Needs Perspective – Soluble Micronutrient Analysis

Fertilizer Methods Forum
February 20, 2020

Florida Statutes and Rules

- **Statute – Chapter 576 Agricultural Fertilizers**
- **Rules – 5E-1 Fertilizer**
  - **Guarantees for secondary or micro plant nutrients except chelated forms of secondary or micro plant nutrients shall be as follows:**
  - **Copper (Cu) shall be expressed as "Copper" if derived from insoluble compounds; "Soluble Copper" or "Water Soluble Copper" if derived from "copper sulfate, copper nitrate, copper chloride or other soluble compounds"; or both if derived from combinations of soluble and insoluble sources. (Similar for Mg, Mn, Fe, Zn)**
  - **Boron (B) shall be guaranteed as to water soluble boron, expressed as "boron"**

- **Chelates**
  - **Rule 5E-1.003**
  - **When a chelated form of a plant nutrient is claimed in addition to another form of the same element, the chelated portion shall be guaranteed and the specific chelated nutrient shall be listed as a source in the "Derived from" statement. The chelated guarantee shall be equal to or less than the "Soluble" or "Water Soluble" element guarantee.**

Methodology

Title	Description/Scope	Prep/Extraction method	Analysis
Soluble Boron	Determines soluble boron in fertilizer	Extracted in boiling deionized water. The solution is brought to volume	ICP-OES with Yttrium Internal Standard
Soluble Manganese	Determines SMn in mixed and pure material fertilizer. Sources: Sulfates, chlorides, nitrates and sucrates	Extracted in ph 5 Buffer (potassium phthalate), brought to volume with deionied water and shaken. Note: pH is critical. In high Phosphate samples >10% with MAP, DAP or Polyphosphate the SMn can be precipitated as Manganese ammonium phosphate at pH above 5.2	AA
Soluble Copper	Determines SCu in mixed and pure material fertilizers. Sources: Sulfates, chlorides, nitrates and sucrates	Extracted in pH 6.0 buffer (0.24M bis (hydroxymethyl)-2,2'2-nitrilotriethanol and hydrochloric acid), brought to volume with deionized water and shaken.	AA
Soluble Iron	Determines SFe in mixed and pure material fertilizers. Sources: Sulfates, chlorides, nitrates and sucrates	Extracted in 1% sulfuric acid solution and skaken. Note: Ferric oxides are slightly soluble at this pH but the solubility of oxides is not generally high enough to give a positive bias.	AA
Soluble Zinc	Determines SZn in mixed and pure material fertilizers. Sources: Sulfates, chlorides, nitrates and sucrates	Extracted in pH 6.0 buffer (0.24M bis (hydroxymethyl)-2,2'2-nitrilotriethanol and hydrochloric acid), brought to volume with deionized water and shaken. Note: Zinc oxide are slightly soluble at this pH level but do not generally give a positive bias.	AA Note: Zinc sample must be analyzed within 1 hour of weighing into buffer solution. The solubility of zinc oxides increases with time under this pH.

History, Challenges and Future Considerations

- Analysis for total, soluble and chelated micronutrients (Cu, Mn, Fe, Zn)
  - Consumer Protection and Level Playing Field (source substitution)
  - Example cost of sources
    - Iron Oxide = $4.80
    - Iron sulfate = $15.83
    - Iron (Chelate group 1) = $324.41
    - Iron (Chelate group 2) = $87.55
- Individual methods for each nutrient for soluble and chelates
- Throughput Issues
- Interferences
- Interested in Universal Method for Solubles
- Future Considerations
  - "Complexed"
  - Slow Release Micronutrients

Questions?

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