

MICRONUTRIENTS

INTRODUCTION

- Micronutrients are eight elements required in small quantities by plants
- Six are applied in irrigation water and/or in complete fertilizers (iron, manganese, zinc, copper, boron, and molybdenum)
- Chlorine and nickel are usually not intentionally added to fertilizers since enough is naturally present in water and fertilizers to meet plant requirements

MICRONUTRIENT APPLICATIONS

- Micronutrients are usually removed from the water sources and soilless media commonly used in greenhouse plant production, resulting in micronutrient deficient plants
- Therefore all the nutrients the plants require must be supplied with the right timing and in the proper quantities and proportions for a particular crop
- Check complete fertilizers to determine if they provide micronutrients
- If micronutrients are not in the fertilizer, apply one application of a commercial mixture of micronutrients before planting

- Micronutrients can also be supplied as an additive in a constant liquid feed program (fertigation)

EFFECT OF MEDIA pH ON MICRONUTRIENT AVAILABILITY

- Media pH determines which nutrients are available to plants and in what quantities
- Deficiencies can occur even if the nutrients are present in the media if the pH level does not allow the nutrients to become soluble enough for absorption by the plant
- The optimum pH range for soilless media is 5.6 to 6.2
- In the optimum range the maximum amount of nutrients are made available to plant roots

MICRONUTRIENT SOURCES

- Traditionally iron, manganese, copper, zinc, and boron are applied as sulfates
- Recently they have been applied as the oxide forms
- Boron is applied as borate, molybdenum as molybdate
- Slow-release micronutrient sources (referred to as fritts):
 - Nutrients are added to molten glass,

EFFECT OF pH ON NUTRIENT AVAILABILITY

Nutrient availability	Very low pH (less than 5.0)	Low pH (5.0–5.5)	Optimum pH (5.6–6.2)	High pH (6.5–7.0)
Soluble—available to plant roots		Manganese, iron, copper, zinc, and boron	Maximum availability	Molybdenum, magnesium, calcium
Insoluble—not available to plant roots	Magnesium, calcium	Molybdenum, calcium, magnesium, sulfur		Phosphorous, iron, manganese, copper, zinc, boron
Highly soluble— toxic levels	Ammonium, manganese, iron, copper, zinc, boron			

glass is cooled and broken up into a powder

- In growing media, nutrients slowly leach out of the powder and become available to plants
- If pH is imbalanced, nutrients may not be readily available to plants
- Slow-release sources for heavy metals (referred to as chelates):
 - Chelates available include iron, manganese, copper, zinc, calcium, and magnesium
 - A chelating agent protects the metal from conditions that would otherwise cause it to precipitate (become a solid) or oxidize (react with oxygen in the air)
 - Chelates are very soluble, therefore the nutrients remain soluble
 - Boron and molybdenum cannot form chelates

Reviewed by:

Dr. Yin-Tung Wang
 Research and Development
 Matsui Nursery
 Salinas, CA

Dr. Mike Orzolek
 Professor of Horticulture
 Penn State University

Dr. Frank Flora
 National Program Leader
 Nutrition, Food Safety, and Quality
 USDA-ARS

Mention of trade names does not constitute an endorsement by University of Maryland Cooperative Extension, University of Maryland College Park, or University of Maryland Eastern Shore.

MICRONUTRIENTS

by

Thomas M. Blessington, David L. Clement, and Kevin G. Williams
 Central Maryland Research and Education Center
 University of Maryland

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, University of Maryland, College Park, and local governments. Cheng-i Wei, Director of Maryland Cooperative Extension, University of Maryland.

The University of Maryland is equal opportunity. The University's policies, programs, and activities are in conformance with pertinent Federal and State laws and regulations on nondiscrimination regarding race, color, religion, age, national origin, gender, sexual orientation, marital or parental status, or disability. Inquiries regarding compliance with Title VI of the Civil Rights Act of 1964, as amended; Title IX of the Educational Amendments; Section 504 of the Rehabilitation Act of 1973; and the Americans With Disabilities Act of 1990; or related legal requirements should be directed to the Director of Human Resources Management, Office of the Dean, College of Agriculture and Natural Resources, Symons Hall, College Park, MD 20742.