

**Phosphorus and Zinc Interaction**  
**Banding high rates of P can induce Zn deficiency in high pH soils.**  
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Phosphorus and zinc are essential nutrients for plant growth. Unfortunately, these nutrients can act antagonistically with one another in certain circumstances. This antagonistic phenomenon is known to cause yield reductions in many crops.

Yield reductions due to this interaction are caused by either phosphorus or zinc deficiencies. Deficiencies typically occur when a nutrient is present in short supply. In this case, the nutrient is present in marginal to normal levels, but the antagonizing nutrient is present in such a large quantity that it forces a deficiency of the other. In other words, excessive phosphorus can cause zinc to become deficient in plant tissue. Similarly, excessive zinc can cause phosphorus deficiency, however, this phenomenon is very rare.

The mechanism of this phosphorus-zinc interaction occurs primarily in the plant root, rather than in the soil, as many people suppose. Excessive concentrations of phosphorus in the plant root result in the binding of zinc within root cells. The zinc becomes part of the “fabric” of the root and, therefore, becomes unavailable for transport to leaves, where it is needed for normal plant growth.

Phosphorus-induced zinc deficiencies are more common than zinc-induced phosphorus deficiencies. This is because it is much more common for growers to apply substantial amounts of phosphorus fertilizer as compared to zinc fertilizer.

Zinc deficiency caused by excessive phosphorus can occur if:

- \*Zinc concentrations in the soil are low, especially in high pH and/or calcareous (excess lime) soil, and
- \*High rates of phosphorus fertilizer are applied.

It is uncommon to see a phosphorus-induced zinc deficiency in soils that simply have a high soil-test phosphorus level. In fact, these deficiencies occur just as readily in soils with low soil-test phosphorus levels. In other words, this phenomenon is more related to the amount of fertilizer applied for the current season rather than the level already present in the soil.

The method of phosphorus fertilizer application also impacts the likelihood of inducing a zinc deficiency. Concentrated bands of phosphorus fertilizer tend to induce zinc deficiencies more commonly than broadcast applications. The probability of creating a zinc deficiency increases as the rate of phosphorus in the band increases.

Producers applying substantial amounts of manure often ask if the very high levels of phosphorus in the manure could induce a zinc deficiency. Although it is true that manure contains a large amount of phosphorus, it also contains organically-complexed zinc, which helps to prevent the deficiencies from occurring.

The manure effect and research on this interaction demonstrate how to prevent phosphorus induced zinc deficiencies:

- \*Base phosphorus fertilizer rates on prudent soil-test recommendations.
- \*Apply a moderate amount of zinc if choosing to apply excessive rates of phosphorus fertilizer, especially when band applied.
- \*Include a small amount of zinc (< 1.5 lb/acre) in phosphorus-based starter mixes, especially if the zinc concentration is low or marginal based on soil-test data.

\*Do not apply zinc fertilizer if soil-test zinc level is above marginal levels and all phosphorus is being applied via broadcast methods.

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