Zinc and it's Role as a Plant Nutrient

FACT SHEET

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Fact Sheet No. 425
Revised 11/2013

The function of most micronutrients in plants and soils for the most part is widely misunderstood. One popular example of this is zinc and its relative importance in plant growth.

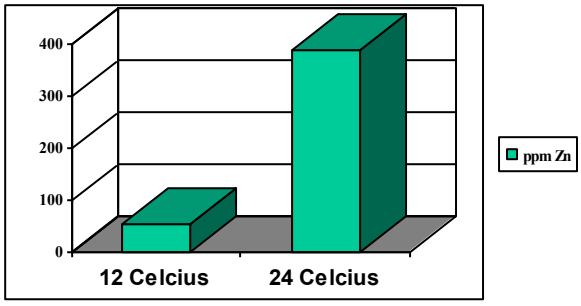
ZINC and its Role in Plant Nutrition

Zinc is predominantly taken up as a divalent cation, Zn^{2+} but in some cases of calcareous and high pH it is believed to be taken up as a monovalent cation $ZnOH^{+}$. Zinc interactions in both plants and soils are quite complex and play a major role in how and when we should apply zinc to a crop.

Understanding what inhibits the uptake and translocation of zinc in both soil and plants will also help us to supply this important micronutrient during time of peak demand. High concentration of divalent cations such as Ca^{2+} will inhibit zinc uptake however the most understood reaction is the Phosphorus to zinc relationship and how it effects zinc availability.

In soils with low zinc levels large applications of P will induce zinc deficiency, or placement of large concentrations of P in the row without adequate zinc will create zinc deficiency. This is also true in the plant itself when high concentrations of P in the shoots will inhibit zinc translocation; which may be more important during seed development. Again as was in the soil the P:Zn ratio is more important than the actual concentration to predict the availability of zinc to the plant.

Temperature of the soil in the spring has a real influence on the amount of zinc that is available from the soil in the spring. Even in soils with adequate zinc levels, zinc may not be available for early growth when it is needed. The earlier a crop is planted the greater the need for row-applied zinc.



The role of zinc in a plant is as complex as the interaction that reduces its availability. Zinc's role in a plant is either as a metal component in an enzyme or as functional cofactor of a number of enzyme reactions.

For the most part however typical symptoms do show up that we readily identify with zinc deficiency. One major symptom that has a dramatic effect on yield and quality is a symptom known as small leaf, which can be identified in any crop.

Zinc deficient plants exhibit low levels of auxins such as indoleacetic acid. Research shows us that zinc is required for the synthesis of Typtophan, which in turn is the precursor for the synthesis of IAA (indoleacetic acid). In the absence of IAA plant growth is stunted particularly internode growth and leaf size.

A typical example of this would be the small leaf symptom exhibited by orchard leaves in zinc deficient areas. This will affect the trees photosynthesis ability and reduce both yield and quality of the crop. Another good example of this is small leaf in potatoes where leaf to shoot ratio has a bearing on tuberziation. Small leaf symptoms with excessive shoot growth will reduce tuberization.

A more direct influence of zinc deficiency is that of grain or seed yield which are reduced to a greater extent by zinc deficiency. Zinc plays a specific role in fertilization as pollen grains contain a very high concentration of zinc. At flowering time during fertilization most of the zinc taken up is incorporated in to the developed seed.

Early development of fruits or tubers is also influenced by zinc. In the process of cell differentiation after flowering high levels of IAA or zinc in the plant will increase cell differentiation. The greater the cell differentiation the larger and denser the fruit. Also with more cells developed there is a greater demand for Calcium. Higher levels of zinc increase the plants ability to absorb calcium to build the cells the plant has created.

In our own research on tomatoes and potatoes we found that zinc had a direct correlation to yield and quality of both crops.

In summary it should stand to reason that zinc availability in the early stages of growth is critical to ensure yield and quality of all crops. Plant analysis at critical stages of growth can determine zinc levels in plant tissue.

Timing, placement and balance of nutrients are critical when considering zinc availability. Supplying adequate zinc to a young developing plant to ensure adequate leaf growth makes sense, particularly in cold soils early in spring when zinc availability may be reduced even further.