Micronutrient Sources

Selecting a micronutrient source requires consideration of many factors.

- Compatibility with N-P-K fertilizers and other tank mix partners
- Convenience in application
- Agronomic effectiveness
- Cost per unit of micronutrient

Which Micronutrients

- Iron
- Zinc
- Copper
- Manganese
- Boron
- Molybdenum

Classes of Micronutrients

The four main classes of micronutrient sources are

1) Inorganic
2) Synthetic chelates
3) Natural organic complexes
4) Other - Nitrate and chloride solutions of zinc, magnesium, calcium, manganese and copper.

-Inorganic sources consist of oxides, carbonates and metallic salts such as sulfates, chlorides and nitrates.

-Sulfates of Fe, Cu, Mn and Zn are the most common metallic salts used in the fertilizer industry because of their high water solubility and plant availability.

-Oxides of Zn are relatively water insoluble and thus must be finely ground to be effective in soils. .

-Broadcast applications of Zn oxides should be applied at least 4 months before planting to be effective[1].

Synthetic Chelates are:

EDTA
EDDHA
NTA
DTPA
ETC.

They are water soluble and protect the associated metal from reaction with other ingredients. They are also expensive per unit of nutrient.

Complexes are

Glucoheptonates – Sugars e.g. sugar cane by-products

Ligninsulfonates – Paper industry by product

Citric Acids – from various citrus products

Metal-ammonia complexes such as ammoniated Zn sulfate are also used by the fertilizer industry. Such complexes appear to decompose in soils and provide good agronomic effectiveness[2].

1 Tri-State Agronomic Team

2. Agronomy Dept, Michigan State

Ammonium, Nitrate, Chloride and combination products

Nitrate and chloride solutions of zinc, magnesium, calcium, manganese and copper are widely used to provide essential elements in plant growth .

They are primarily used for soil application although low rates are used for foliar application, care must be taken to avoid foliar burn. The pH usually runs between 2.5 and 4.0. The analysis varies and pH tends to go lower over time.

Some mixtures will heat up.

250 PSI CHEMICAL REACTORS

TETRA MICRONUTRIENTS

Cold Mix Plant

Source must fit grower management style

Adapted for starter fertilizer

Costs

Relative cost of source of Zinc micronutrient per water soluble unit.

$- Zinc Sulfate

$$- Ammoniated Zinc

$$$- Zinc Complexes

$$$$$- Zinc Chelates (EDTA)

Foliar Application

- Basically the same for Iron, Zinc, Copper, Manganese and Boron.
- Evaluate the cost.
- More exotic tank mixes e.g. addition of herbicides, fungicides and insecticides require some level of complexing or chelating for compatibility.

UAN

Ammonium Thiosulfate

10-34-0

Mixtures to avoid

- Any phosphate and magnesium (except chelate)
- Any calcium and phosphate or sulfate (except chelate)
- Sulfate and phosphate
- Phenoxy and amine products plus sulfate
- High pH added directly to low pH products (vice versa)
- Soluble powders added to 10-34-0
- Non-chelates added to ortho-phosphate
- Etc.

Some mixtures are guaranteed

Calcium Chloride

Ammonium Thiosulfate

Gypsum

GLYPHOSATE and MICROS

However, the prescience of the hard-water cations Ca^{2+} and Fe^{3+}, and the fertilizer Mn^{2+}, in the spray solution have antagonized Glyphosate efficacy. In solution, Glyphosate is a weak acid and readily forms complexes with cations. When Glyphosate complexes with di- and trivalent metal cations, Glyphosate absorption into and/or translocation within the plant is reduced.

Order of Compatibility

Oxides – Only in Suspensions

Sulfates – in water then into 10-34-0, UAN, Potash mixtures

Complexes – some directly into NPK some dilute with water first Jar test first.

Chelates (liquid)– direct mix into NPK

Raw Materials For Custom Liquid Products

LOW ph

HIGH pH

ACID

Acetic
Boric
Carbonic
EDTA
Formic
Hydrochloric
Lactic
Nitric
Phosphoric
Phosphorus
Sulfuric

Metal/Base

Ammonia
Calcium
Copper
Iron
Manganese
MEA
Potassium
Sodium
Ulexite
Zinc

TETRA MICRONUTRIENTS

TETRA MICRONUTRIENTS

COMPATABILITY / STABILITY TABLE

	$ ZINK-GRO 20 Liquid Zinc	$$ PRO-ZINC 10 Chelated Zinc Solution	$$$ PRO-ZINC 10+ Chelated Zinc Solution with EDTA	$$$$ TETRA-MAX 9 9% Zinc EDTA Chelated Solution
Analysis	16-0-0-20Zn	8-0-0-10Zn	9-0-0-10Zn-4S	6-0-0-9Zn
Lbs/Gallon	11.1 ppg	9.6 ppg	11 ppg	10.9 ppg
Lbs of Elemental Zinc per Gallon	2.22 ppg	.96 ppg	1.1 ppg	1 ppg
Salt Out/Freeze	-40 F	+20 F	-40 F	+20 F
Complexing/ Chelating Agent	Ammonia	Citric Acid	Citric Acid/EDTA	Pure EDTA
Zinc Source	Zinc Chloride	Zinc Chloride	Zinc Sulfate	Pure Zinc Oxide
Mixes with 10-34-0	YES Major Agitation	YES Minimal Agitation	YES Splash Mix	YES Splash Mix
Mixes with Orthophosphate	NO	NO	NO	YES
Foliar Application	NO	NO	YES	YES
Irrigation/Fertigation	NO	NO	YES	YES

Summary

Conclusion

- Selecting a micronutrient source requires consideration of many factors, such as compatibility with N-P-K fertilizers or pesticides in foliar application, convenience of application, and cost per unit of micronutrient.

THANKS FOR YOUR TIME!

TETRA MICRONUTRIENTS