration of leaves, some minor chlorotic and necrotic flecking. Tip and marginal necrosis. Slightly susceptible.

*C. seifrizii*—slight mottling of leaflets, but generally just tip necrosis. Slightly susceptible.

*Chamaerops humilis*—fine translucent flecking coalescing to encompass entire leaf. Chlorotic areas have necrotic flecking within. Most severely affected leaves have marginal and tip necrosis. Moderately susceptible.

*Chelyocarpus sp.*—Extensive marginal and tip necrosis surrounded by slight chlorotic halo. No spotting present. Moderately susceptible.


Chrysalidocarpus cabdae—translucent yellow flecking interspersed with necrotic flecking. Extensive marginal and tip necrosis giving frizzled appearance to older leaves. Very susceptible.

C. lutescens—leaves becoming off-colored to orange. Translucent orange flecking and necrotic spotting with extensive marginal and tip necrosis. Very susceptible.

Coccodrithrinax mirogama—yellow to orange flecks or elongated streaks. Streaks becoming necrotic. Marginal and tip necrosis. Moderately susceptible.

Cocos nucifera—translucent orange flecking becoming interspersed with necrotic spotting as severity increases. Extensive marginal and tip necrosis giving withered appearance to leaf tip. Very susceptible.

Corypha elata—very fine translucent yellow flecking followed by marginal and tip necrosis. Moderately susceptible.

Dictyosperma album—uniform translucent yellow flecking throughout leaves. No necrosis observed. Moderately susceptible.

Elaeis guineensis—translucent orange and light green flecking near leaflet tips with marginal and tip necrosis resulting in frizzled appearance. Moderately susceptible.


Heterospathe iloro—leaflets becoming off-color. Necrotic flecking and tip necrosis with some necrotic streaking evident. Slightly susceptible.

Houea forsteriana—leaflets becoming slightly discolored with necrotic tips. Occasional orange flecking near leaflet tips. Slightly susceptible.

Hyophorbe liliifolia—bright orange translucent flecking with entire leaf eventually becoming orange. Extensive marginal and tip necrosis giving oldest leaf frizzled appearance. Extremely susceptible.

Hyphaene sp.—fine necrotic flecks coalescing to form large necrotic blotches. Some tip necrosis. Moderately susceptible.

Latania lontaroides—general discoloration with extensive chlorotic and necrotic streaking, followed by marginal and tip necrosis of leaflets. Moderately susceptible.

Licuala grandis—translucent yellow flecking with some tip necrosis around the margin of the leaf. Moderately susceptible.

Livistona australis—Extensive necrotic streaking and marginal and tip necrosis giving leaves a tattered appearance. No flecking or discoloration evident. Extremely susceptible.

L. chinensis—Necrotic flecking with narrow orange halos surrounding flecks concentrated in the center of the leaflets. Leaflet centers becoming necrotic rather than marginal or tip necrosis as in other species. Moderately susceptible.

L. forsteriana—leaflets becoming slightly discolored with necrotic tips. Occasional orange flecking near leaflet tips. Slightly susceptible.

L. rotundifolia—older leaves off-color. No flecking, but extensive marginal and tip necrosis and necrotic streaking. Moderately susceptible.

Neodypsis decaryi—yellow translucent flecks coalescing to form larger chlorotic spots. Extensive marginal and tip necrosis giving oldest leaves a frizzled appearance. Moderately susceptible.

Phoenix dactylifera—some discoloration towards the tips of leaflets with very fine translucent flecking followed by marginal and tip necrosis. Moderately susceptible.

P. reclinata—tips of leaves off-color. Some translucent yellow and necrotic flecks followed by extensive marginal and tip necrosis. Moderately susceptible.

P. roebelenii—tips of leaflets becoming off-color and then orange followed by tip necrosis. Moderately susceptible.

Pritchardia beccariana—translucent yellow flecking, off-color foliage and extensive tip necrosis. Moderately susceptible.


P. macartthuri—necrotic spots with narrow yellow halos. Some necrotic streaking and marginal necrosis. Slightly susceptible.


Ravenea ripularis—older leaves slightly off-color. Fine necrotic flecking becoming necrotic streaks with some tip and marginal necrosis. Severely affected leaves have only necrotic veins remaining on leaves. Moderately susceptible.

Raphis excelsa—older leaves off-color with very fine necrotic flecking and extensive marginal and tip necrosis. Moderately susceptible.

Roystonea regia—Some translucent yellow flecking, but extensive marginal and tip necrosis giving older leaves a frizzled appearance. Moderately susceptible.

Sabal mauritiifolius—translucent yellow spotting, leaves off-color towards tips with marginal and tip necrosis. Slightly susceptible.
S. palmetto — translucent yellow-orange flecking followed by marginal and tip necrosis. Slightly susceptible.

Scheelea rostrata — translucent fine light green streaking, necrotic spotting, truncation of leaf tip, and extensive marginal necrosis. Moderately susceptible.

Syagrus amara — translucent yellow-orange flecking and necrotic flecking surrounded by chlorotic halo. Marginal and tip necrosis. Slightly susceptible.

S. pseudococos — Highly resistant.

S. romanzoffiana — clusters of translucent yellow flecks near leaflet tips with some marginal and tip necrosis. Severely affected leaves appear frizzled and orange in color. Moderately susceptible.

S. schizophylla — general discoloration of older leaves with light green translucent flecks coalescing into spots up to 3 mm in diameter. Moderately susceptible.

Thrinax radiata — translucent yellow and necrotic flecking. No significant marginal or tip necrosis. Moderately susceptible.

Trachycarpus martianus — minor yellow flecking on slightly off-color leaves. Some tip necrosis. Fairly resistant.

Trithrinax acanthocoma — translucent light green flecks usually appearing in longitudinal bands along the leaflets. Some tip necrosis and necrotic streaking. Fairly resistant.

Veitchia mcdanielsii — slight tip necrosis. Very resistant.

Wodyetia bifurcata — interveinal chlorotic streaking with necrotic spots surrounded by narrow yellow halo. Some marginal and tip necrosis. Moderately susceptible.

**NOTICE**

"Palms in tropical rain forests." A symposium in IQUITOS, PERU, 18–24 September 1991 — to include a field trip in the Lower Ucayali River Basin. For information write: FRANCIS KAHN, ORSTOM, Apartado 18–1209, LIMA, PERU.

**Back Cover**

Potassium deficiency in palms of south Florida. Upper left, old leaflets of potassium deficient *Dictyosperma album* held up to the light to show translucent yellow flecking. Upper right, *Caryota mitis* showing the necrotic flecking characteristic of potassium deficiency in this species. Lower left, old leaf of *Roystonea regia* showing marginal and tip necrosis caused by potassium deficiency in the species. Lower right, *Hyophorbe verschaffeltii* with reduced leaf number and characteristic frizzling of the oldest most severely affected leaf. Less severely affected leaves have extensive orange translucent flecking, not apparent in this photograph. See pp. 151–155.