UF IFAS Extension UNIVERSITY of FLORIDA

ENH1012

# Boron Deficiency in Palms[1]

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## Symptoms

Boron (B) deficiency results in a wide array of symptoms, not only among species of palms, but also within a single species. Symptoms always occur on newly emerging leaves, but remain visible on these leaves as they mature and are replaced by younger leaves.

One of the earliest symptoms of B deficiency on *Dypsis lutescens* (areca palm) and *Syagrus romanzoffiana* (queen palm) is transverse translucent streaking on the leaflets. In many species, including *Cocos nucifera* (coconut palm), *Elaeis guineensis* (African oil palm), and *S. romanzoffiana*, mild B deficiency can be manifested as sharply bent leaflet tips, commonly called "hookleaf" (Figure 1). These sharp leaflet hooks are quire rigid and cannot be straightened without tearing the leaflets.

Figure 1. *Cocos nucifera* with "hookleaf," a mild syptom of B deficiency.
Credits: T. K. Broschat, UF/IFAS

Boron deficiency can be very transient in nature, often affecting a developing leaf primordium for a very short period of time (e.g., 1 to 2 days). This temporary shortage of B can cause necrosis (dead tissue) on the primordial spear leaf for a distance of about 1 to 2 cm. When such leaves eventually expand, this "point" necrosis affects the tips of all leaflets intersected by that necrotic point, the net result being the appearance of a blunt, triangular truncation of the leaf tip (Figures 2 and 3). This pattern can be repeated as many as three times during the development of a single leaf of *Cocos nucifera* (about 5 weeks) (Figure 4).

Figure 2. Leaf tip of B-deficient *Phoenix roebelenii* (pygmy date palm) showing necrotic truncation in an inverted V-shape.
Credits: T. K. Broschat, UF/IFAS

One of the most common symptoms of B deficiency is the failure of newly emerging spear leaves to open normally. They may be tightly fused throughout their entire length, or the fusion can be restricted to basal or distal parts of the spear leaf. In a chronic state, multiple unopened spear

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leaves may be visible at the apex of the canopy (Figures 5 and 6).

Figure 3. Boron deficiency of *Bismarckia nobilis* (Bismarck palm) showing necrosis at two separate times during the development of this leaf.
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Figure 4. Boron-deficient *Cocos nucifera* showing a series of inverted V-shaped truncations on each leaf. These leaf constrictions represent separate temporary B deficiencies caused by a series of heavy rainfalls.
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Perhaps the most unusual symptoms of chronic B deficiency is the tendency for the entire crown to bend in one direction (Figures 7 and 8). This is one form of epinasty that can also cause twisting of petioles and leaves or sharp bends in the petiole, resulting in a single new leaf growing downward along the trunk (Figure 9). These epinastic symptoms are believed to be caused by a B deficiency-induced decrease in IAA-oxidase activity and therefore excessive auxin concentrations within the leaves.

Figure 5. Multiple unopened spear leaves on a chronically B-deficient *Cocos nucifera*.
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Figure 6. Mulitple unopened spear leaves on B-deficient *Phoenix roebelenii*.
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Figure 7. Chronic B deficiency on *Adonidia merrillii* (Christmas palm) showing trunk bending. The tiny crumpled leaves indicate that the deficiency was at one time acute, but was subsequently alleviated to some degree.
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Figure 8. Severe epinasty in *Roystonea regia* (Cuban royal palm) due to B deficiency. Note also the small size of some of the leaves.
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Figure 9. Bent new leaf of *Syagrus romanzoffiana* caused by B deficiency.
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Boron deficiency in its acute form produces yet other symptoms. Often leaves emerge greatly reduced in size and crumpled in a corrugated fashion (accordion leaf) (Figures 10 and 11). Palms often grow out of these symptoms, but the deficiency may kill the meristem.

Boron-deficient palms often abort their fruits prematurely and inflorescences may have extensive necrosis near their tips (Figures 12 and 13). These symptoms are very similar to those of lethal yellowing (LY) in species affected by that disease. The calyx end of fallen coconuts from LY-infected *Cocos nucifera* will be blackened, whereas coconuts from B-deficient trees will not have this blackened end.

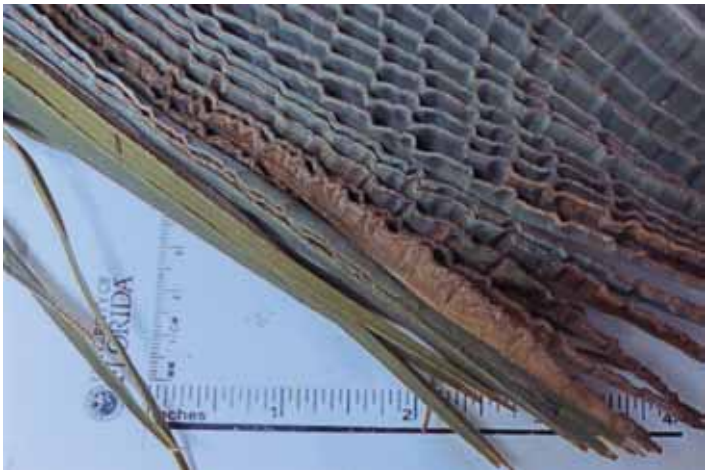

Figure 10. Accordion-leaf in *Syagrus romanzoffiana*, a symptom of B deficiency.
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Figure 11. Acute B deficiency in *Heterospathe elata* (sagisi palm) showing small crumpled new leaves.
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Figure 12. Necrotic inflorescence (flower stalk)of *Syagrus romanzoffiana* caused by B deficiency.
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Figure 13. Premature fruit drop in *Cocos nucifera* caused by B deficiency.
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## Cause

Boron deficiency is caused by insufficient B in the soil. Boron is readily leached through most soils, with a single heavy rain event temporarily leaching most available B out of the root zone. When this leaching stops, B released from decomposing organic matter will again provide adequate B for normal palm growth in most cases. Boron deficiency is also common in deserts and seasonally dry areas where soil drying tightly binds B. Chronic B deficiency is believed to be caused by soil drying and high soil pH, while temporary B deficiency is caused by heavy leaching.

## Occurrence

Boron deficiency is very widespread on palms growing in wet climates throughout the world, but can also occur in desert climates. Boron deficiency has been observed in container-grown palms, especially in seedlings.

## Diagnostic Techniques

Boron deficiency symptoms are quite distinctive and are usually sufficient for diagnosis by themselves. Manganese deficiency in *Cocos nucifera* produces symptoms similar to those of B deficiency, but Mn-deficient leaves show necrotic truncations of all leaflets, not just those near the tip of the leaf. No other common deficiency produces symptoms that could be confused with those of B deficiency.

Because B deficiency is often very transient in nature, the element is immobile within the palm (cannot move from one leaf to another), and deficiencies affect only leaf primordia developing within the bud area, leaf analysis is not particularly useful. Leaf analysis tells you the B status of the single leaf that you sampled, but that is not the current B status of the newly developing leaves within the bud area. Rather, it indicates the B status of the palm 4 or 5 months ago when the sampled leaf itself was in the developmental stage within the bud. The B status of the palm is likely to have changed considerably one way or another during 4 or 5 months since the affected leaf became old enough to sample. Thus, leaf analysis, or even leaf symptoms, unless the deficiency is chronic (regularly occurring), cannot tell you about the current B status of a palm. Similarly, soil analysis is not recommended for diagnosis of B deficiency.

## Management

Because the difference between deficiency and toxic levels of B within plants is rather small, extreme caution should be exercised when applying B fertilizers. Recommended landscape maintenance fertilizers typically contain 0.05%–0.15% B, and that appears to be sufficient to prevent B deficiencies in most cases. One product, Granubor®, has a longevity of about 3 months, making it suitable for blending with other slow-release fertilizers that have similar longevities. Its granular form also prevents it from settling out in mixed fertilizers. Water-soluble sodium borates such as Solubor® or Borax suffer from several problems when incorporated into granular fertilizer blends. First, they are typically powders, which tend to settle to the bottom of a fertilizer bag. Fertilizer taken from the top of the bag may contain insufficient B for plant needs, while fertilizer taken from the bottom may contain toxic concentrations of B. Also, water-soluble B fertilizers are readily lost to leaching during excessive rainfall, rendering them less effective than slow-release forms.

Current recommendations for correcting B deficiencies in palms are intentionally conservative because of the potential for toxicity. Dissolve about 2–4 oz of Solubor® or Borax in 5 gallons of water and drench this into the soil under the canopy of a single palm. Do not attempt to apply dry B fertilizers to the soil, because turfgrass or other groundcovers in contact with it may be killed. Do not repeat this for at least 5 months, because it will take this long to see the results of the first application.

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