Zinc adds "Micro-Power" to Crop Nutrition

Zinc (Zn) is as essential for plant growth as is nitrogen (N), phosphorus (P) or any of the other 16 essential elements. The micro amounts of zinc required for plant growth are related to the type of work it performs. Like potassium (K) it is heavily involved in enzyme activation which serves to regulate plant growth activity. A shortage of zinc is most often noted when plants are in an early stage of growth. Thus, zinc is closely associated with both phosphorus (P) and nitrogen (N) performance. Research helps to document how zinc nutrition management practices contribute to improved crop growth and profitability.

Why is zinc important?

Some of the benefits that zinc provides in growing plants are:

- An activator or component of many enzyme systems
- Improved fruit development
- Improved crop use of phosphorus
- Formation of plant growth regulators
- Formation of chlorophyll and carbohydrates

What nutrients do crops need?

Zinc is one of nine essential elements required in very small amounts for plant growth. Research shows that a 180 bu/a corn crop contains only one half pound of zinc. Zinc is needed early in the growth of crops such as corn, especially in reduced tillage practices and earlier planting of seed in cool, moist soils. Also, crop response to fertilizer zinc can be expected on soils with high soil pH, high organic matter content, high levels of soil test P, and marginal soil test levels of zinc. It is possible to induce a zinc deficiency when the soil P:Zn balance is too high.

Nutrient uptake by major crops

Crop	# N	# P_2O_5	# K_2O	# S	# Mg
Corn (180 bu/a)	240	100	240	28	41
Soybeans (60bu/a)	325*	65	140	25	26
Bermudagrass (8t/a)	370	96	400	44	26
Wheat (55bu/a)	120	45	85	13	15
Rice (7500#/a)	120	60	170	12	15
Cotton (1500#/a)	180	65	155	40	32
Alfalfa (8t/a)	410*	95	400	40	40

** Legumes get most of their N from the air.*

Zinc deficiency in corn

Deficiency symptoms:

- Stunted early season growth
- Broad bands of light-colored stripes on lower leaves
- Unfolding leaves in the whorl of corn seedlings are often white streaked
- Shortened internodes of young plants

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When do high yielding crops need zinc?

A 180 bushel corn crop must absorb nearly one half pound of zinc during the growing season. It is not uncommon for growers to apply 5-8 pounds of zinc to get a more uniform distribution of zinc. Zinc must be available for use throughout the growing season so a 100% water soluble product is not always the best choice. Peak zinc needs differ with the crop and responsiveness to zinc applications vary as shown in the table. Corn shows leaf chlorosis and stunted plants during the first few weeks. A shortage appears later with beans as flower buds shed or with cotton as growth and fruiting are delayed. Thus, most crops need a readily available supply of zinc for both early and late season growth and yield development.

Importance of balanced nutrition

Proper nitrogen management has received the most attention in crop nutrition, but it should be noted that micronutrients such as zinc are important in getting the most out of an investment in NPK fertilizer. Zinc is heavily involved in enzyme functions essential for regulating plant growth. Zinc, nitrogen and phosphorus are essential for rapid stem and leaf formation, for seed development and for other vital growth activities that create crop yield and quality. As tillage is reduced and surface crop residues increase, seedbeds remain cool and moist. These conditions tend to slow zinc and phosphorus uptake by a smaller root system.

Impact of zinc levels on yield

High crop yields are not possible without zinc, even though it is needed in very small amounts. Soils might contain anywhere from a few to several hundred pounds of zinc. Fine textured soils often contain more zinc than coarse textured soils. University of Georgia soils lab has established 2 lbs/a as a low testing soil and 2-8 lbs as a medium soil test range. Such low levels of availability have been reported across the country and crop responses have been measured. Kansas research showed that rates of 0, 2, and 4 pounds of zinc per acre increased soybean yields from 30 to 46 and 50 bu/a, respectively. The zinc leaf composition increased from 18 to 25 and 29 ppm as the yield increased. Kentucky studies revealed that a row application was the most consistent method for applying zinc to responsive soils.

Corn response to row and band application of zinc (Kentucky)

Application Method	Percent of trials showing response of:			
Number of Sites	< 5 bu/a	5-10 bu/a	11-15 bu/a	15+ bu/a
Broadcast (31)	55	6	19	20
Row (28)	29	21	29	21

Factors Affecting Zinc Availability in Soils

- ***Soil pH*** — zinc availability declines as soil pH increases. Crop response to Zn increases as soil pH increases from 6 to 7 or higher.
- ***Soil texture*** — fine textured soils are less responsive than coarse textured soils due in part to a higher cation exchange capacity and a larger reservoir of zinc and other nutrients.
- ***Soil phosphorus level*** — coarse textured soils testing medium to low in zinc and high in phosphorus are most likely to respond to fertilizer zinc.
- ***Organic matter*** — zinc is closely associated with the organic fraction of soil. As microorganisms decompose residues, zinc becomes available.
- ***Subsoil zinc*** — the subsoil is a poor provider of zinc since zinc moves little in the soil, plant root growth is limited and organic matter is low.
- ***Reduced tillage*** — zinc absorption by seedling plants is difficult when soils are cold and wet and plant roots are growing at a slow pace.

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