Gender and Expression of Magnesium Deficiency in Canary Island Date Palms

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The Canary Island date palm (CIDP), *Phoenix canariensis*, is one of the most iconic ornamental landscape palms of southern California (Hodel 2012). A dioecious species, its solitary, tall, robust trunk topped with a huge canopy of long, drooping to arching, dark green, pinnate leaves is a majestic and common sight (Front Cover). With few peers for size, grandeur, and stateliness, it is especially common in coastal areas but is also used with some frequency in interior valleys and even desert locales. A much sought-after palm for landscaping, plants sell for between US$300 and 500 per foot-trunk (30 cm of trunk height).

Because of their grandeur and elegance, CIDPs make unsurpassed specimens for repetitive, uniform plantings, such as lining boulevards or other wide thoroughfares in a *grande allée* fashion or defining large open spaces (Fig. 1). Unfortunately, CIDPs are not without their problems, and several diseases and disorders, including Fusarium Wilt, Sudden Crown Drop, and nutritional disorders, sometimes afflict them, causing death or detracting significantly from their esthetic quality.

One such nutritional disorder is magnesium deficiency. Magnesium is a mobile element and is moved from the older leaves to where it is needed most in the plant, typically into the apical meristem area where new leaves and inflorescences develop; thus, deficiency symptoms show up first in the older or lower leaves in the palm canopy. Magnesium deficiency appears on older leaves as a distinct yellowing pattern where affected leaves typically have an outer band of light green to

1. The Canary Island date palm is one of the most iconic ornamental landscape palms of southern California (Newport Center, Newport Beach, CA).

greenish yellow to yellow around the outside of the leaf blade while the area in the middle of the blade along the rachis remains green (Broschat 2004, Broschat & Meerow 2000) (Fig. 2).

Through numerous casual observations we noticed an apparent correlation between gender and expression of magnesium deficiency symptoms; pistillate (female, fruit-bearing) plants tended to show older leaves

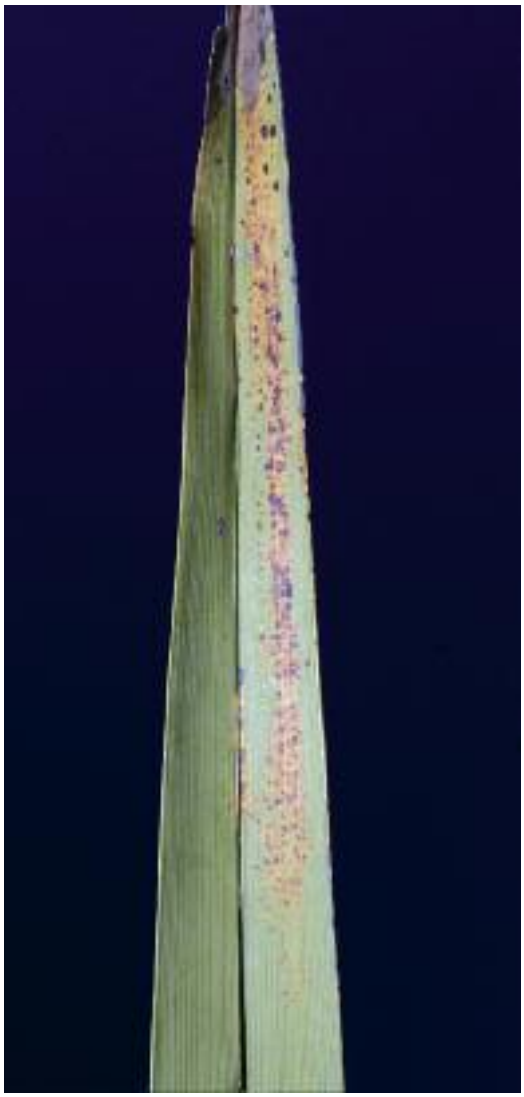
2. When viewed up close, magnesium deficient leaves in CIDPs are yellow around the outside of the leaf blade while the area in the middle of the blade along the rachis remains green (Seal Beach, CA).

3. This staminate CIDP was given a "0" rating for no symptoms of magnesium deficiency. 4. A pistillate CIDP given a "1" rating or little symptoms of magnesium deficiency. 5. A pistillate CIDP given a "2" rating or moderate symptoms of magnesium deficiency. 6. A pistillate CIDP given a "3" rating or severe symptoms of magnesium deficiency. (All photographed at Las Palmas, Hope Ranch, Santa Barbara, CA.)

Table 1. Effect of gender on expression of magnesium deficiency symptoms, Canary Island Date Palms, Hope Ranch, Santa Barbara, California, May 2015.

Symptoms	Staminate	Pistillate	Total	P Value
None	128	20	148	$1.7E^{-20}$
Little	34	51	85	0.1
Moderate	1	63	64	$6.7E^{-14}$
Severe	0	40	40	$9.3E^{-10}$
Total	163	174	337	

7. Close visual inspection of retrieved magnesium-deficient leaves of a CIDP also revealed the presence of orange, yellow, and dark flecking and leaflet tip necrosis, which are symptoms of potassium deficiency (Las Palmas, Hope Ranch, Santa Barbara, CA).



with yellow margins more often and had more severe symptoms than did their staminate (male, pollen-bearing) counterparts. These symptomatic leaves are easily visible from the ground and in many cases detract esthetically from the palm's ornamental value. Thus, we wanted to determine if a correlation existed between gender and magnesium deficiency and, if so, how it could impact landscape management of this species.

Materials and Methods

We selected two, long, fairly uniform street plantings of 1.8 and 1.4 km each, comprising 337 mature specimens of CIDPs on Las Palmas in the Hope Ranch area near Santa Barbara, California, north of Los Angeles. Planted about 1905 (Chase 1993), the palms are 15 to 20 m tall and generally unpruned and unmaintained, which enabled us to determine gender rather easily because gender-dimorphic inflorescences were present and old leaves were present that would show magnesium deficiency symptoms. In a visual inspection, we recorded gender and severity of magnesium deficiency symptoms for each palm on a scale of 0 to 3, where 0 = no symptoms (Fig. 3), and 1, 2, and 3 = little (Fig. 4), moderate (Fig. 5), and severe (Fig. 6) symptoms, respectively. We entered the data in a Microsoft Excel spreadsheet and performed a chi-square test to determine correlations, if any, between gender and presence of symptoms and gender and severity of symptoms and their statistical validity.

Although we later retrieved symptomatic leaves for a closer inspection, we determined magnesium deficiency symptoms visually, not by tissue analysis. It is difficult to confirm simply by leaf analysis that magnesium deficiency causes the characteristic yellow leaf margins (T. Broschat, pers. comm.). Inducing magnesium deficiency symptoms in sand

culture can prove causation of the symptoms and that has been done on a number of occasions, so the symptoms themselves, which are quite distinctive, are sufficient to diagnose the cause. The symptoms we describe and illustrate are a perfect match for those established and illustrated for magnesium deficiency (Broschat 2004); thus, we felt it was unnecessary to include leaf analyses.

Close visual inspection of retrieved magnesium-deficient leaves also revealed the presence of orange, yellow and dark flecking and leaflet tip necrosis, symptoms of potassium deficiency (Fig. 7). Because these symptoms are not readily discernible on tall trees when viewed from the ground, we did not rate potassium deficiency symptoms.

Results and Discussion

The data clearly show that pistillate individuals were much more likely to show magnesium deficiency symptoms and to have more severe symptoms than their staminate counterparts (Table 1).

Pistillate individuals typically develop annually numerous (15 to 20), large infructescences that if allowed to remain on the palm become heavily laden with fruits, acting as an element "sink," drawing magnesium and other mobile elements like potassium from older leaves to meet their developmental needs. Thus, landscape managers can anticipate higher demands for magnesium and (and likely potassium) from pistillate individuals, especially those that are allowed to carry infructescences to maturity, and can adjust fertilizer rates and frequency upward accordingly to meet this increased demand and avoid unattractive, yellow, magnesium-deficient leaves. Perhaps fertilizer rates 50 percent higher than the recommended rate would be appropriate for pistillate, fruit-bearing palms. Alternatively, pruning out inflorescences once they have elongated fully but have yet to develop fruits would likely also help to preclude development of unattractive, magnesium-deficient leaves.

Because magnesium-deficient (and potassium-deficient) leaves will never become green and attractive again, even after fertilizer applications, it is important to prevent these nutritional disorders through appropriate cultivation and a regular fertilizer program.

Future research on this subject might look at how much additional fertilizer would be required to maintain appropriate magnesium and potassium levels in fruit-bearing Canary Island date palms.

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Literature Cited

Broschat, T.K. 2004. Magnesium deficiency and potassium deficiency, pp. 53–56 & Fig. 15, *in,* Elliott, M.L., T.K. Broschat, J.Y. Uchida, and G.W. Simone (eds.), Compendium of Ornamental Palm Diseases and Disorders. The American Phytopathological Society, St. Paul, MN.

Broschat, T.K. and A.W. Meerow. 2000. Ornamental Palm Horticulture. University of Florida Press, Gainesville, FL.

Chase, H.S. 1993. Hope Ranch: A Rambling Record. Mission Creek Studious and the Santa Barbara Historical Society, Santa Barbara, CA.

Hodel, D.R. 2012. The Biology and Management of Landscape Palms. The Britton Fund, Inc., Western Chapter International Society of Arboriculture, Porterville, CA.