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Zn Management in Corn and Wheat

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Crop nutrition discussions are often around nitrogen (N), phosphorous (P) and potassium (K). However, optimal plant performance and nutrient use efficiency is achieved when all 13 of the essential nutrients are supplied to the plant.

This article discusses the important of zinc (Zn), its availability, rates and timing of application for corn and wheat.

Zinc, a micronutrient, is required for plant health and production. It is involved in many enzymatic activities. Growth and development would stop if specific enzymes were not present in plant tissue. Carbohydrate, protein, and chlorophyll formation is significantly reduced in zinc-deficient plants. Therefore, a constant and continuous supply of zinc is needed for optimum growth and maximum yield.

Zinc deficiency are common in calcareous soils (pH > 7.3 and free lime), in very sandy and low organic matter soils and where topsoil has been removed, or significant cuts were made (i.e. terraced or leveled fields). Zinc deficiency is most likely to occur under cool, wet conditions in the spring when root growth is slow. In calcareous soils, applying high rates of phosphorus without no Zn could induce Zn deficiency and reduce yields in soils with moderate to low levels of Zn.

Zinc deficiencies of wheat are not common in Colorado. In general, Zn deficiency is a problem in coarse-textured (sandy) soils under intensive cropping. In wheat, Zn deficiency mainly results in reductions in plant height and leaf size. These symptoms are followed by the development of whitish-brown necrotic spots on middle-aged leaves. As the severity of zinc deficiency intensifies, the necrotic spots spread on the leaves, and the middle parts of the leaves are often collapsed, showing a “scorched” appearance. The critical zinc concentrations of leaves or whole shoot at the vegetative growth stage are generally around 15-17 ppm.

Zinc deficiencies of corn have been widely reported in eastern Colorado soils. In corn, Zn deficiency occurs early in the growing season and has the appearance of interveinal chlorosis and/or white mid-leaf streaking. In many cases, especially with remote diagnostics or/and when driving by in a truck, Zn deficiency is misdiagnosed as a N deficiency due to a yellow or pale color in the field.

Soil testing for Zn concentration, organic matter, pH, cation exchange capacity and understanding of soil texture are important factors to determine Zn availability and the need for application. Other factors such as air and soil temperature can influence the ability of plants to take up Zn, even when soil Zn concentration is adequate, or Zn has been applied.

The need for zinc in a fertilizer program can be determined through soil tests and plant analyses. Plant analyses can confirm a suspected Zn deficiency during the growing season. However, plant analysis should be used in combination with soil tests before arriving at firm recommendations for using zinc in a fertilizer program.

Incorporation of manure or treated sewage sludge (biosolids) may correct Zn deficiencies. Zinc deficiencies in corn could also be corrected with banded or broadcast applications of $ZnSO_4$. Band application is more effective than broadcast application; thus, suggested rates are lower for band application (Table 1).

Table 1. Suggested zinc rates for band and broadcast applications to irrigated and dryland corn.

ppm Zn in soil AB-DTPA	Relative level	Fertilizer rate (lb Zn/A)*	
		Banded	Broadcast
0.1 – 0.9	Low	2	10
1.0 – 1.5	Marginal	1	5
> 1.5	Adequate	0	0

*Rates are based on zinc sulfate applications.

Zinc deficiencies also may be corrected by foliar sprays of a 0.5 percent $ZnSO_4$ solution applied at a rate of about 20 to 30 gallons per acre, but several applications may be necessary. However, it is difficult to prepare this solution in the field so ZnEDTA or other soluble Zn sources can be used. A surfactant (wetting agent) increases plant absorption of the applied Zn.

Zinc fertilizers have measurable residual effects, and repeated annual applications will result in a buildup of extractable Zn in the soil. Because of these residual effects, periodic soil tests are suggested to assess extractable Zn levels in soil. As soil test Zn increases to higher levels in soil, decrease Zn rates according to soil test results.

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