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Why Chelates?

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The growing use of micronutrients, and their effect on overall plant health and yield has spawned an increasing amount of misinformation and confusion on the differences between inorganic micronutrient sources. The following attempts to clarify at least some of the major sources of confusion between chelates and sulfates.

Each micronutrient will react, both in fertilizer mixes and in the soil, in different ways. This is mainly due to the inter-reactions in the fertilizer blends of each micronutrient and eventually in the soil. To explain chelation and the advantage of chelates, zinc has been chosen simply due to the widespread use of zinc and the high areas of zinc deficiencies in most states.

Solubility, availability and protection of the zinc molecule are the three key words to chelation. In a gallon of 10% zinc chelate, there are approximately 30 to the 23rd power zinc molecules which are chelated. This protection allows the zinc to remain soluble and available. The zinc will not convert to zinc carbonate, zinc ammonium phosphate or other unavailable forms, because of the chemical shield which surrounds the metal, either in the soil or the fertilizer blend.

Each crop planted requires different levels of zinc for optimum yield. Again to make zinc chelation simple, let's use one crop example of corn, with a crop yield of 150 bushels to the acre.

Many soil labels consider 1.3 to 1.7 ppm or above (using the DPTA extraction test) as sufficient. At .5 ppm or less, a recommendation of 10 lbs per acre of elemental zinc may be given. (1)

Tissue testing would require 10 to 50 ppm in the ear leaf at silk; 20 to 50 ppm in the whole plant at the 30 to 4 leaf stage, to be in the sufficient zinc range for the crop. (2)

Using the same analogy as above, a 150 bushel corn crop would remove approximately .15 pounds of zinc from the soil. Again, not much zinc. (3)

The reason for this point is that it simply does not take much zinc to raise a 150 bushel corn crop, if the zinc is available and water soluble.

But what would cause the zinc to be unavailable? To look at this, we must consider what happens when we put zinc sulfate in the soil.

First, we need moisture to break the granule down. Then the area surrounded by the acid from the sulfate allows the zinc to be available, chemical reactions in the soil start to work and the zinc or a percent of the zinc is converted to zinc carbonate, zinc oxide, zinc ammonium phosphate or zinc phosphate. Thus, a chelate protects the metal from conversion to a source that is not available to the plant. (4)

This is exactly the point about chelates. Chelates are soluble and available to the crop during the season. If we put down one quart of zinc per acre this equates to .29 lbs of soluble zinc per acre, nearly double the amount removed by the crop.

When we take a soil test and receive the report back, it tells how much zinc is in the soild, not how much is soluble or available. For zinc deficiencies to appear, a high soil pH, a soil low in organic matter with a high pH or a cool wet soil may be the reason or a high phosphate level that could cause a zinc deficiency.

Due to the unique ability of chelating agents to protect the zinc molecule in the soil this allows the zinc to become and remain available, while preventing zinc tie up in the clay structure of the soil. It is this ability which allows zinc chelates to be sold on efficiency ration of 1 part chelate to 10 parts inorganic zinc. When we place an

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