

e-GRO Electronic Grower Resources Online

PourThru Nutritional Monitoring

Brian Whipker
NC STATE UNIVERSITY

THE
Fred C. Gloeckner
FOUNDATION, INC.

e-GRO Electronic Grower Resources Online

Sudden Problems



e-GRO Electronic Grower Resources Online


Sudden Problems



e-GRO Electronic Grower Resources Online

Low pH


- Lower leaves of nasturtiums with black speckles.



e-GRO Electronic Grower Resources Online

Low pH


- Lower leaves of marigolds with yellow speckles.



e-GRO Electronic Grower Resources Online


High pH

- Upper leaves of scented geraniums with interveinal chlorosis.




e-GRO Electronic Grower Resources Online **High EC**

- Upper leaf curl and stunted growth.



e-GRO Electronic Grower Resources Online **Low EC**

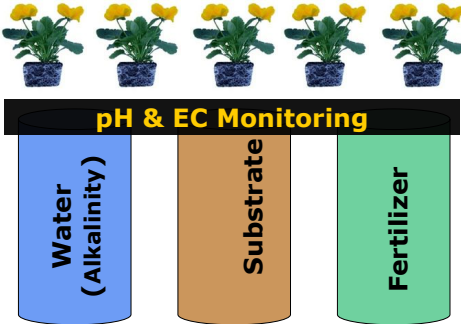
- Lower leaf yellowing and necrosis of geraniums.



e-GRO Electronic Grower Resources Online **PourThru Monitoring**


Monitoring with the PourThru method PREVENTS pH and EC problems!!!!

Building a Strong Foundation



e-GRO Electronic Grower Resources Online **Nutrient Management**

- Crops are generally started with proper nutrition
- Problems arise during production
- Monitoring and adjustments are needed



e-GRO Electronic Grower Resources Online **Nutritional Problems**

- Delay crops
- Reduce quality
- Lower cost efficiency

We must prevent problems before they occur!

e-GRO Electronic Grower Resources Online

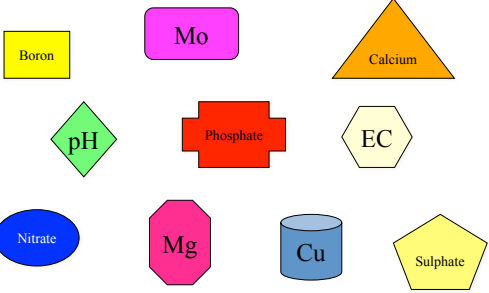
Visual monitoring too late...

We cannot afford this any more!



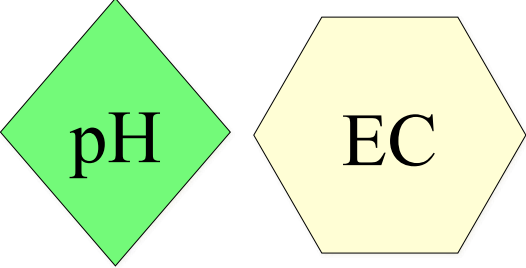
e-GRO Electronic Grower Resources Online

Nutrition Mumbo-Jumbo



e-GRO Electronic Grower Resources Online

Nutritional Monitoring



Good News

Maintaining proper substrate pH & EC will PREVENT most nutrient problems


We can do this!




e-GRO Electronic Grower Resources Online

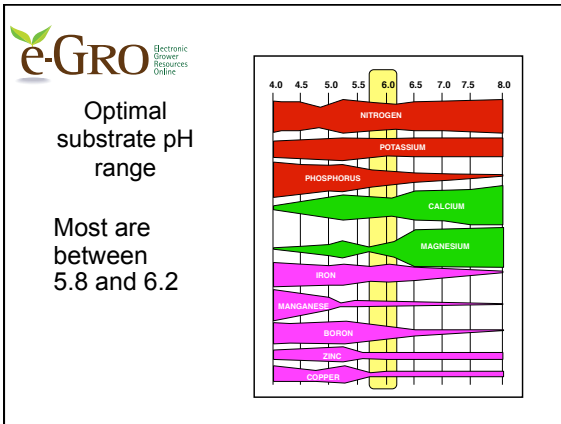
What will it take?

- Equipment: ~ \$200
- Supplies: ~ \$2 / wk
- Time: 20 to 30 minutes / wk



pH Factors





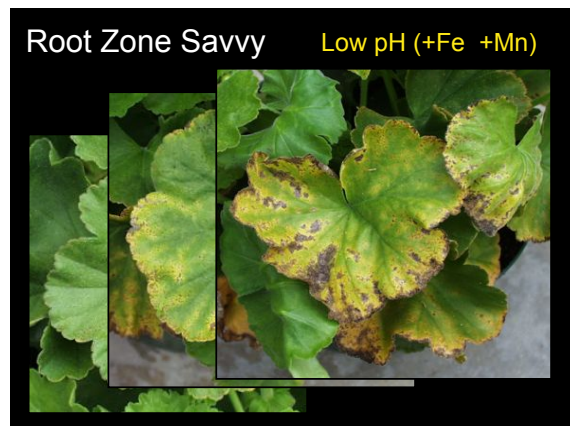
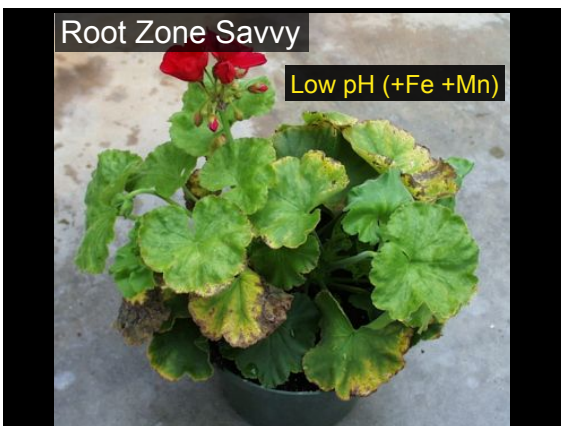
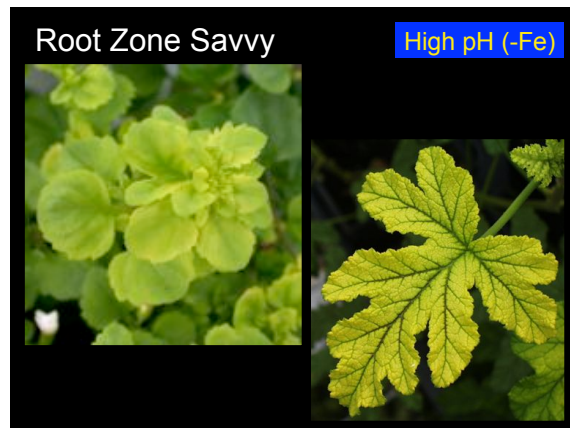
e-GRO Electronic Grower Resources Online

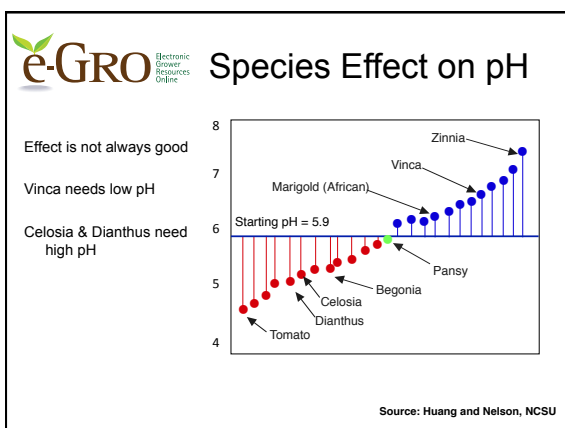
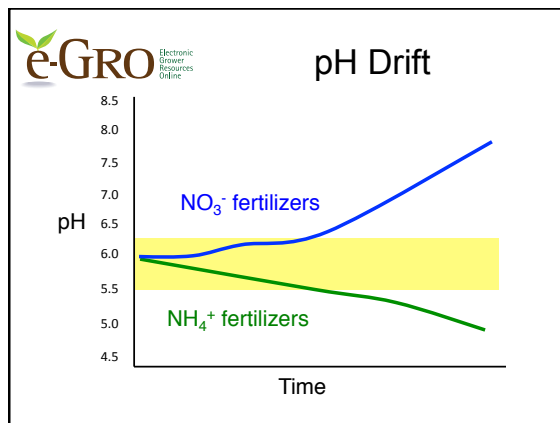
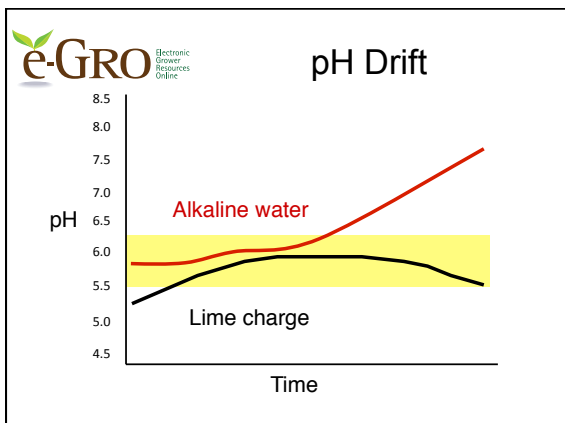
Problems with pH

Low High

- Toxic
 - Fe, Mn, Zn, Cu
- Deficient
 - Ca, Mg, Mo
- Sensitive: NH_4
- Leached: PO_4

- Deficient
 - Fe, Mn, Zn, Cu, B





EC Factors

e-GRO Electronic Grower Resources Online

Substrate Electrical Conductivity

- Measure of all salts
- Does not give specific salt concentration
- Helps to estimate nutritional satisfaction

e-GRO Electronic Grower Resources Online

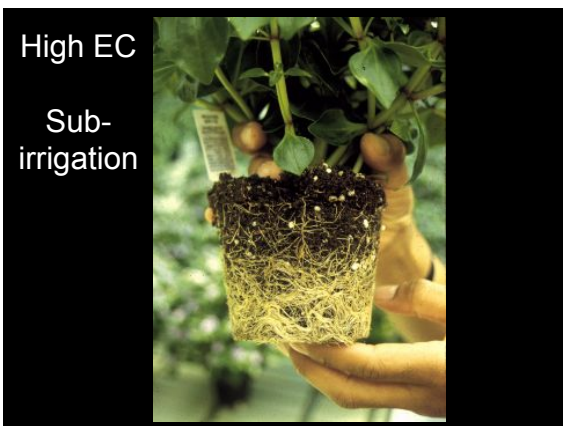

Low Substrate EC

- Occurs when...
 - The fertilization rate is too low
 - The amount of leaching is too high




e-GRO Electronic Growth Resources Online **High Substrate EC**

- Occurs when salts accumulate
- Causes
 - Insufficient leaching
 - Fertilization rate \geq nutrient requirements



PourThru Sampling



e-GRO Electronic Grower Resources Online **PourThru Sampling**

MONITORING WILL HELP ASSURE THE PLANT'S NUTRITIONAL REQUIREMENTS ARE BEING MET.

e-GRO Electronic Grower Resources Online **Step 1**

- Irrigate the crop thoroughly.



e-GRO Electronic Grower Resources Online **Step 2**

- Allow 30 to 60 minutes for draining
- Place a saucer under the pot
- Sample a minimum of 5 pots (or cell packs)



e-GRO Electronic Grower Resources Online **PourThru: Cell Packs**
6 or 8-inch saucers



e-GRO Electronic Grower Resources Online **Step 3**

- Add distilled water to displace the solution into the saucer



e-GRO Electronic Grower Resources Online **Distilled Water Volumes**

Pot Size (inches & cm)	ml	oz
Cell Pack	30	1.0
4" (10 cm)	30	1.0
5" to 6" (12 to 15 cm)	75	2.5
6.5"+ (16 cm+)	100	3.4

e-GRO Electronic Grower Resources Online

Step 4

- Collect the solution



e-GRO Electronic Grower Resources Online


Optimal Solution Sample Volume

- 30 ml (1 oz) from a cell pack
- 50 ml (~2 oz) from a 6-inch (15 cm) pot
- 50 to 60 ml (~2 to 3 oz) from a 6.5-inch (16 cm) or larger pot.

e-GRO Electronic Grower Resources Online

Step 5


- Calibrate meter(s).
 - Do each time you sample
- Determine pH and EC values.



e-GRO Electronic Grower Resources Online

Step 6

- Evaluate pH and EC values.
 - Take preventative or corrective actions if needed.



e-GRO Electronic Grower Resources Online


Bottom Line

Use enough to get:

- 30 ml (1.0 oz) from a cell pack*
- 50 ml (~ 2 oz) from a 6" (15 cm) pot*
- 50-60 ml (~ 2-3 oz) from a 6.5" (16 cm) or > pot*

e-GRO Electronic Grower Resources Online

How Many Samples?



5 pots / cell packs



How to Monitor

- Sample plants with different requirements separately
 - pH: acidic vs basic
 - EC: high vs low
- Randomly select plants
- Select plants from interior of bench



Volume Variations

- Amount for an individual pot may vary
- Substrates
- Crops
- Uneven irrigation



Monitoring: How Often?

- Routine
 - Check initial values
 - Every 2 weeks
- Problem crop
 - As needed



Monitoring: Spring Production

- Top 10 crop concerns
 - Geraniums, Vinca, Begonias, Impatiens, Marigolds, New Guineas, +, +, +, +
- Monitor 1/2 one week, 1/2 the next week
- Total samples
 - 25 per week



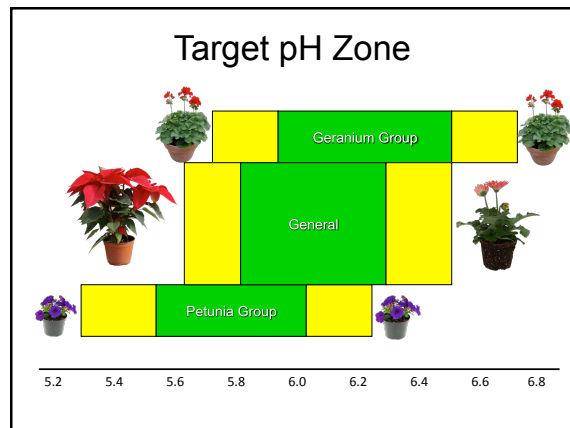
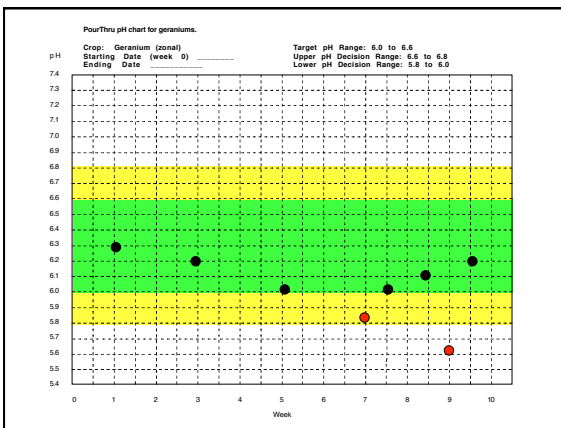
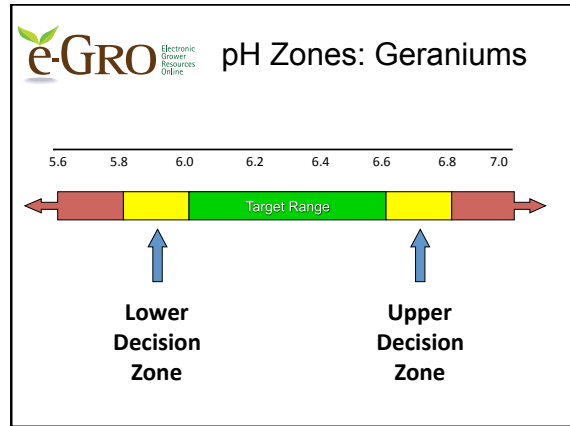
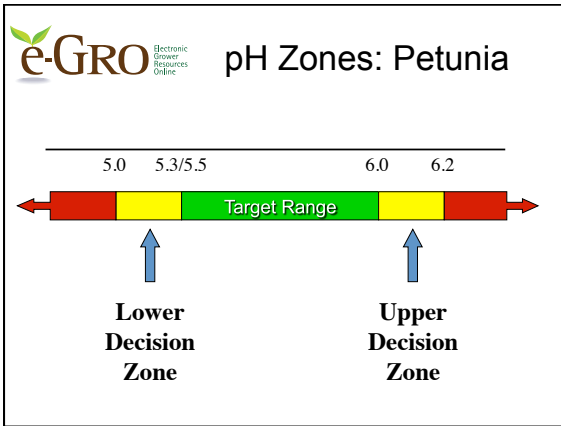
Monitoring is the Key...

- Have a manageable plan
- Consider monitoring to be your insurance policy



pH Management





pH Groups

- Petunia
 - + Calibrachoa, Pansy, Vinca, ...
 - Target pH 5.4 to 6.0
- General
 - Begonia, Mum, Poinsettia, ...
 - Target pH 5.8 to 6.2
- Geranium
 - + Fuchsia, Marigold, Osteospermum, ...
 - Target pH 6.0 to 6.6

pH - Optimal Ranges by Group

Parameter	Low (Petunia)	General (General)	High (Geranium)
pH	5.3 to 6.2	5.8 to 6.3	6.0 to 6.6

Goals: Avoiding HIGH pH problems Avoiding LOW pH problems

High pH Correction



High pH Correction

- Lowering pH to acceptable levels corrects problems.
- Options
 - Acidic fertilizers
 - Acid water drench
 - Iron applications



High pH Correction

- Use an Acidic Fertilizer
 - 20-10-20, etc
 - Extremely acidic: 21-7-7



High pH Correction

- Acid Water Drench
 - Use sulfuric acid to acidify your irrigation water to pH 4.0 to 4.5.
 - Apply as a substrate drench
 - Rinse foliage ASAP



High pH Correction

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

Additional guidelines in the Understanding pH Management bulletin by Argo & Fisher

Low pH Correction





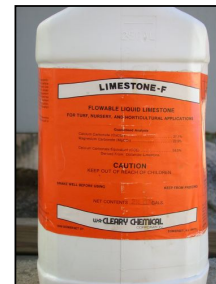
Low pH Correction

- Options
 - Flowable lime
 - Hydrated lime
 - Potassium bicarbonate



Low pH Correction

- Flowable Lime
 - Use 1 to 2 quarts per 100 gallons of water.
 - Rinse foliage.



Low pH Correction

- Hydrated Lime
 - Mix 1# in 3 to 5 gal of WARM water. Mix twice. Let settle. Decant liquid and apply thru injector at 1:15.
 - Caustic (rinse foliage ASAP and avoid skin contact)



Low pH Correction

- Potassium Bicarbonate (KHCO_3)
 - Use 2 # per 100 gal of water
 - Rinse foliage ASAP
 - Provides 933 ppm K
 - Leach heavily the following day with a complete fertilizer to reduce EC levels and restore nutrient balance.



Low pH Correction

- Warning!!!!
- Flowable Lime
 - Avoid damage to your injector by using rates of 2 qts per 100 gal of water, or less
 - Can split applications
- Potassium Bicarbonate (KHCO_3)
 - Rates greater than 2 # per 100 gal of water can cause phytotoxicity!

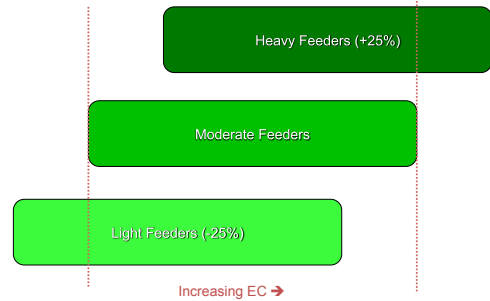
EC Management



e-GRO Target EC Factors

- Not all plants have same nutrient requirements
- Irrigation method influences target range

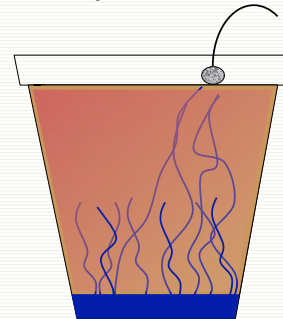
e-GRO Target EC Ranges



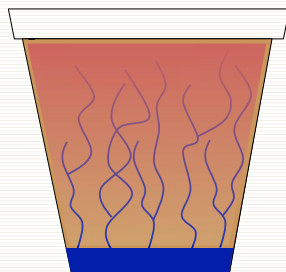
e-GRO Irrigation Effects

- Drip systems
- Subirrigation
- Sprinklers
- Hand watering

Drip System Effects

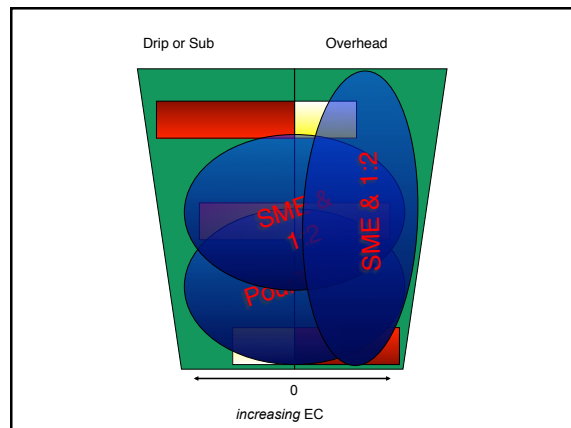
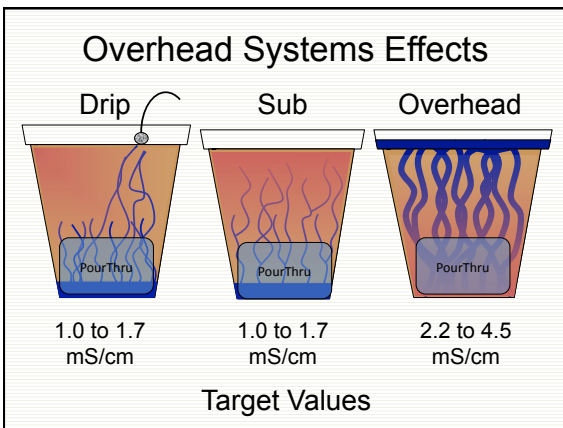
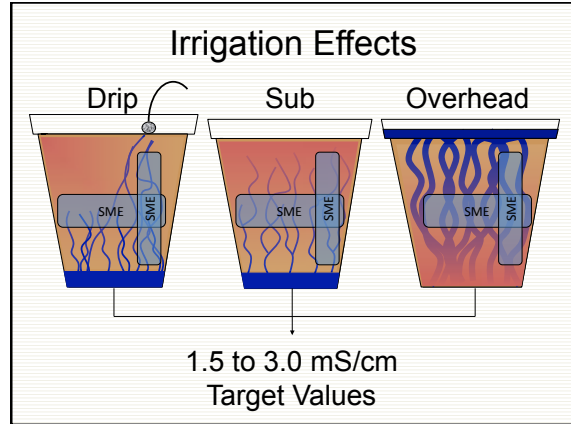
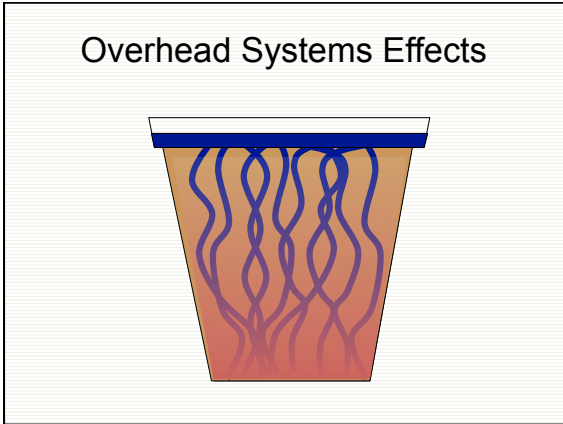


Subirrigation Effects



EC Zones





e-GRO Electronic Grower Resources Online

EC Correction/Prevention

<ul style="list-style-type: none"> • High EC correction <ul style="list-style-type: none"> – decrease fertilization rate – increase clear water irrigations – leach with clear water twice within a few hours 	<ul style="list-style-type: none"> • Low EC correction <ul style="list-style-type: none"> – increase fertilization rate – limit clear water irrigations – reduce leaching
--	--

e-GRO Electronic Grower Resources Online

Maintaining proper substrate pH & EC will PREVENT most nutrient problems

e-GRO Electronic Grower Resources Online **Problem Avoidance!**

Monitoring with the PourThru method PREVENTS pH and EC problems before they occur!!!!

e-GRO Electronic Grower Resources Online **pH and EC Monitoring**

Start a PourThru Monitoring Program!!!



e-GRO Electronic Grower Resources Online

THE Fred C. Gloeckner FOUNDATION, INC.

Partnering Universities

UNIVERSITY of NEW HAMPSHIRE NC STATE UNIVERSITY

Cornell University KSTATE Kansas State University PURDUE UNIVERSITY