e-GRO Nutritional Monitoring




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## Nutritional Monitoring Series

# *Eggplant, transplants*

### *(Solanum melongena)*

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Eggplant transplants require low fertility of 100 to 150 ppm N. Plants prefer a pH within the range of 5.8 to 6.5. This range prevents low substrate pH induced iron (Fe) and manganese (Mn) toxicities which occurs if the pH drifts lower than 5.5. Substrate pH values above 6.5 can also inhibit Fe availability and result in the upper foliage developing interveinal chlorosis (yellowing).


Figure 1. Eggplant (*Solanum melongena*) transplants grown in a substrate with a pH range of 5.8 to 6.5. Photo by: W. Garrett Owen.

Eggplant, transplants

## Target Nutrition Parameters

**pH Category III, IV:**
*5.8 to 6.5*

**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*



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## Fertility Management of Eggplant Transplants

Eggplant transplant should be grown with a pH range of 5.8 to 6.5 (Fig. 1). Use recommended 1:2 Extraction, SME, or PourThru methods to determine and monitor substrate pH and soluble salts [referred to as electrical conductivity (EC)] values. Additionally, conduct routine foliar analysis tests to monitor crop nutrient status. Tissue nutrient levels found in healthy, newly expanded leaves of eggplant transplants are listed in Table 1. Monitoring substrate pH and nutrient status will enable growers to avoid pH induced nutritional disorders.

Substrate pH below 5.8 results in increased uptake of iron (Fe) and manganese (Mn) which results in toxic levels accumulating in leaf tissue. Plants exhibiting Fe and/or Mn toxicity will exhibit lower leaf chlorosis and black spotting or speckling along the leaf margin of older leaves. Corrective procedures for low substrate pH should begin within the range of 5.5 to 5.8. Plants can grow excessively large (Fig. 2).

High substrate pH above 6.5 can inhibit Fe uptake causing newly developed leaves to become deficient in Fe and exhibit interveinal chlorosis. Plant will also exhibit stunted growth (Fig. 2). Corrective procedures for high substrate pH should begin within the range of 6.2 to 6.4.

Eggplant transplants are considered to require low levels of fertility. During Stage 2 [radical, hypocotyl (stem), and cotyledons (seedling leaves) emergence] of seedling production, begin fertilizing

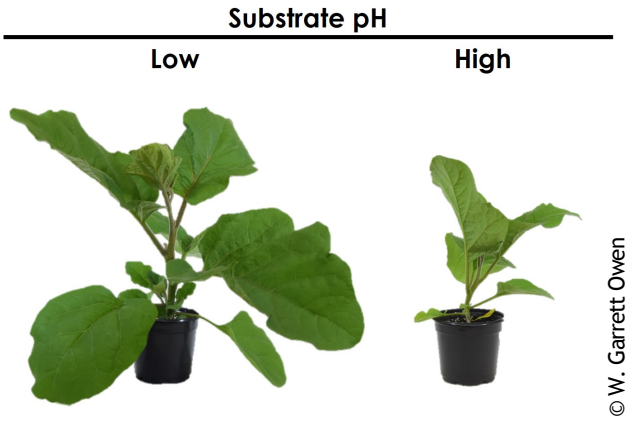


Figure 2. Eggplant (*Solanum melongena*) transplants grown under low [pH 5.1] (left) and high [pH 6.9] (right) substrate pH conditions. Photo by: W. Garrett Owen.

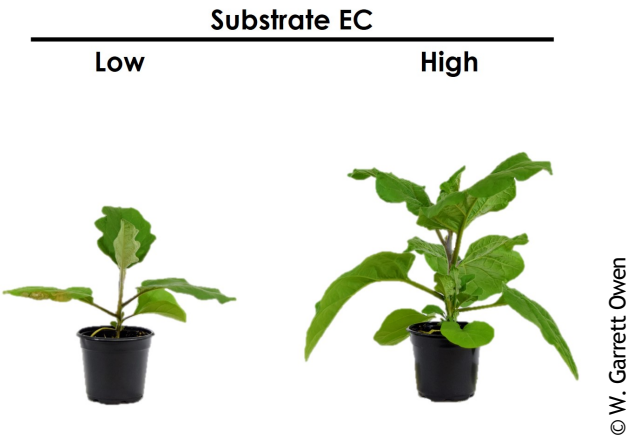


Figure 3. Eggplant (*Solanum melongena*) transplants grown under low [0.27 mS/cm] (left) and high [3.95 mS/cm] (right) soluble salts [referred to as electrical conductivity (EC)] conditions at a substrate pH of 5.8. Photo by: W. Garrett Owen.


Figure 4. Eggplant (*Solanum melongena*) transplant exhibiting leaf necrosis as a result of water stress because plants were held beyond the permanent wilting point. Photo by: W. Garrett Owen.

with 50 to 75 ppm N from 15-0-15 or 15-5-15 once the cotyledons have fully expanded (Nau, 2011). Continue fertilizing during Stage 3 (true leaves develop). At Stage 4 (toning or hardening off for transplant), increase fertility to 100 to 150 ppm N delivered from 14-0-14 weekly (Nau, 2011). Maintain substrate EC below 0.6, 1.3, or 2.0 mS/cm, based on the 1:2 Extraction, SME, or PourThru methods, respectively. Plants grown under lower or fertility deficient conditions will become chlorotic and stunted while transplants provided with excessive fertility will develop large leaves and may exhibit marginal leaf necrosis (Fig. 3).

Managing fertility during eggplant transplant production can assist producers in controlling growth. Avoiding ammoniacal-nitrogen fertilizers will further assist growers in preventing undesirable and excessive growth. Growers may apply Sumagic (uniconazole), a plant growth regulator (PGR) registered for vegetable transplants, early in transplant production to control growth. It is recommended to always read and follow label directions [application rate(s), application timing, personal protective equipment (PPE), and re-entry interval (REI)] and conduct small in-house trials thereby determining appropriate application rate for your operation, market, and desired final plant size. Growers often withhold water (water stress) from plants to the point of wilting. This is a common practice to control growth, but growers must be careful not to stress plants beyond the permanent wilting point which results in leaf rolling, marginal leaf necrosis (Fig. 4), leaf drop, and sometimes, plant loss.

**Summary**

Providing eggplant transplants with low levels of fertility ranging from 100–150 ppm N and maintaining a substrate pH of 5.8 to 6.5 will prevent most nutritional disorders from occurring.

**Literature Cited**

Bryson, G.M., H.A. Mills, D.N. Sasseville, J.B. Jones, Jr., and A.V. Barker. 2014. Plant analysis handbook III. Micro-Macro Publishing, Inc., Athens, GA.

Nau, J. 2011. Ball redbook,18th ed. Ball Publishing, W. Chicago, IL.

Table 1. Leaf tissue nutrient sufficiency range recommended for eggplant (*Solanum melongena*) grown in greenhouses and production fields.

| Element | | Sufficiency range [1] |
|---|---|---|
| Nitrogen (N) | (%) | 4.00 – 5.00 |
| Phosphorus (P) | | 0.13 – 0.23 |
| Potassium (K) | | 3.50 – 5.00 |
| Calcium (Ca) | | 1.00 – 2.50 |
| Magnesium (Mg) | | 0.30 – 1.00 |
| Sulfur (S) | | 0.29 – 0.60 |
| Iron (Fe) | (ppm) | 50 – 300 |
| Manganese (Mn) | | 40 – 250 |
| Zinc (Zn) | | 20 – 250 |
| Copper (Cu) | | 5 – 10 |
| Boron (B) | | 25 – 75 |
| Molybdenum (Mo) | | 0.11 – 0.56 |

**[1]Source: Bryson et al. (2014) for eggplant grown in greenhouses and production fields. These values represent the most recently matured leaf at the onset of flowering to small fruit development.**

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## 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 ($KHCO_3$) 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* ($KHCO_3$)

- 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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