Nutrient Deficiency Symptoms and Management for Walnut

Richard P. Buchner – UCCE Tehama, Butte and Glenn counties
Joe Connell – UCCE Emeritus Butte, Glenn and Tehama counties
Katherine Pope – UCCE Sacramento, Solano and Yolo counties
Janet Caprile – UCCE Contra Costa and Alameda counties
Franz Niederholzer – UCCE Colusa, Sutter and Yuba counties
Patrick Brown and Ted De Jong, UC Davis

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14 Essential Nutrients

(life cycle cannot be completed without all of them)

MACRONUTRIENTS

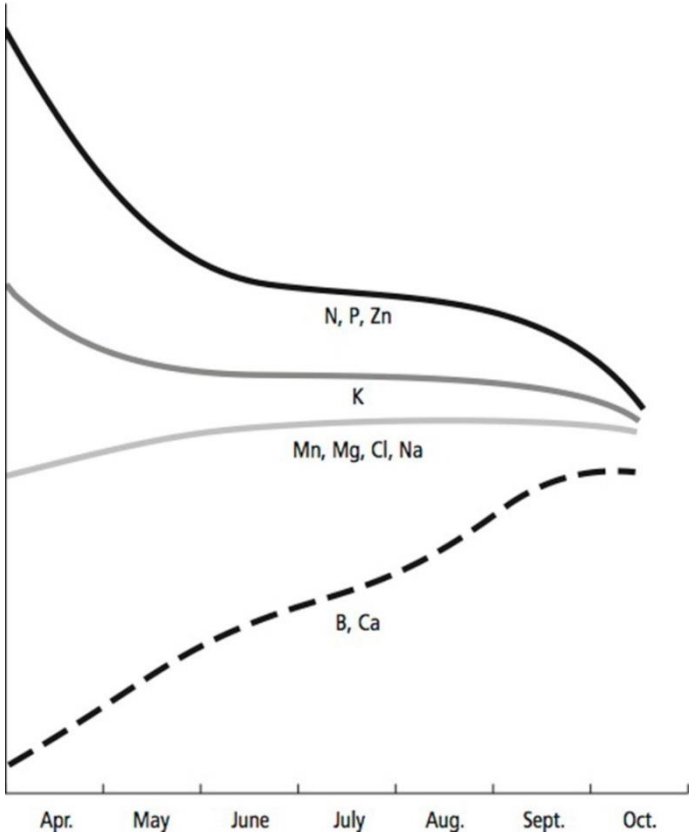
(N) Nitrogen
(P) Phosphorous
(K) Potassium
(Ca) Calcium
(Mg) Magnesium
(S) Sulfur

MICRONUTRIENTS

(Zn) Zinc
(B) Boron
(Fe) Iron *(cold wet soils)*
(Mn) Manganese *(cold wet soils)*
(Cu) Copper
(Cl) Chlorine
(Ni) Nickel
(Mo) Molybdemum

Plant Analysis (Leaf Samples)

Nutrient Curves throughout Season



- Integrates soil & plant factors and provides a direct measure of plant nutrition
- Annual nutrient status “survey”
  - Leaf samples collected in July
  - Plant macro-nutrient status does not change rapidly (they are stored) so an annual evaluation works.
- Diagnostic sampling
  - Collect leaf samples anytime
  - Compare symptomatic with healthy

Nitrogen Deficiency Almond

- Pale color
- Little new growth
- Reduced yield
- Weak Trees

Nutrients in Fruit - Totals

N / ton of nuts (in-shell, 8% moist) and assoc. hulls.

Site	2013*	2014*
N Chandler	26 a	26 b
D Chandler	31 a	31 a
S Chandler	25 a	25 c
N Tulare	25 a	24 c
D Tulare	32 a	31 a
S Tulare	27 a	27 c
GRAND MEAN	27	

Meat & Shell: 25-32 lbs.

Hulls: 0.5-2 lbs.

Other Scraps: 0.5-2 lbs. (?)

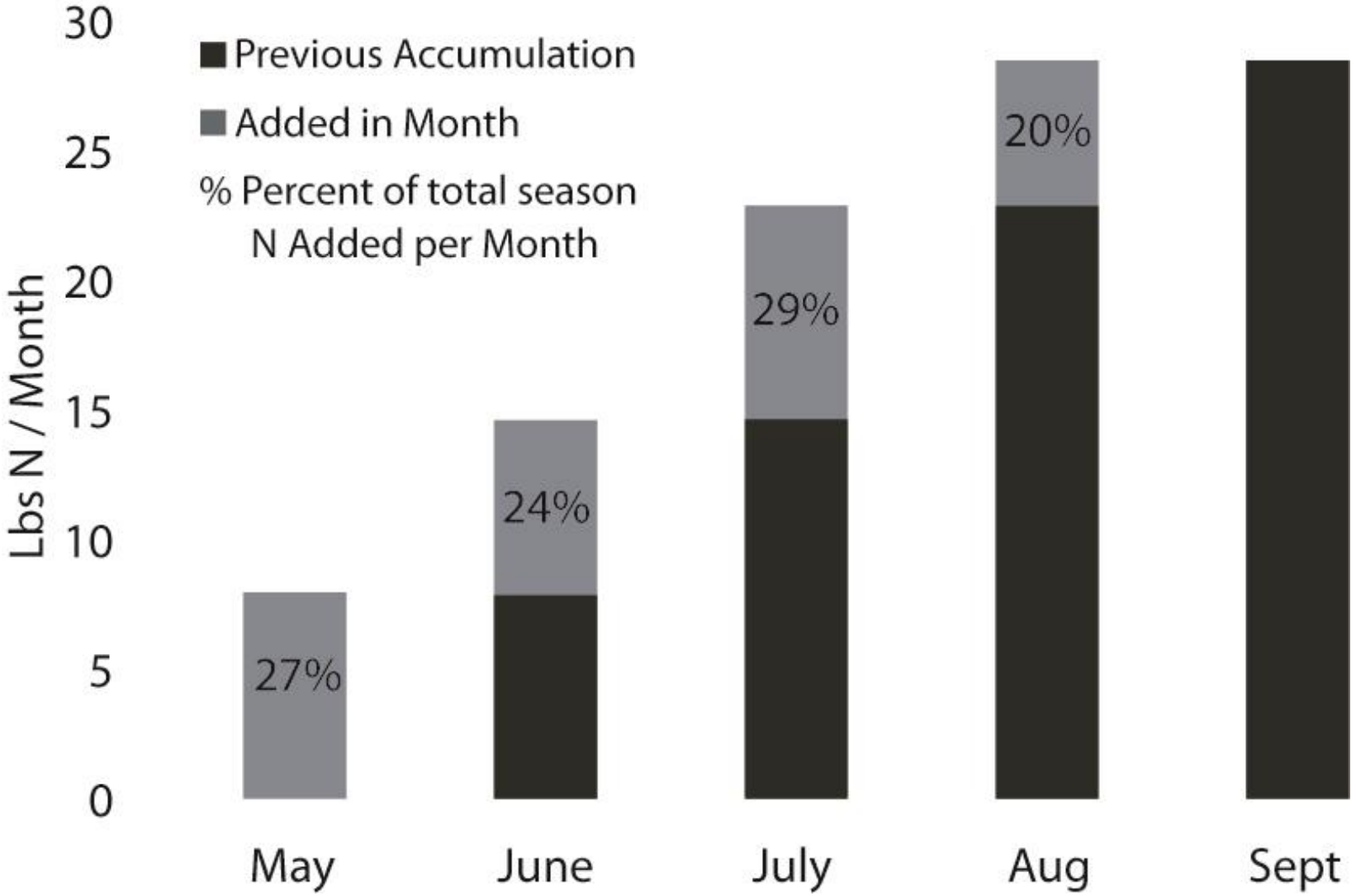
New Growth: 2-6 lbs.**(?)

N / ton in-shell: 28-40 lbs.

*Letters show dif's w/in cv.

**Based on Weinbaum's 0.13 lb N/tree, 50 trees/acre, 16 year old Hartleys.

Nitrogen Added per Month 2013 & 2015, Chandler & Tulare



Walnut Summary

- N is dynamic
- Nitrate moves with water
- N is taken up when it's needed, *not* when it's applied
  - Spoon feeding gives greatest N efficiency
  - 28-40 lbs/ton evenly over the May-Aug

K Deficiency Walnut

- Pale leaves mid summer
- Edges curl upward
- Underside is grayish
- Leaf margins necrotic
- Reduced leaf size
- Reduced shoot growth
- Reduced nut size

Potassium Deficiency Walnut

Sample Treatment for K Deficiency

Soil Type	Amount of KCL or K_2SO_4	Method
Sandy	400 lbs/A	Band, drill, inject
Clay or silt loam	1500 lbs/A initial + 400 lbs/A annual	band

Zinc Deficiency Walnut

Photo: Bob Beede

- Delayed budbreak in spring
- Small, sometimes chlorotic leaves appearing in tufts on rapidly growing spring growth (*little-leaf*)
- Interveinal chlorosis on larger leaves
- Terminal dieback in severe cases
- Whole tree or single shoot

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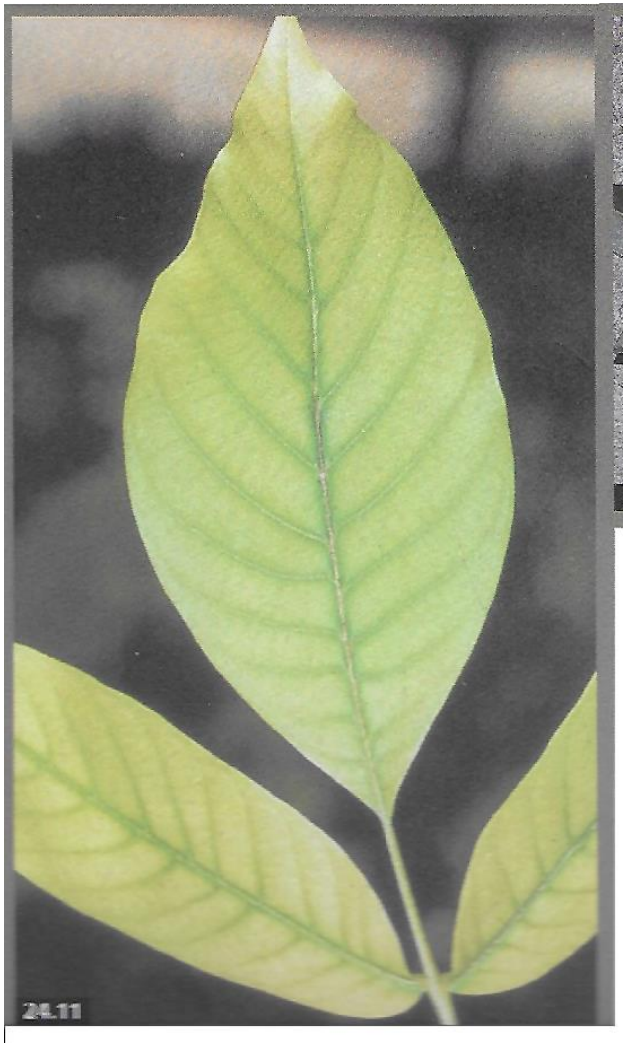
Zinc Deficiency Walnut

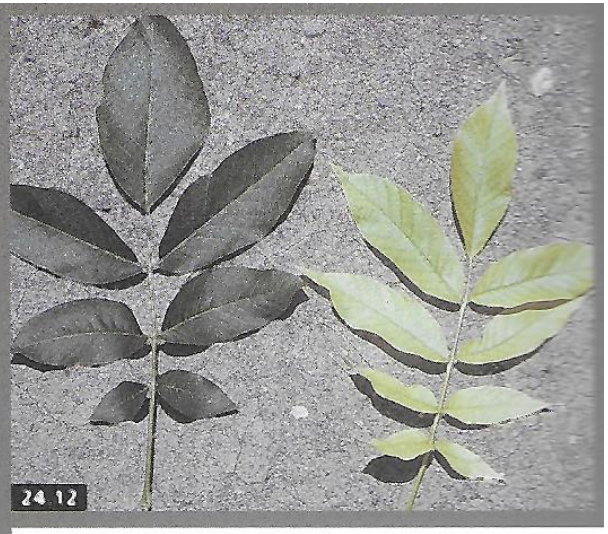
Sample Foliar Treatment for Zn Deficiency

- Foliar applications may be cheaper and more effective especially on fine textured soils
- Mature leaves do not absorb Zn well

Material/A	1-2 lbs **ZnSO4** (36% zinc) in 100 GPA + surfactant + pH adjusted to 5.0 OR 1-2 lbs **Zn-EDTA** (15%) in 100 GPA + surfactant
Timing	Post bloom at 6-10 inches of shoot growth (leaves have just turned from pink to green) Reapply in 2-3 weeks if symptoms persist

Iron Deficiency Walnut

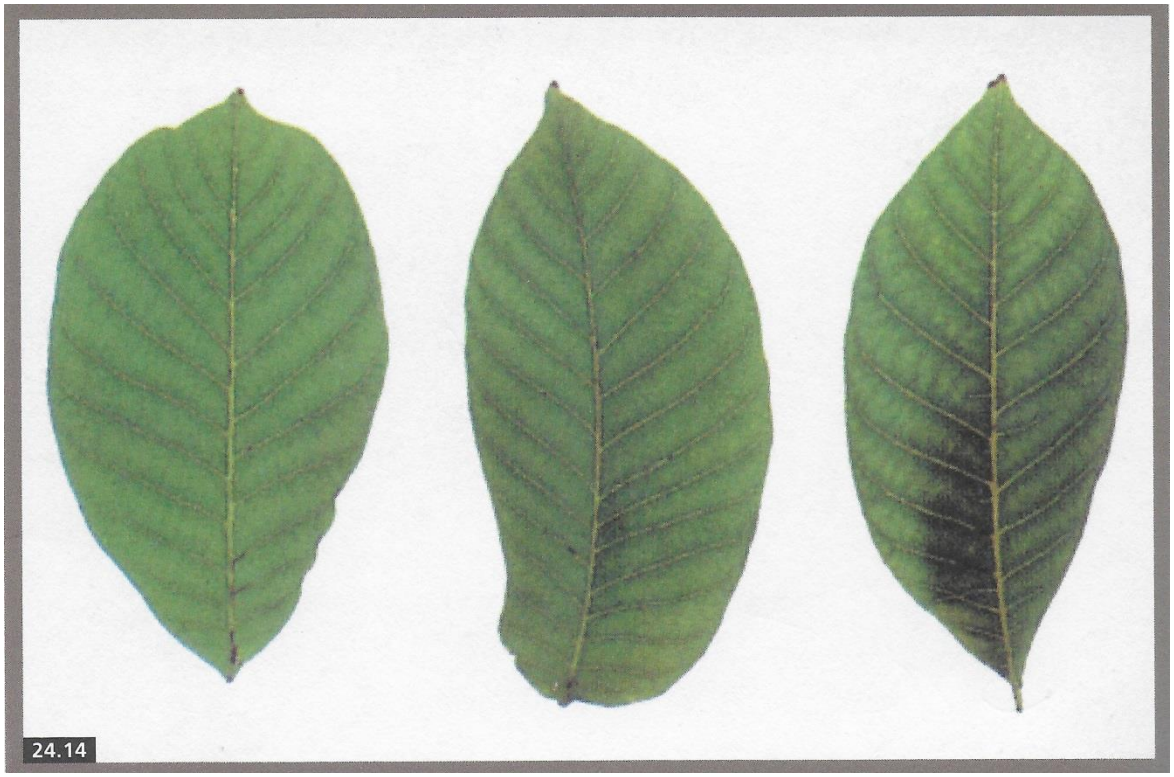




- Essential for Chlorophyll synthesis, Nitrogen metabolism, photosynthesis and enzyme production
- Early season chlorosis
- Entire leaf turns uniformly yellow
- Almost white if severe

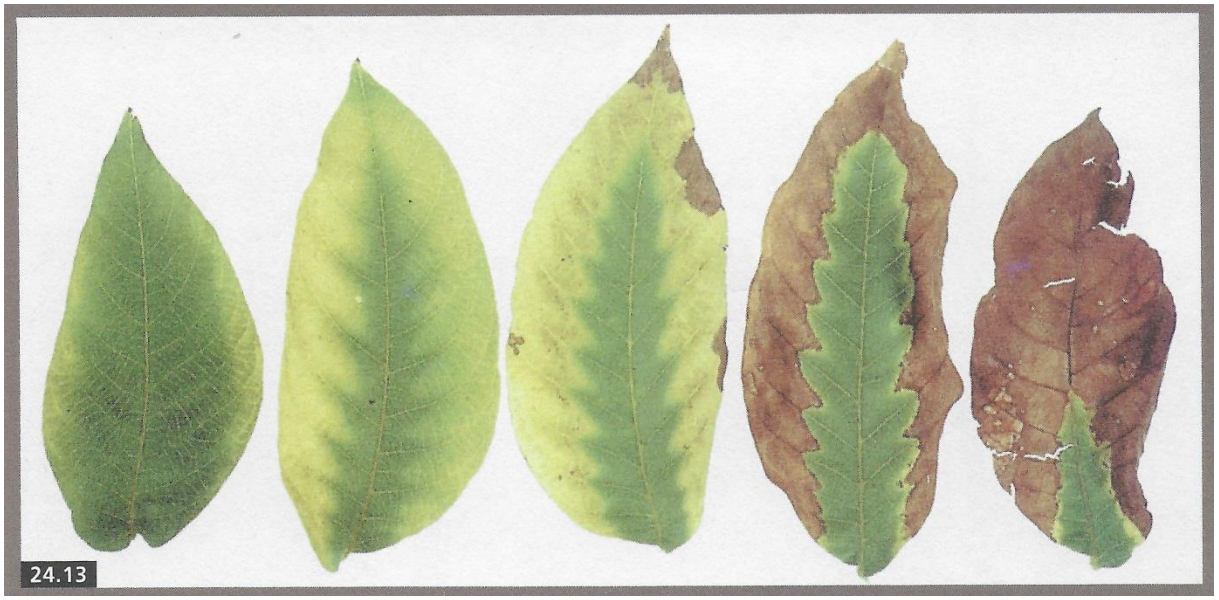
Iron Deficiency Walnut

Manganese Deficiency Walnut



- Plays a central role in photosynthesis
- Symptoms early to mid summer
- Chlorosis between the main and lateral veins
- Herring bone effect

Magnesium Deficiency Walnut



- Integral part of the chlorophyll molecule
- Necessary for photosynthesis
- Symptoms appear mid to late summer
- Basal leaves chlorotic forming an inverted “V’ of green along the basal part of the mid rib.

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