A Key to Common Landscape Palm Disorders and Diseases in the Continental United States

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Palms in the landscape are susceptible to a wide range of diseases and disorders. This key should allow the reader to identify the most common diseases and disorders encountered in the continental United States.

Although most known diseases and physiological disorders of ornamental palms are discussed and illustrated in two recent books (Elliott et al. 2004; Broschat & Meerow 2000), diagnosis of a particular palm problem requires either a comprehensive understanding of all of the possibilities, or a systematic key to help the diagnostician focus on the cause of the problem. The following is a key to the most common diseases and disorders affecting landscape palms in the continental United States. Areas of the palm-growing world outside the continental United States should still find this key useful, since physiological problems are the same wherever palms are grown. Disease and other pest problems, however, vary from region to region, and thus for practical reasons we have limited the geographical scope of this key. Some insect pests are included in the key, as the damage they cause may appear similar to some diseases or disorders. For a comprehensive reference on insects that damage palms, see Howard et al. (2001).

Since few people have immediate access to analytical laboratories, this key is based solely on visible symptoms. Fortunately, visual symptoms are sufficient to accurately diagnose the majority of palm problems. Visual symptoms are also the first step in determining which diagnostic lab to use for further analysis and which tissue should be sampled for analysis. A laboratory analysis should be used only in conjunction with the field diagnosis of the problem. It is critical to understand that plant diagnostics is not nearly as sophisticated or infallible as human medical diagnostics. Just because a laboratory report suggests deficiencies of one or more nutrient elements or the presence of one or more potential pathogens does not mean that those deficiencies or pathogens are the actual cause of a particular problem. Thus "false positives" are a common and often misleading weakness of laboratory diagnostics. In the case of palm diseases, "false negatives" are also a common problem, especially when the wrong tissue is sampled or a sample of poor quality is submitted to the laboratory.

If confirmation of a field disease diagnosis is necessary, it should be conducted by a qualified plant disease diagnostic laboratory. For example, molecular tests can be used to confirm Fusarium wilt and lethal yellowing, but only a few laboratories have this capability. Note that sometimes it is not possible to make a confirmation of a field diagnosis until a dead or dying palm is cut down. For example, palms affected by Ganoderma butt rot may die without producing conks (basidiocarps). However, when the palm is cut down and cross-sections made of the trunk, the disease will be easily confirmed.

Sampling the correct tissue is critical for an accurate diagnosis. One common error is to sample roots. However, root rots of palms growing in the landscape are uncommon, and are usually the secondary result of a palm being planted in the wrong environment – e.g., planting *Phoenix dactylifera* in soils that are routinely water-logged. A diagnostic laboratory will usually be able to isolate *potentially* pathogenic fungi from roots, but these fungi are seldom the *primary* cause of the problem observed. Likewise, soil sampling for potential pathogens is not recommended.

As with diseases, most nutrient deficiency problems can be readily diagnosed by visual symptoms alone. However, there are situations where multiple deficiencies may be present on a single palm. Symptoms of these deficiencies may be present on different parts of the palm (e.g., old vs. new leaves) but may occasionally be superimposed on the same tissue. A common example of the latter is potassium and magnesium deficiency symptoms both being present to some degree on the older leaves of a palm.

Leaf nutrient analysis can be useful for distinguishing multiple deficiencies where the symptoms of one deficiency may mask those of another. Leaf analysis can also be used to confirm or clarify a diagnosis based on visual symptoms. However, there are exceptions. For example, leaf analysis is not particularly useful for diagnosing iron deficiency in any plant, and may not accurately assess the boron sufficiency status of a palm at any given time, due to the highly transient nature of boron deficiency. Since there is a delay of four or more months between the time that boron deficiency is experienced by the palm and when the affected leaf appears outside the bud area, sampling a newly emerging leaf merely shows the boron status of the palm at the time that leaf was developing four or more months ago, and not the current boron sufficiency status of the palm. Leaf nutrient analyses are usually based on samples of several leaflets taken from the center of the youngest fully expanded leaf. In pinnate-leaved palms, this leaf should have all of its basal leaflets (or spines in some species) expanded out and perpendicular to the petiole axis, as in older leaves.

Soil nutrient analysis has often been employed in the diagnosis of plant problems. Unfortunately, this technique has limited value for this purpose, and often leads to erroneous conclusions. Just because a nutrient element is found to be "deficient" in the soil, does not mean that the plant is unable to extract sufficient amounts of that element from the soil. Alternatively, a palm may be suffering from a deficiency of an element that is present in "sufficient" levels according to soil tests. Soil analysis can be useful for diagnosing problems such as high soluble salts, a disorder with symptoms very similar to those of chemical toxicities, or even potassium deficiency in some species. Soil analysis may also provide useful information such as soil pH, which could affect your choice of corrective fertilizers.

When collecting soil samples for laboratory analysis, it is best to scratch away the mulch

or other surface covering and obtain a cup or more of soil from the top 4–6 inches of the soil profile. Sample several areas under the canopy of a single palm, or from under the canopies of several palms, if they are all affected by a single problem. These samples should be thoroughly mixed, and about one cupful of the mixture taken to the soils laboratory for analysis.

Once a diagnosis is made, treatment for that particular problem can be obtained from recent books such as Elliott et al. (2004) or Broschat and Meerow (2000). These references contain discussions and illustrations of the palm diseases and physiological disorders included in this key and should be used in conjunction with this key. You should also consult with your local Cooperative Extension Service office for local updates.

The following key focuses on typical symptoms associated with each disorder or disease. However, atypical symptoms do occur. Also, symptoms of a single disease or disorder vary among palm species, and to some extent, even within a single palm species. It is also important to consider the palm's environment and history when making a diagnosis. Remember that diagnosing palm problems in the landscape can be as much an art as it is a science, and experience is invaluable. The key is divided into five major headings based on location of symptoms observed.

LITERATURE CITED

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The Key

Note: Leaf symptoms of lethal yellowing (LY) vary greatly with palm species and coconut cultivars. In the United States, LY has thus far been found only in southern Florida. A similar disease has been observed in the lower Rio Grande Valley of Texas. The range of LY is restricted by the lack of cold hardiness of its insect vector.

A. Symptoms affecting the entire canopy (all leaves)
  1. wilting
    a. fungal conk (basidiocarp) present on trunk – **Ganoderma butt rot**
    b. no fungal conk on trunk
      1) older leaves dying and hanging against trunk; leaves may first become chlorotic or discolored – **lethal yellowing (symptoms primarily on 'Malayan Dwarf' coconuts)**
      2) top of root system is not found within top 15 to 30 cm (6 to 12 inches) of soil – **palm planted too deeply**
      3) soil is water-logged – **poor soil aeration**
      4) cross-sections of trunk show rotting or discoloration of wood (determined after palm is cut down)
        a) discoloration confined to lowest 1.2 m (4 feet), usually located in the center of trunk – **Ganoderma butt rot**
        b) trunk discoloration at any height, usually concentrated on one side of trunk, with dark fibrous appearance – **Thielaviopsis trunk rot**
  2. leaves reduced in size
    a. leaves uniformly light green or yellow in color – **nitrogen deficiency**
    b. leaves chlorotic and necrotic – **late stage potassium deficiency**
  3. canopy growth at sharp angle to trunk axis – **boron deficiency**
  4. collapse of crown
    a. rapid (1 or 2 days) collapse of crown – **lightning damage**
    b. moderately fast (more than 4 days) to slow collapse of crown

1) cross-section through crown area shows crumbly trunk tissue (actually insect frass) and possibly 18 to 25 mm (3/4 to 1 inch) long gray caterpillars – ***Opogona*** **(banana moth) larvae damage**

2) cross-section through crown reveals galleries packed with frass, sometimes with white beetle grubs or pupae – **palmetto weevil damage**

3) cross-section through crown area shows rotted black fibrous appearance, but not crumbly trunk or bud tissue – **Thielaviopsis trunk or bud rot**

5. leaves tattered – **wind damage**

6. leaflets missing or partially missing from leap tips – **boron deficiency**

7. chlorosis or necrosis of distal portion of leaves close to high voltage power lines – **powerline decline**

8. leaves uniformly light green – **nitrogen deficiency or chronic iron deficiency**

9. "spotting" on leaves

a. uniformly colored necrotic spots accompanied by leaflet tip necrosis – **foliar spray toxicity**

b. "spots" not raised; variable in size and in color from yellow to black; most common on small, immature palms – **leaf spot diseases (e.g.,** ***Exserohilum, Bipolaris, Calonectria, Pestalotiopsis*****, etc.)**

10. leaf bases (and often dead leaf blades) covered with light salmon-pink spores – **Gliocladium blight**

B. Symptoms most severe on oldest leaves

1. chlorosis

a. one or more older leaves uniformly yellow to yellow-orange in color (typically accompanied by skirt of dead leaves hanging down against trunk; yellowed leaves may originate mid-canopy in some cases) – **lethal yellowing**

b. chlorosis confined to margins of leaves or leaflets; central portion of leaves or leaflets distinctly green – **magnesium deficiency**

2. leaves discolored, but not necessarily chlorotic; usually shades of red to dark brown or gray (typically accompanied by skirt of dead leaves hanging down against trunk) – **lethal yellowing**

3. leaflets of oldest living leaves necrotic on one side of rachis only and petiole/rachis have reddish-brown to brown or black streak and vascular discoloration evident in longitudinal section of petiole – **Fusarium wilt (primarily** ***Phoenix canariensis,*** **but may occur on** ***P. dactylifera*****)**

4. reddish-brown to brown or black streaks or lesions on petioles or rachis; necrotic segments in fan palm leaf blades or uneven death of leaflets in pinnate palm leaf blades – **rachis blight (caused by one of several fungal pathogens; small fungal spore-producing structures may be present on surface of lesioned or streaked petiole)**

5. tip or marginal leaf or leaflet necrosis

a. leaflet tips necrotic and curled – **potassium deficiency**

b. leaflet tips not curled

1) leaflet tips often broken off – **potassium deficiency (*Phoenix* spp.)**

2) leaflet tips not broken off

a. leaflets have translucent yellow/ orange or necrotic spotting or yellow-orange discoloration – **potassium deficiency**

b. leaflets do not have translucent yellow/orange or necrotic spotting or yellow-orange discoloration – **potassium deficiency, soil salt injury, micronutrient or other chemical toxicity, water stress (often requires leaf nutrient analysis, soil analysis or knowledge of plant environment or management history to differentiate)**

6. chlorotic and/or necrotic, brown, or black "spotting"
   a. very small ≤1 mm (<1/16 inch) raised "spots" (actually fungal structures) – **Graphiola leaf spot (false smut) (primarily *Phoenix* spp.)**
   b. 3 to 8 mm (1/8 to 1/3 inch) raised black, diamond-shaped "spots" (actually fungal structures), often accompanied by leaflet tip necrosis – **diamond scale (only on *Washingtonia filifera* in California and Arizona)**
   c. no raised spots – **potassium deficiency**
7. gummy exudates ("bleeding") from multiple small 5 to 8 mm (1/5 to 1/3 inch) wounds in palm leaf bases – **weevil damage (e.g., *Metamasius* spp.)**
8. old to middle-aged leaves have necrotic "skeletonized" patches with only veins and surface layers of leaf intact; underside of leaf necrotic patches typically covered in tubes of insect frass – **leaf skeletonizers**
9. leaf kinks and hangs parallel to trunk
   a. leaf remains healthy – **wind damage**
   b. leaf dies
      1) multiple small 5 to 8 mm (1/5 to 1/3 inch) wounds in leaf base – **weevil damage (e.g., *Metamasius* spp.)**
      2) no wounds and palm is *Adonidia merrillii* – **lethal yellowing**

C. Symptoms affecting youngest leaves only
1. spear leaf (i.e., youngest unopened leaf) discolored or collapsed
   a. spear leaf hanging down, but otherwise healthy – **boron deficiency**
   b. spear leaf pulls out easily
      1) on cold-damaged palm – **secondary bacterial bud rot [Note: cold damage occurred weeks prior to bud rot symptoms]**
      2) non cold-damaged palm – **Phytophthora bud rot; Thielaviopsis bud rot; lethal yellowing (*Phoenix dactylifera, Borassus flabellifer*)**
2. no new leaves emerging, but older leaves still green – **bud rot (bacterial, Phytophthora or Thielaviopsis) or non-pathogenic bud damage**
3. new leaves chlorotic
   a. necrotic streaking present – **manganese deficiency**
   b. no necrotic streaking present – **iron deficiency**
   c. green spots superimposed on chlorotic new leaves – **iron deficiency**
   d. leaflets of chlorotic new leaves becoming necrotic and palm is *Roystonea* sp. **–royal palm bug damage**
4. new leaves reduced in size, but older leaves full-sized
   a. leaves mostly necrotic
      1) leaflets curled or frizzled; leaflet necrosis more severe towards base of leaf – **manganese deficiency**
      2) leaflets not curled or frizzled – **pre-emergent herbicide injury**
   b. new leaves not necrotic, but crumpled and greatly reduced in size – **boron deficiency**
   c. new leaves have truncated tips
      1) all leaflet tips truncated – **manganese deficiency (*Cocos* only)**
      2) distal leaflet truncated in inverted "V" shape – **boron deficiency**
5. new leaves have sharply hooked leaflet tips – **boron deficiency**
6. spear (and often other new leaves) fail to open normally – **boron deficiency**
7. transverse puckering or transverse translucent streaking on leaflets – **boron deficiency**

D. Symptoms affecting flowers and fruits

1. flower stalks have blackened tips – **boron deficiency, lethal yellowing (look for other symptoms to separate deficiency from disease)**
2. premature nut drop in *Cocos*
   a. stem ends blackened and water soaked – **lethal yellowing**
   b. stem ends green to brown and not water soaked – **boron deficiency**

E. Symptoms affecting trunk

1. gummy sap flowing from trunk ("bleeding")
   a. bleeding from single large wound with evidence of wood rot
      1) light salmon-pink spores present on trunk – **Gliocladium trunk rot**
      2) light salmon-pink spores not present – **Thielaviopsis trunk rot**
   b. bleeding from one or more widely dispersed areas throughout the trunk – **lightning injury**
2. holes in trunk at any location along trunk
   a. large holes 15 mm (5/8 inch) – **borer damage (*Dinapete*) (on *Washingtonia* only in California, Utah, and Arizona)**
   b. many small 5 mm (1/5 inch) holes, often in rows – **woodpecker feeding damage**
   c. small holes 1 to 2 mm (1/16 inch), randomly dispersed; typically having sawdust plugs protruding out of hole – ***Ambrosia* beetle damage**
3. holes or wounds (5 to 8 mm; 1/5 to 1/3 inch) in crownshaft or trunk near canopy – **weevil damage (e.g., *Metamasius* spp.)**
4. longitudinal splitting of trunk
   a. palm obviously dying – **lightning injury**
   b. palm appears to be otherwise healthy – **excessive water uptake**
5. tapering of trunk (pencil-pointing)
   a. leaves chlorotic and/or necrotic
      1) leaves chlorotic, but no necrosis present – **nitrogen deficiency**
      2) leaves chlorotic and necrotic – **late stage potassium deficiency**
   b. leaves not chlorotic and/or necrotic – **reduced vigor due to routine overpruning, prior cold temperatures, or other environmental stress**
6. shriveling – **water stress (may be caused by waterlogged soils or deep planting)**
7. fungal conk (basidiocarp) on trunk – **Ganoderma butt rot (leaves often wilted; cross-sections reveal internal rot at base of trunk)**
8. trunk collapses on itself – **Thielaviopsis trunk rot**