WATER ACIDIFICATION

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Water pH and high alkalinity can be a limiting factor in container production of greenhouse crops. An understanding of both is needed to accurately treat water with a high pH.

A pH reading is a measurement of the hydrogen ion concentration of a solution (how acid or basic a solution is), and readings range from 0 (most acidic) to 14 (most basic). Nutrient availability and subsequent plant growth can be affected severely by high substrate and irrigation water pH. Although pH 7 is considered "neutral" (not acidic or alkaline), 7 is not the optimum pH for irrigation waters or substrate solutions for nutrient availability and plant growth in container production due to the substrate components we use. The recommended range of irrigation water pH for greenhouse production is 5.0 to 6.5 and is 5.2 to 6.2 for substrate solution pH. Acid treatment of high pH water may be needed prior to use in greenhouses.

Water alkalinity is a measure of a water's capacity to neutralize acids; the concentration of soluble alkalis in a solution. The term "alkalinity" should not be confused with the term "alkaline," which describes situations where pH levels exceed 7.0. Laboratory test results will express alkalinity as milligrams per liter of calcium carbonate equivalents (mg/l $CaCO_3$) or milliequivalents per liter of calcium carbonate equivalents (meq/l $CaCO_3$). You can convert between these two units using the following conversion: 1.0 meq/l $CaCO_3$ = 50.04 mg/l $CaCO_3$. The term "total carbonates" (TC) may also be used by some labs to refer to alkalinity of a solution. Alkalinity is related to pH because alkalinity establishes the buffering capacity of a water. Alkalinity affects the how much acid is required to change the pH. The following example may help explain the importance of alkalinity when trying to acidify water: Grower A has a water with a pH of 9.3 and an alkalinity of 71 mg/l $CaCO_3$ (TC = 1.42 meq/l $CaCO_3$). To reduce the pH of this water to 5.8, it takes 46.6 ml of 35% sulfuric acid per 100 gallons of water. In contrast, Grower B has a water with a pH of 8.3 and an alkalinity of 310 mg/l $CaCO_3$ (TC = 6.20 meq/l $CaCO_3$). To reduce this water to a pH of 5.8, it takes 203.0 ml of 35% sulfuric acid per 100 gallons of water. Despite the fact that Grower B's water is a full pH unit lower than Grower A's, it takes *more than four times more acid* to lower the pH to 5.8. Both alkalinity and pH are important to consider when attempting to adjust the pH of a water.

Injection of sulfuric, phosphoric, or nitric acid into irrigation water can effectively improve the quality of high pH/high alkalinity water. It is desirable to reduce the amount of bicarbonate (and carbonate) to prevent a rise in substrate pH over time. To accurately predict the amount of acid required to acidify to a given pH, both the pH and alkalinity of the irrigation water must be known. Table 1 outlines starting amounts of acid to inject to drop the pH to approximately 5.8. However this table is only taking alkalinity into account (and does not account for the starting pH of a water sample), and fine tuning of the amount of acid added will be necessary. When acidifying water, an end point of 5.8 is adequate to control substrate solution pH rise due to alkalinity in the irrigation water.

Growers who acidify their water should adjust their fertilization program for the nutrient supplied by the acid used. For example, if using phosphoric acid, make sure to reduce your phosphorus feed accordingly to account for the P supplied from the acid. When attempting to acidify waters very high in alkalinity, phosphoric acid may not be feasible. For example, if your water supply contains 6.0 meq/l of alkalinity and you use phosphoric acid to neutralize the alkalinity, over 280 ppm P_2O_5 (126 ppm P) will be supplied at each irrigation, a high level of phosphorus. If using nitric acid, account for the additional N supplied from the acid. Using 67% nitric acid to acidify water containing 6.0 meq/l of alkalinity would supply 67 ppm N at each irrigation, a significant quantity of nitrogen. Sulfuric acid treatment for this water would supply 75 ppm S, more than sufficient sulfur for plant production.

The 75% phosphoric acid and the 35% sulfuric acid are relatively safe to work with as compared to the 67% nitric acid. However, care should be taken when handling any acid, and protective eye ware and clothing are required.

The sulfuric acid recommended is a battery electrolyte product named Qual® and can be purchased from most auto supply stores for about $10 per 5 gallons. At this price, a grower would spend 17.2¢ on sulfuric acid per meq of alkalinity per 1000 gallons of water. For example, if your water had an alkalinity of 4 meq/l, you would need to add 44 fl oz. of 35% sulfuric acid per 1000 gallons of irrigation water, and this amount of acid would cost 69¢. We recommend sulfuric acid over nitric and phosphoric acid due to it's relative ease and safety of use, cost, and availability. If you know both the starting pH and the alkalinity of your water, we can give you the exact amount of 35% sulfuric acid required to lower the pH to any end point.

One final word of warning about water acidification: acidic water will corrode galvanized piping and fittings over time. Also, the injector used to add the acid into your water should be approved for acid injection by the manufacturer.

Table 1. Amount of acid to inject to drop water pH to approximately 5.8 and resulting concentrations of nutrients provided by one fl oz. of each acid per 1000 gallons of water.

Acid	Amount of acid to add for each meq of alkalinity*	Concentration of nutrient provided by one fl oz. of acid per 1000 gallons water
Nitric acid (67%)	6.8 fl oz./1000 gals	1.64 ppm N
Phosphoric acid (75%)	7.3 fl oz./1000 gals	2.88 ppm P
Sulfuric acid (35%)	11.0 fl oz./1000 gals	1.13 ppm S

*Add this amount for each meq of alkalinity present. For example, if your water report indicates an alkalinity of 3 meq/l and you choose to use sulfuric acid, you would add 33 fl oz. of 35% sulfuric acid per 1000 gallons of water.

Poinsettia Production Update

Tuesday, 19 July 1994

Sites in Asheville, Chapel Hill, Charlotte, Greenville, Raleigh, Wilmington, and Winston-Salem

North Carolina Landscape Bedding Plant Field Day
Wednesday, 27 July 1994

Horticulture Field Laboratory and
McKimmon Extension Center
Raleigh, North Carolina

PROGRAM

9:15 – 11:30 AM	Registration/Refreshments, Horticulture Field Laboratory, (Site of NCSU Arboretum) 4301 Beryl Road, Raleigh	NCCFGA
9:30 – 11:45 AM	Self-Guided Tour of Trial Areas	
12:00 – 1:30 PM	Buffet Luncheon & Welcoming Remarks, J.S. McKimmon Extension Education Center, Gorman Street, Raleigh (Directions to McKimmon Center will be available at registration)	
Growers' Session (Limited to first 100 Registrants)		
1:30 – 1:50 PM	Overview of Greenhouse Financial Management	Safley
1:50 – 2:40 PM	Balance Sheet Breakdown	Oltmans
2:40 – 2:55 PM	BREAK	
2:55 – 3:40 PM	Ratio Rationale for Your Finances	Oltmans
3:40 – 4:00 PM	Where Do We Go From Here?	Safley & Oltmans
Landscapers & Retailers Session (Limited to first 300 Registrants)		
1:30 – 2:20 PM	Trends in Southern Landscaping	Powell
2:20 – 2:35 PM	BREAK	
2:35 – 3:20 PM	Weed Control in Color Beds	Warren
3:20 – 4:00 PM	Under-Utilized Bedding Plants	Bailey

This year's trials are composed of over 470 cultivars of bedding plants including species suitable for sun as well as shade locations. A complete cultivar listing and plot map will be available for registered attenders. The North Carolina State University Trial Garden is an All America Selection Judging Site, an AAS Display Garden, and a Fleuroselect Display Garden.

Split sessions will be offered in the afternoon; one addressing greenhouse business for the growers and the second covering bedding plants in the landscape for landscapers and retailers. This will be the second in a series of program conducted on financial management for greenhouses, and the first was met with very positive response. A barbecue luncheon buffet is included in the registration fee, and attenders will also receive a copy of plant performance evaluations from last year's summer and winter trials. Please plan to attend our field day this July--you can't afford to miss it!!!

Program Participants

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COOPERATORS
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N.C. Cooperative Extension Service
N.C. Commercial Flower Growers' Assn.

Bedding Plant Field Day Registration Form

Return to: NCCFGA
P.O. Box 52276
Raleigh, NC 27612

Make checks payable to: NCCFGA
Preregistration deadline is 21 July 1994
Preregistration fee is $18.00
Registration fee after July 21 is $23.00

The registration fee includes the tours of the trial gardens, a map and trial cultivar reference listing, refreshments at the trial gardens, a buffet luncheon at the McKimmon Center, the afternoon oral sessions, a copy of the 1993 Trial Summary, a copy of the 1993–94 Pansy Trial Summary, and session proceedings.

Name(s): ______________________ ______________________

______________________ ______________________

Firm: ____

Address: ____

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Please indicate how many registrants will attend each session:

___ Grower Session
___ Landscaper/Retailer Session

Please indicate your category:

- ❑ Education/Extension Service
- ❑ Garden Center/Bedding Plant Retail Sales
- ❑ Landscape Contractor
- ❑ Landscape Maintenance
- ❑ Parks/Recreational/Public Horticulture
- ❑ Retail Grower
- ❑ Student
- ❑ Wholesale Grower