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## Nutritional Monitoring Series

### Oregano (*Origanum vulgare*)

Oregano requires low levels of fertility between 100 and 150 ppm N. Optimal substrate pH values range from 5.8 to 6.2. Oregano can develop both low and high substrate pH disorders. High pH inhibits iron (Fe) uptake, leading to symptoms of interveinal chlorosis (yellowing) on the upper leaves. Low pH induces toxic accumulation of Fe and manganese (Mn) in the lower leaves, leading to necrotic spotting.



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Figure 1. Excessively high soluble salts [referred to as electrical conductivity (EC)] causes necrosis (browning) on the lower leaves of oregano (*Origanum vulgare*). Photo by: Josh Henry.

### Target Nutrition Parameters

**pH Category III:**  
5.8 to 6.2

**Fertility Category:**  
Low  
100 to 150 ppm N

**EC Category: A**  
1:2 Extraction:  
0.4 to 0.6 mS/cm

**SME:**  
0.9 to 1.3 mS/cm

**PourThru:**  
1.3 to 2.0 mS/cm

Oregano

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Figure 2. Excessively high soluble salts [referred to as electrical conductivity (EC)] causes necrosis (browning) on the lower leaves of oregano (*Origanum vulgare*). Photo by: Josh Henry.



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Figure 3. Low soluble salts [referred to as electrical conductivity (EC)] causes stunting and chlorosis (yellowing) (left) in oregano (*Origanum vulgare*) compared to plants grown with optimal EC (right). Photo by: Josh Henry.

## Fertility Management of Oregano

Oregano can be propagated by seeds and vegetative cuttings. Seed grown oregano can be propagated in plugs trays or directly in the final container. In either case, fertilization should begin following emergence of the cotyledons. Fertilize with a complete fertilizer such as 13-2-13 or 14-4-14 at a rate of 100 to 150 ppm N (Currey, 2018).

Oregano cuttings can be sensitive to excess moisture; therefore, it is important to maintain a humid propagation environment with frequent light misting than heavy mist or irrigation events. Once root initials are visible, cuttings can be fertilized with 50 ppm N and increase up to 150 ppm N provided by a 14-4-14 or similar fertilizer. At this time, misting should cease, thereby reducing the likelihood of leaching nutrients from the substrate.

High substrate soluble salts [referred to as electrical conductivity (EC)] can cause necrotic (brown) spotting on the lower foliage (Fig. 1). Additionally, the foliage may develop a dull cast compared to the appearance of a healthy plant (Fig. 2). If EC becomes too high, discontinue fertilization for a few irrigation cycles to ease back the EC levels or if the EC levels are excessively high, leach with clear water. Low substrate EC causes significant stunting and an overall pale green or chlorotic (yellow) appearance (Figs. 3 & 4).

Substrate pH should be maintained between 5.8 and 6.2. Values below this range results in iron (Fe) and manganese (Mn) becoming highly available for uptake and accumulation, thus inducing Fe and/or



Mn toxicity. Symptoms of low pH-induced Fe and Mn toxicity appear as necrotic (brown) spotting on the lower leaves (Figs. 5 & 6). Table 1 contains recommended tissue values compared to values obtained from that plants in Figs. 5 and 6. These values demonstrate increased Fe and Mg uptake with foliar tissue values that were ten- and two-fold higher than the recommended range, respectively (Table 1). High pH limits Fe uptake and can induce Fe deficiency, leading to symptoms of interveinal chlorosis on the upper foliage (Figs. 7 & 8).

**Summary**

Maintaining low fertility at 100 to 150 ppm N and a pH of 5.8 to 6.2 can assist you in growing healthy oregano without pH or EC related nutrient disorders.

**Literature Cited**

Bryson, G.M. and H.A. Mills. 2015. Plant analysis handbook IV. Micro Macro Publishing, Athens, GA.

Currey, C.J. 2018. Herbs 101: A production guide. Produce Grower.

Nau, J. 2011. Ball Redbook volume 2: Crop production. 18th ed. Ball Pub., West Chicago, IL.



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Figure 4. Low soluble salts [referred to as electrical conductivity (EC)] cause stunting and chlorosis (yellowing) in oregano (*Origanum vulgare*). Photo by: Josh Henry.



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Figure 5. Low substrate pH causes toxic iron (Fe) and/or manganese (Mn) accumulation and symptoms of necrotic (brown) spotting on the lower leaves of oregano (*Origanum vulgare*). Photo by: Josh Henry.



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Figure 6. Low substrate pH causes toxic iron (Fe) and/or manganese (Mn) accumulation and symptoms of necrotic (brown) spotting on the lower leaves of oregano (*Origanum vulgare*). Photo by: Josh Henry.



Figure 7. High substrate pH limits iron (Fe) availability, leading to symptoms of interveinal chlorosis (yellowing) on the upper leaves of oregano (*Origanum vulgare*). Photo by: Josh Henry.



Figure 8. High substrate pH limits iron (Fe) availability, leading to symptoms of interveinal chlorosis (yellowing) on the upper leaves of oregano (*Origanum vulgare*). Photo by: Josh Henry.

Table 1. Recommended foliar tissue sufficiency ranges for oregano (*Origanum vulgare*) compared with values obtained from oregano plants experiencing low pH induced iron and manganese toxicities.

Element		Recommended Range <sup>1</sup>	Low pH
Nitrogen (N)	%	2.50 - 3.60	3.72
Phosphorus (P)		0.15 - 0.24	0.71
Potassium (K)		2.00 - 3.20	2.60
Calcium (Ca)		0.55 - 0.85	0.48
Magnesium (Mg)		0.35 - 0.55	0.52
Sulfur (S)		0.15 - 0.25	0.51
<b>Iron (Fe)</b>	ppm	<b>50 - 75</b>	<b>812</b>
<b>Manganese (Mn)</b>		<b>40 - 60</b>	<b>141</b>
Zinc (Zn)		20 - 50	50
Copper (Cu)		5 - 12	10
Boron (B)		20 - 30	50

<sup>1</sup> Source: Bryson and Mills (2015).

## Corrective Procedures for Modifying Substrate pH and Electrical Conductivity (EC)

When the pH or substrate electrical conductivity (EC) drifts into unwanted territory, adjustments must be made. Below are the standard corrective procedures used to modify the substrate pH and EC for greenhouse grown crops in soilless substrates.

### 1. Low Substrate pH Correction

When Fe and Mn toxicity becomes a problem, adjust (raising) substrate pH to the recommended pH range. Corrective procedures to raise low pH levels are listed below. Switching to a basic fertilizer when the substrate pH is nearing the lower limit will help stabilize the pH. If the pH is below the recommended range, then corrective procedures will need to be implemented. Flowable lime is one option. Using a rate of 2 quarts per 100 gallons of water will typically increase the substrate pH by roughly 0.5 pH units. Two quarts can be used through an injector. Additional applications can be made if needed. Potassium bicarbonate ( $\text{KHCO}_3$ ) can also be applied. A rate of 2 pounds per 100 gallons of water will increase the substrate pH by roughly 0.8 pH units. This treatment will also provide excessive potassium (K) and cause a spike in the substrate EC. A leaching irrigation with clear water is required the following day to restore the nutrient balance (the ratio of K:Ca:Mg) and lower the EC. As always, remember to recheck your substrate pH to determine if reapplications are needed.

## pH Adjustment Recommendations

### *Flowable Lime*

- Use 1 to 2 quarts per 100 gallons of water.  
Rinse foliage.
- Avoid damage to your injector by using rates of 2 quarts per 100 gallons of water, or less.
- Can split applications.

### *Hydrated Lime*

- Mix 1 pound in 3 to 5 gallons of WARM water. Mix twice. Let settle. Decant liquid and apply through injector at 1:15.
- Caustic (rinse foliage ASAP and avoid skin contact)

### *Potassium Bicarbonate ( $\text{KHCO}_3$ )*

- Use 2 pounds per 100 gallons of water
- Rinse foliage immediately.
- Provides 933 ppm K.
- Leach heavily the following day with a complete fertilizer to reduce substrate EC and restore nutrient balance.
- Rates greater than 2 pounds per 100 gallons of water can cause phytotoxicity!

### 2. High Substrate pH Correction

The target pH for many species is between 5.8 and 6.2. Higher pH values will result in Fe deficiency and lead to the development of interveinal chlorosis on the upper leaves. Check the substrate pH to determine if it is too high. Be careful when lowering the substrate pH, because going too low can be much more problematic and difficult to deal with.

### *Acid-based Fertilizer*

If the substrate pH is just beginning to increase, then first consider switching to an acidic-based fertilizer. These ammoniacal-nitrogen (N) based fertilizers are naturally acidic and plant nitrogen uptake will help moderate the substrate pH over a week or two.

### *Acid Water Drench*

Some growers use this intermediate correction if pH levels are not excessively high and a quick lower of the substrate pH is desired. Use sulfuric acid to acidify your irrigation water to a pH 4.0 to 4.5. Apply this acid water as a substrate drench providing 5 to 10% excessive leaching of the substrate. Rinse the foliage to avoid phytotoxicity. Results should be visible within 5 days. Retest the substrate pH and repeat if needed.

### *Iron Drench*

If the levels are excessively high, then an Fe chelate application can be made to the substrate. Below are the options.

### *Iron Chelate Drench (options)*

- Iron-EDDHA: mix 5 ounces in 100 gallons of water
- Iron-DTPA: mix 5 ounces in 100 gallons of water
- Iron sulfate: mix 4-8 ounces in 100 gallons of water
- Apply as a substrate drench with sufficient volume to leach the pot.
- Rinse foliage immediately.
- Avoid use on iron efficient plants (geraniums).

## 3. Low EC Correction

If low EC problems occur, increase the fertilization rate to 300 ppm N for a few applications before returning to the recommend fertilization rate for the crop.

## 4. High EC Correction

Excessively high fertilization rates will result in a marginal leaf burn. Check the substrate EC to confirm your diagnosis. Values greater than 6.0 mS/cm based on the PourThru sampling method can be problematic for many plants.

### *Switch to Clear Water Irrigations*

If the substrate EC is just beginning to increase over time, then leach with a few clear water irrigations to lower EC levels by flushing out the salts.

### *Clear Water Leaching*

If the EC values are excessively high, leach the substrate twice with back-to-back clear water irrigations. Then allow the substrate to dry down normally before retesting the EC. If EC levels are still too high, repeat the double leach. Once the substrate EC is back within the normal range, use a balanced fertilizer at a rate of 150 to 200 ppm N.





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