POMEGRANATE NUTRITION AND FERTILIZATION: A SMALL INTRODUCTION

Pomegranate plants require regular fertilization in order to assure their best performance in a commercial production system. The topic of fertilizing pomegranate plants was addressed at the 1st annual meeting of the Florida Pomegranate Association [***click here***]. Highlights of that presentation suggest that pomegranate enthusiasts in Florida should consider the following when developing a program and applying proper nutrition:

- The essential elements [those required for a plant to complete its life cycle] are carbon, hydrogen and oxygen [organic], and N, P, K, Mg, Ca, S [inorganic, macronutrients] and Mo, Cu, Zn, B, Fe, Ni and Cl [inorganic, micronutrients].
- Plants obtain C, H and O from carbon dioxide and water.
- The inorganic elements are supplied by the soil through the root system. Their relative quantities in plants are described as macro and micro.
- Many soils in Florida used for growing crops are sandy with low organic matter content. As a result, their ability to retain water and applied nutrients is poor.
- At certain locations in Florida, the topography is such that the soils are often chronically wet. Those conditions are unsuitable for growing pomegranates. Wet soils also affect the availability of nutrients.
- **Pomegranate plants can be treated like citrus trees regarding a nutritional program.**
- There are many acceptable approaches to a nutritional program, not just one. Their success should be judged by annual sampling. *However, note that leaf nutrient standards have not been researched or established in Florida!*

Fertilizer Basics

See the following publications for guidance on such things as fertilizer types and composition, interpreting the product label [e.g., what does 8-0-8-2-0.3 mean?], material sources and their fate in the soil, and the function of each nutrient element.

- **Nutrition of Florida Citrus Trees**: https://edis.ifas.ufl.edu/pdffiles/SS/SS47800.pdf
- **A Guide to Citrus Nutritional Deficiency and Toxicity Identification**: https://edis.ifas.ufl.edu/pdffiles/CH/CH14200.pdf.
- **Citrus Fertilizer Management on Calcareous Soils:** http://edis.ifas.ufl.edu/pdffiles/CH/CH08600.pdf.
- **Manganese (Mn) and Zinc (Zn) for Citrus Trees**: https://edis.ifas.ufl.edu/pdffiles/SS/SS61600.pdf.
- Visit **UF-EDIS** [Electronic Data Information Source] for much more information: http://edis.ifas.ufl.edu/.

Basic Fertility Concepts

- N and K are the most important nutrients. N supports vegetative growth, flowering and fruit yield. K plays an important role in fruit yield, size and quality.
- Usually one should apply fertilizers with N and K in equal parts or a 1:1 ratio.
- P is a relatively stable element in the soil meaning it does not readily leach from rainfall or irrigation. It does not need to be applied in large amounts or frequently. If a soil test indicates 60 lbs/acre or more is present in the soil, that is considered adequate.

- Soil pH is easily measured and should be maintained between 6.0 to 6.5.
- Maintaining the soil pH at a proper value is critical because the availability of certain nutrients especially micronutrients are pH sensitive.
- Ca is a macronutrient. The soil supply is affected by pH. When the pH value is adequate, but the Ca level in the soil is low, $CaSO_4$ can be used.
- All the micronutrients are applied and used by the plant in small quantities, but they are, nevertheless, essential. Often they are applied 1-2x/year to the leaves on a maintenance basis. Additional applications are made as needed. Further, applications of products containing all micronutrients are rarely done. Applications are made to address specific situations.
- ***YES, pomegranate plants can be over-fertilized!***

Diagnosing Plant Nutrient Status: Leaf Nutrient Standards

To judge the effectiveness of any nutritional program in fruit crops, a particular tissue is collected from the plants and analyzed. With citrus and pomegranate, that tissue is the leaf. Samples are collected when new leaves have emerged in the Spring, reached maturity [fully expanded] and their nutrient concentration is relatively stable. Table 1 shows values for citrus and pomegranate. They are provided only as a baseline and for guidance.

Table 1. Pomegranate and citrus optimum leaf nutrient concentrations.

Nutrient element	Calif.	India	Spain	FL-citrus
Macronutrients, %				
N	2.0-2.5	0.91-1.66	1.4-1.7	2.5-2.7
P	0.15-0.25	0.12-0.18	0.10-0.15	0.12-0.16
K	1.0-1.8	0.61-1.59	0.55-0.69	1.2-1.7
Ca	0.75-2.0	0.77-2.02	0.66-1.5	3.0-4.9
Mg	0.25-0.75	0.16-0.26	0.30-0.36	0.30-0.49
S	??	0.16-0.26	??	0.2-0.4
Micronutrients, ppm				
B	30-100	??	16	36-100
Cu	6-20	29-72	16	5-16
Fe	25-200	71-224	74	60-120
Mn	25-60	29-89	79	25-100
Mo	??	??	??	0.10-2.0
Zn	25-100	14-72	5	25-100

Table 1 notes. The California data are the result of standard sampling of commercial orchards. The Indian data are from a research publication. The Spanish data are from a study conducted in Spain with their popular cultivar, Mollar, and an Israeli cultivar. Leaf nutrient concentrations were measured in low-, medium- and high-yielding orchards. The Florida standards are for orange trees. Overall, data are missing for S and Mo partly because S requires a separate analysis from the one used for the remaining elements, and Mo is rarely deficient so is not included in most routine commercial analyses.

Diagnosing Plant Nutrient Status: Leaf Deficiency Symptoms

The visible symptoms of fruit crop leaves are a useful window into nutrient deficiencies and plant nutrient status. However, there are few images of pomegranate leaf nutrient deficiency symptoms available. Therefore, images of peach leaves are used herein as a substitute.

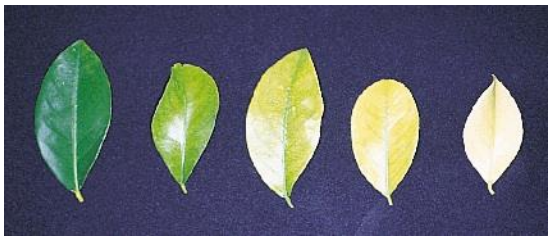
To be a skilled diagnostician, one must observe whether leaf nutrient deficiency symptoms occur either on young, newly emerging leaves, or on older leaves. The location of the symptoms is a critical first step in identifying the nutrient problem.

The reason for the differences in appearance location is because the ***macronutrients*** [with the notable exception of Ca and S] are largely ***mobile*** in the plant. That means that if the plant is suffering a mild N deficiency, symptoms will not appear on the young leaves because the plant is able to move N from older leaves to younger ones. That is not the case with ***micronutrients*** which are mostly ***immobile***. If a plant is Fe deficient, the young leaves will be the first show deficiency symptoms.

Caveats.

- A deficiency may be the result of the actual absence or limited supply of the nutrient from the supply source such as the soil environment.
- ***CAUTION***: A deficiency may be the result of a lack of bioavailability. In other words, the nutrient may be present in an adequate supply, but for some reason such as flooding, drought or too high or too low soil pH, is not available to the plant.
- Nutrients interact with each other in the soil and their availability and uptake may be affected.
- Visibly deficient leaves may be lacking one or more nutrients and display a mixture of symptoms, particularly when the micronutrients Fe, Mn and Zn are involved.

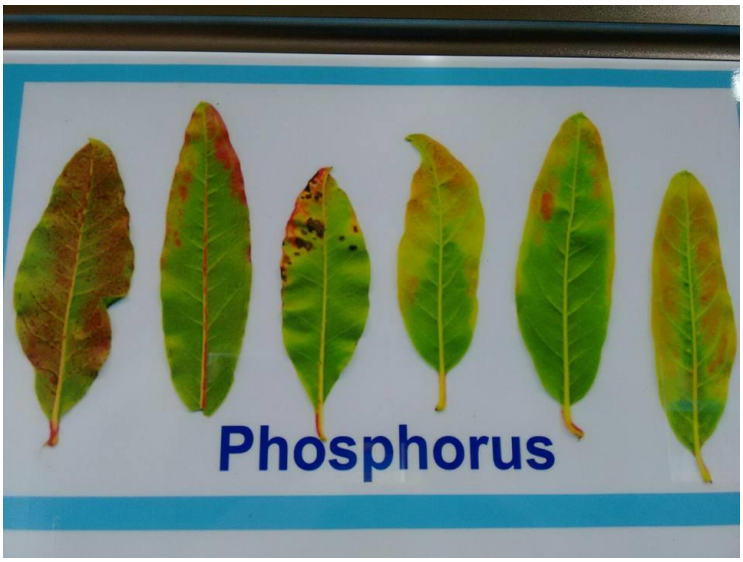
[Left] Peach leaves. Note normal leaf size and red coloration indicating a low level or deficiency of **NITROGEN [N]** . [Below] Progressive N deficiency in citrus.



Pomegranate seedlings. Note normal leaf size, but red coloration and a generally pale yellow overall condition affecting the whole leaf indicating **N** stress. **N** is a highly mobile element, thus, under light to mild **N** deficiency, the first symptoms will appear in older leaves.

Pomegranate cutting with **N** deficiency and possible **P** deficiency. Note reddish margins on the uppermost leaves. It is also likely that the leaves are Fe deficient. All symptoms were corrected with the application of a 20-20-20 (N-P-K) soluble fertilizer.

Peach leaf with distinctive red coloration due to **PHOSPHORUS [P]** deficiency.



Pomegranate leaves with distinctive red coloration due to **P** deficiency.

Peach leaves with scorching and rolling up as if water stressed due to **POTASSIUM [K]** deficiency. Pomegranate leaves show **K** deficiency symptoms in older leaves first. Brown spots appear along the leaf blade margins with some yellowing.

Peach leaf. **MAGNESIUM [Mg]** necrosis along the edges of the leaf blade at the tip of the leaf.

Citrus leaf. These classic symptoms illustrate severe **Mg** deficiency. Note the "green arrow" bordered by chlorotic areas of the leaf blade. Sometimes the tip of the blade also remains green. **Mg** is a mobile element which means that the deficiency appears first on older leaves.

[Photo courtesy: Dr. Mongi Zekri

Pomegranate leaves [left]. Note classic symptoms of **IRON [Fe]** deficiency. Light colored leaf with prominent green veins. **Fe** is an immobile element so symptoms appear first on young leaves. With severe **Fe** stress, young leaves are small and nearly white. When soils are wet, **Fe** changes chemical state and becomes **unavailable** to the plant.

Citrus leaf [below]. Note same symptoms.

[Left] Pomegranate leaves. Note classic symptoms of **MANGANESE [Mn]** deficiency. Light colored leaf with prominent green veins. **Mn** is an immobile element so symptoms appear first on young leaves.

[Below] Citrus leaves. Note similar symptoms.

[Left] Citrus leaves with **Zn** deficiency. More obvious interveinal chlorosis veins on small leaves. Prominent green veins. Deficiency occurs among young leaves and is often called "**Zn little leaf**."

[Below] Peach leaves.

Pomegranate Nutrition Guidelines [prepared by Dr. Mongi Zekri, UF/IFAS Extension]

- ***Fertilizer rates*** for pomegranate trees vary with tree age, size, soil conditions, fruit yield, and other cultural practices.
- Pomegranate orchards benefit from 0.5 to 1 lb N/tree per year split into late winter and spring.
- An example of a nutrient element ratio- [1]**N**:[0.2-0.25] **P_2O_5**: [1.0-1.25 **K_2O**: [0.2-0.25] **Mg**

Nitrogen rate

- **Young** trees should receive about 2-3 lbs of 8-8-8 or similar analysis fertilizer twice a year in early spring and early summer (4-6 lbs x 0.08 = ~ **0.3 – 0.5 lb N/tree/year**).
- **Mature** trees can use twice this amount (8-12 lbs x 0.08 = ~ **0.7 – 1.0 lb N/tree/year**).

Table 2. Suggested pomegranate fertilization program, lbs/plant.

Plant age, yrs	*N*	*P_2O_5*	*K_2O*
1-2	0.3-0.5	0.3-0.5	0.3-0.5
3	0.5-1.0	0.5	0.5-1.0
4	1.0	0.5	1.0
5	1.0	0.5	1.0
Above 5 years or for very productive trees.	1.0-1.5	0.5	1.0-1.5

- Apply 75-150 lbs of N/acre/year
- Over-applying or late applications of N may cause excessive vegetative growth, reduce fruit production and quality and delay fruit maturity and color.
- Apply 65 to75% of the tree's nutritional requirements between late winter and late spring with most of it in place during flowering and fruit-setting period.
- Split fertilizer application or fertigation combined with sound irrigation management increases fertilizer efficiency by maintaining a more constant supply of nutrients and by reducing leaching if unexpected rain occurs. Less fertilizer can be used.
- Compost, animal manures, biosolids, organic fertilizers, and mulch in pomegranate production are very useful and beneficial especially when trees are grown on poor sandy soils or rocky calcareous soils.
- Humus, which is the end product of broken down (decayed) organic matter, is an important component of healthy soils and has many great benefit.

Foliar application of micronutrients. Considering the wide variations in soil types and pH in Florida, foliar applications of the micronutrients (Mn, Zn, B, and Cu) are a more effective, economical, and quicker way to supply these nutrients than soil application. Sulfate forms are less expensive and nitrate forms appear to facilitate the uptake of micronutrients.

Foliar rates of micronutrients for mature trees. Use 100-150 gallons of water/acre

- For manganese (Mn) and zinc (Zn), apply 3-6 lbs metallic/acre/year (1-2 lbs during the spring, summer, and fall).
- Copper should not be included in dry fertilizers if Cu sprays are used for disease control and if the grove soil test show adequate Cu (5-10 lbs/acre).

- For boron (B), apply 0.5-0.6 lb B/acre/year (0.25-0.3 lb during the spring and summer).
- For molybdenum (Mo), apply 5-6 ounces/acre of ammonium or sodium molybdate (spring).

Soil application of Fe chelates is the most reliable way of supplying Fe to fruit trees. Apply 0.1 to 0.3 oz of metallic Fe/tree depending on tree age and size.

Management practices to improve fertilizer efficiency

- Evaluation of leaf analysis data
- Adjustment of rates to the level based on expected fruit yield
- Selection of fertilizer formulations to match existing conditions
- Careful placement of fertilizer within the root zone
- Fertilizer application at the right time
- Good irrigation management

Anecdotal Observations of a Retired Horticulturist and Pomegranate Enthusiast

- Pomegranate plants appear to benefit from **frequent** [monthly?] fertilizer application rather than from only a few [2-3] applications per growing season. This would be especially true for pomegranates just planted through the first 2-3 years.
- The color of pomegranate leaves may be a **good visual indicator** of plant nutrient status. If the leaves are a healthy green, nutrition is adequate. When new leaves appear and are pale or older leaves start to develop a lighter green color, it is time to fertilize again.
- **Micronutrients**, because of soil and other factors, may be especially problematic for pomegranates. Be vigilant and apply micronutrient products to the soil or the foliage as needed.