2nd International Webinar Conference

Managing pH Drift
Brian Whipker, NCSU

2nd International Webinar Conference

Sponsored by:

2:30 to 3:00 Eastern

MANAGING pH DRIFT:
RECOGNIZING AND CORRECTING HIGH AND LOW pH DISORDERS

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Topics: Managing pH Drift

- 1. Optimal pH Ranges
- 2. Symptoms
  - High and low pH symptoms
- 3. Factors influencing pH drift
- 4. Monitoring procedures
- 5. Corrective procedures

1

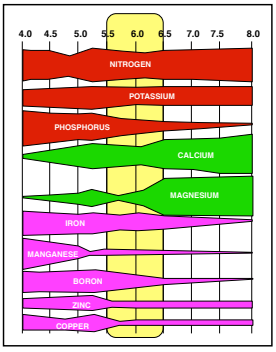
What are the optimal substrate pH ranges?

Substrate pH Range

Principle:

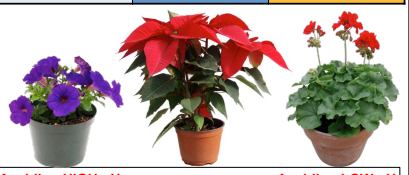
Substrate pH has a significant affect on nutrient availability

Most plants are within the range of 5.5 to 6.5



pH - Optimal Ranges by Group

Parameter	Low (Petunia)	General (General)	High (Geranium)
pH	5.5 to 5.8	5.8 to 6.2	6.0 to 6.5



Goals: Avoiding HIGH pH problems — Avoiding LOW pH problems

Suggested Greenhouse PourThru pH & EC Categories

Substrate EC Categories		Substrate pH Categories I. 4.5 – 5.5	II. 5.5-5.8	III. 5.8 – 6.2	IV. 6.0—6.5
	A. Low (1.3 to 2.0 mS/cm) *SME: 0.9 to 1.3 mS/cm 1:2: 0.4 to 0.6 mS/cm*	Venus Fly Trap	Pansy	Marigold New Guinea impatiens	Echeveria
	B. Medium (2.0 to 3.0 mS/cm) *SME: 1.3 to 2.0 mS/cm 1:2: 0.6 to 0.9 mS/cm*	Hydrangea, Blue	Hydrangea, Pink Petunia	Abutilon Coleus Dahlia Gerbera Geranium Petunia	Agastache Alocasia Duranta Geranium
	C. High (3.0 to 4.9 mS/cm) *SME: 2.0 to 3.3 mS/cm 1:2: 0.9 to 1.5 mS/cm*	*Few species*	Petunia Poinsettia	Chrysanthemum, Garden Cleome Dahlia Geranium Hibiscus, Hybrid Mandevilla Petunia Poinsettia	Geranium Pentas

2a

What are the symptoms of high substrate pH?

Problem Location

Iron Deficiency (High pH)

DW Begonia

High pH: Geranium

- Upper leaves of scented geraniums with interveinal chlorosis.

High pH (Iron Deficiency)

Initial: *Slight interveinal chlorosis of recently matured leaf*

Moderate: *Interveinal chlorosis more pronounced, spread to other leaves*

Advanced: *Bleached (white) interveinal chlorosis*

Leaves – Upper

- Description: Interveinal chlorosis leads to bleaching and necrosis with advanced symptoms

High pH induced Fe deficiency

Possible Causes – Iron Deficiency

- Substrate pH too high
- Other Causes
  - Root rot (*Pythium*, etc – check roots)
  - Cold growing
  - Waterlogged conditions

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2b

What are the symptoms *of low substrate pH?*

Three Symptom Types

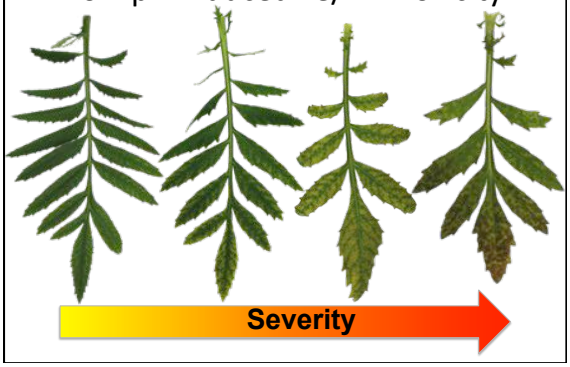
Low pH Type I: Bronzing

Good | Low pH

Low pH Type I: Bronzing

- Lower leaves of marigolds with yellow speckles.

Low pH Induced Fe/Mn Toxicity



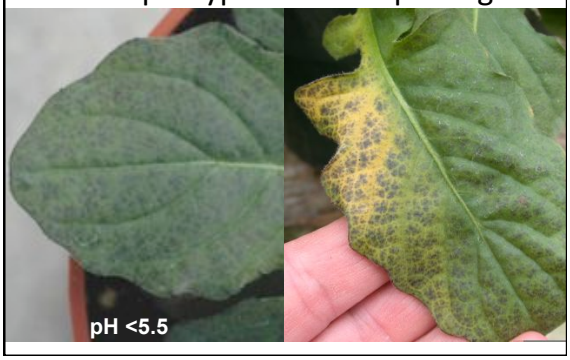
Low pH Type II: Black Spotting

- Lower leaves of nasturtiums with black speckles.

Low pH (Iron/Manganese Toxicity)

Lower leaves with purplish-black spotting

Low pH Type II: Black Spotting



Low pH

Zinnia

Low pH (Fe/Mn Toxicity)

Streptocarpus pH 4.5 3-29 e-GRO

Low pH (Fe/Mn Toxicity)

Ageratum pH 5.1 3-30 e-GRO

Low pH (Fe/Mn Toxicity)

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Dragon Wing Begonia pH 5.1

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Low pH (Fe/Mn Toxicity)

Table 1. Leaf tissue analysis results.

Element	Normal Plant	Symptomatic Plant
Nitrogen (%)	4.42	4.04
Phosphorus (%)	0.35	0.47
Potassium (%)	2.15	3.98
Calcium (%)	1.13	1.69
Magnesium (%)	0.87	1.34
Sulfur (%)	0.27	0.28
Iron (ppm)	787	1870
Manganese (ppm)	193	618
Zinc (ppm)	48.9	53.4
Copper (ppm)	12.7	16.9
Boron (ppm)	53.1	66.1

DW Begonia

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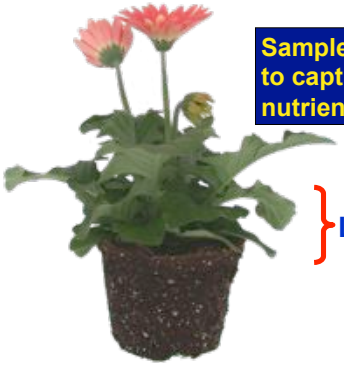
Targeted Tissue Sampling



Sample lower leaves to capture micro-nutrient levels

Lower

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Low pH Type III: Stunted Growth

# Lime/Yard^3:	0	5	10
Resulting pH:	3.3	4.8	5.1
Dry weight Reduction:	*59%*	*29%*	--

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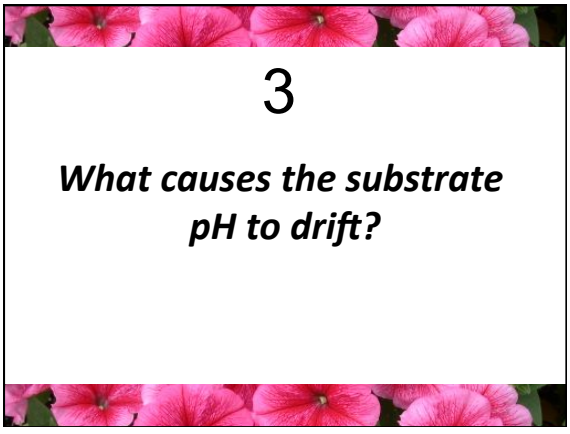
Low pH Type III: Stunted Growth

pH: 2.9 4.7 6.0



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What causes the substrate pH to drift?

Major Factors Influencing pH Drift

Factors	High pH Drift	Low pH Drift
Substrate Components	Coir (Is more neutral)	Peat & Bark (Acidic)
Limestone in Substrate	Too much	Too little
Water Alkalinity	Excessive (> 200 ppm bicarbonate)	Little or None (< 50 to 100 ppm bicarbonate)
Fertilizer Type	Basic (Nitrate-based)	Acidic (Ammonium-based)
Plant Species Grown	Yes	Yes

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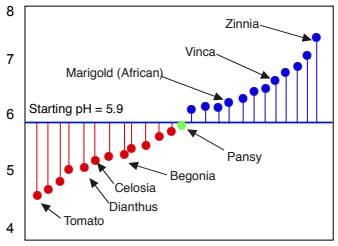
Species Effect on pH

Effect is not always good

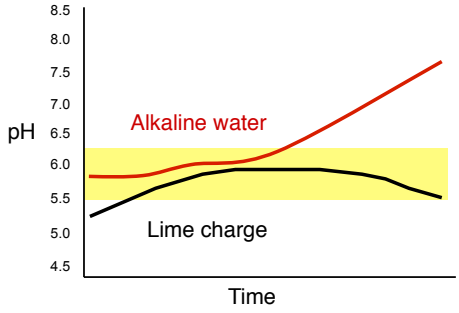
Vinca needs low pH

Celosia & Dianthus need high pH



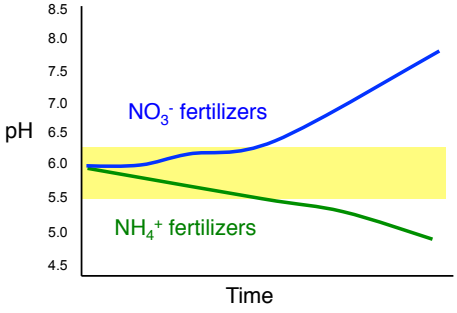
Source: Huang and Nelson, NCSU

pH Drift



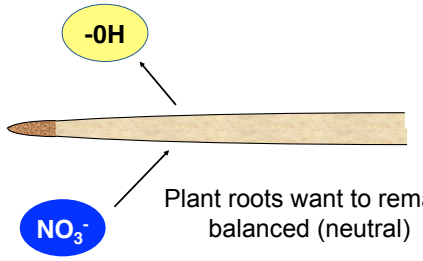
Uptake Effect

pH Drift



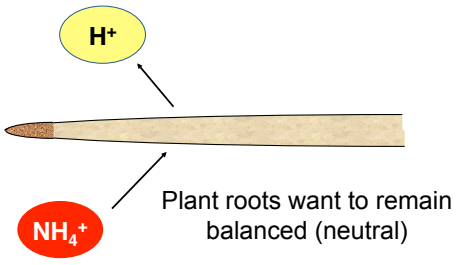
Uptake Effect: Basic Fertilizer

Fertilizer Uptake
[-] uptake ⇨ pH Rises



Uptake Effect: Acidic Fertilizer

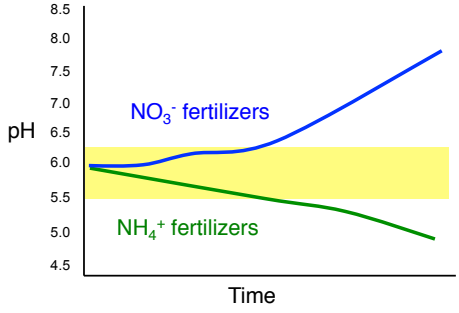
Fertilizer Uptake
[+] uptake ⇨ pH Falls



Uptake Effect

pH Drift

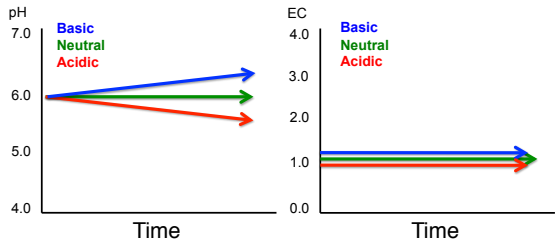
(When: Fertilizer Supplied = Fertilizer Demand)



pH Drift

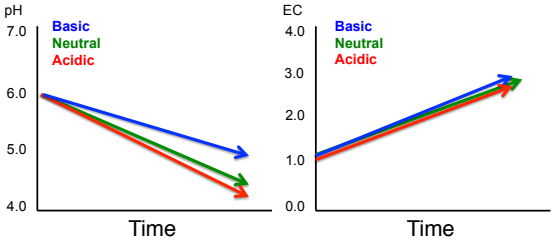
- Research directed by Dr. Paul Nelson of NC State looked in depth into the effects of basic and acidic fertilizers on substrate pH.
  - *Fertilizer Acidity/Basicity and Concentration Effect on Substrate pH and EC. Unpublished. K.Y. Jeong and P. Nelson.*

pH Drift *100 ppm N*



Fertilizer Supplied = Demand)

pH Drift *200 ppm N*



Fertilizer Supplied > Demand)

Chemical Effect

Fertilizers

Acidic Fertilizer (20-10-20)	Basic Fertilizer (13-2-13 Cal-Mag)
200 ppm N	200 ppm N

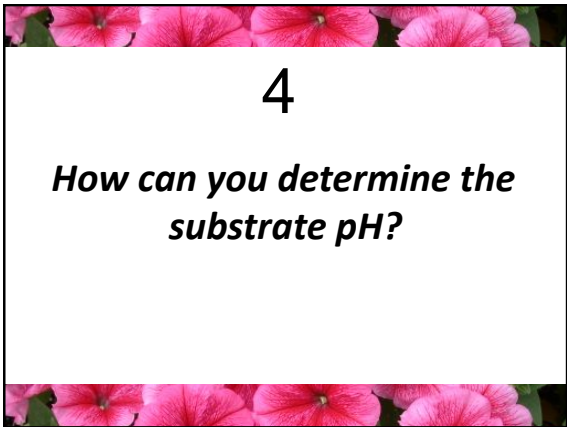
Solution pH?

Fertilizers

Supplied = Demand	*Supplied > Demand*
Uptake > Chemical	**Uptake < Chemical**
Fertilizer type works	**pH decreases**

Basic fertilizers increase pH
Neutral fertilizers hold pH
Acidic fertilizers decrease pH

Match the EC level with the plant's requirements.
Monitor the substrate pH and EC to assure values are on target.



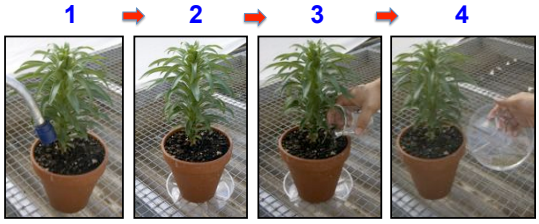
pH Monitoring Methods

- 1:2 Dilution
  - In-house test of using 1 part substrate to 2 parts water
- SME (Saturated Media Extract)
  - Utilized by most substrate testing labs
- PourThru
  - A non-destructive in-house test

pH and EC Monitoring

PourThru Monitoring Program

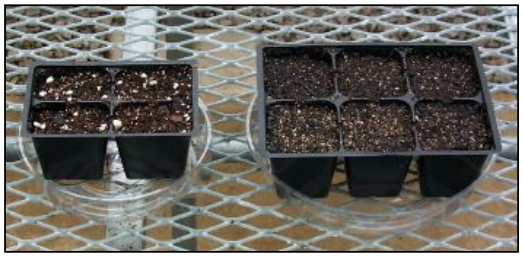
PourThru Steps



1	2	3	4
Irrigate the crop 1 HR prior to PourThru	Place a plastic saucer under container	Pour enough water over top of substrate to displace ~50 ml of solution	Collect and analyze the leachate

PourThru: Smaller Containers

Use 6 or 8-inch saucers



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How do you evaluate substrate pH values and correct problems?

pH - Optimal Ranges by Group

Parameter	Low (Petunia)	General (General)	High (Geranium)
pH	5.5 to 5.8	5.8 to 6.2	6.0 to 6.5

Goals: Avoiding HIGH pH problems — Avoiding LOW pH problems

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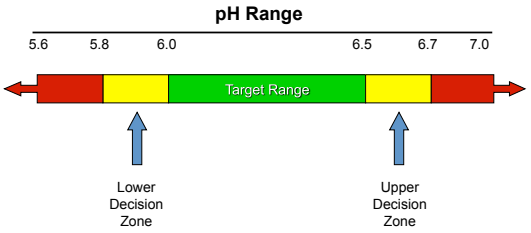
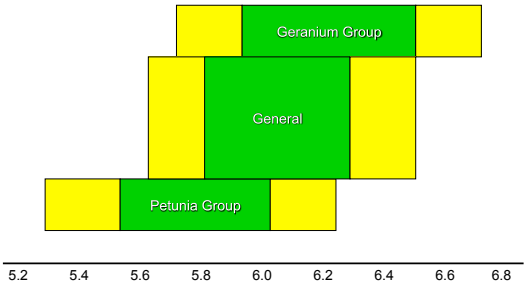
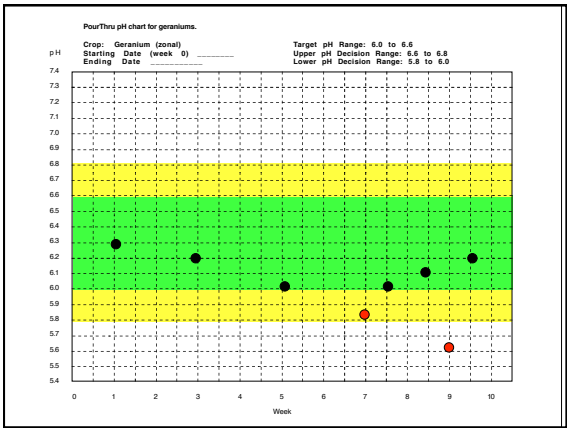
pH Zones: Geranium



Target pH Zones





pH Corrective Procedures

e-GRO 3-05

Conclusions

pH Management

- Learn to diagnose symptoms
  - High and low pH
- Know which factors influence pH drift
  - If the EC is too high, pH can drop.
- Start a monitoring program to check pH/EC
- If problems occur, implement the corrective procedures in e-GRO Alert 3-05.

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