Jw 6-2-76 2½M

FACT SHEET

L-721

Zinc Deficiency and Fertilization

Charles D. Welch and Carl Gray*

Zinc deficiency has only recently been associated with field crops grown in Texas. The following conditions have been associated with deficiencies as well as responses from zinc fertilization:

1. *Alkaline soils.* The availability of zinc decreases with increased alkalinity. Few zinc deficiencies have been observed below pH 6.5.

2. *Susceptible crops.* Corn, pecans and flax are affected most frequently, although deficiencies have been reported for a number of crops including cotton, grain sorghum, peanuts and some vegetables. Other crops may be affected to varying degrees, but distinct symptoms have not been observed in Texas.

3. *High phosphorus.* A number of studies have shown a relationship between high levels of soil phosphorus and zinc deficiency. If alkaline soils are relatively high in native or applied phosphorus, the possibility of zinc deficiency is greater than at low phosphorus levels. This does not suggest that crops should be limited in phosphorus fertilization, but that the level of this nutrient should be considered in determining the need for zinc.

Deficiency Symptoms

Visual symptoms differ between crops. Fields generally are not affected uniformly. Therefore, it is difficult to identify zinc deficiencies through soil tests of composite samples. Information in Table 1 provides a guide to the identification of zinc deficiency.

Zinc deficiency can be confirmed by spraying deficient plants with a dilute solution of zinc sulfate, or other zinc compounds containing 1 level teaspoon of material per gallon of water. Soil tests and laboratory analyses for pecan leaves and greenhouse tomatoes along with suggested zinc treatments if needed, are available on a service basis from the Texas Agricultural Extension Service Soil

Table 1. Description of zinc deficiency on crops

Crop	Description of symptom
Pecans	Shortening of the internodes on new growth giving an appearance of "rosette." Yellowing or chlorosis between the veins gives leaflets a striped effect. In severe cases, some leaflets may die imparting an appearance of "terminal die back."
Corn	A broad band of yellow or white tissue develops on both sides of the midrib when plants are 2 or 3 weeks old. These pale bands start near the base of the leaf but generally do not extend to the tips. The margins and midrib generally remain green. Part of the chlorotic tissue may die or turn reddish-brown. The root system may be poorly developed.
Grain sorghum	The symptoms are similar to those on corn but less pronounced. Although grain sorghum is not as susceptible as corn, zinc deficiency appears to retard development and maturation of heads.
Cotton	The first true leaves may show a pronounced yellowing between the veins and develop a "mottled bronze" appearance. The leaves become thick and brittle with their margins cupped upward. Leaves usually are deeply indented between lobes and yellowing or chlorosis develops between veins.
Flax	Chlorosis and white spots on the new leaves develop to a bronze or grayish-brown followed by a loss of color and dead spots. Short internodes cause rosetting on the top of the main stem. The growing point of the main stem may die back.
Citrus	Leaves become chlorotic with a condition known as "mottleleaf" or "frenching." Irregular green bands develop along midrib and lateral veins. Leaves become small and narrow. Twigs tend to "die back."
Peaches	Leaves look "frenched" and chlorotic, similar to citrus, and has been called "narrow leaf."
Peanuts	Very severe deficiency results in stunted plants and dwarfed upper leaves that curl downward. Older leaves develop a slight bronzing.
Tomatoes	Older plants develop thick leaves with a brownish-orange chlorosis, some may show necrotic spots. Stems are normal size but leaves are smaller, commonly called "little leaf."
Rice	Seedlings appear chlorotic or yellowed and may exhibit mottled or uneven bronzing. Severe deficiency causes death of seedlings resulting in thin stands and general stunting of the surviving plants. Surviving plants may outgrow these deficiencies, but fail to recover adequately to regain normal yield potential.

*Extension soil chemists, The Texas A&M University System.

Texas Agricultural Extension Service • The Texas A&M University System • Daniel C. Pfannstiel, Director • College Station

and Plant Testing Laboratory at College Station. For more information about these tests, see your county agricultural agent.

Correcting or Preventing Deficiencies

Foliar applications of zinc should be considered as salvage measures since this will only prevent the development of symptoms on new growth. Soil application should be used for future susceptible crops. A definite need for zinc should be established before including zinc in the fertilizer. When the decision has been made to use zinc, apply it in amounts that are adequate to correct or prevent the deficiency. Information in Table 2 will serve as a guide in selecting suitable materials, methods of application and rates.

Where zinc and iron are mixed in solutions, use 1½ percent iron sulfate (6 pounds per 50 gallons water) and ¼ percent zinc sulfate (1 pound per 50 gallons water). Concentrations of chelates can remain about the same in combination as for single application, since they are less likely to cause leaf burn. Suggested concentrations of chelates in sprays are the same as for zinc sulfate due to the lower zinc content of the chelates and experimental evidence shows that their effectiveness in sprays is not much different from zinc sulfate. Include a wetting agent or spreader sticker according to manufacturers directions.

Table 2. Rates of zinc materials

	Spray (include wetting agent)	Soil applications[3]	
Crop	Zinc sulfate[1] or chelates	Zinc sulfate[2]	Chelates
Field crops (Corn, grain sorghum, flax and peanuts)	¼ to ½ % solution, (1 to 2 lb. in 50 gal. water) 15 to 30 gal./A	10 to 20 lb./A.	2 to 6 lb./A.
Vegetables	¼ % solution. (1 lb. in 50 gal. water).	20 to 30 lb./A.	3 to 6 lb./A.
Greenhouse tomatoes	¼ % solution. (1 lb. in 50 gal. water or spray). Repeat as needed.	1 to 3 lb./1,000[4] sq. ft.	½ to 1 lb./1,000 sq. ft.
Pecans, citrus and tree crops	¼ % solution. (1 lb. in 50 gal. of regular spray). Thoroughly dampen foliage.	Generally limited to noncommercial trees.	

[1]Do not exceed the concentration of zinc sulfate as there is danger from burning the leaves. Including ¼ pound of hydrated lime per 50 gallons of spray will minimize chances of burning. The addition of 1 ¼ quarts NZN per 100 gallons has been shown to increase the zinc concentration in pecan leaves.

[2]Rates for polyflavonoid compounds would be similar to those suggested for zinc sulfate.

[3]Lower rates for band application, higher rates for broadcast.

[4]Based on incorporating with 10 to 12 inches of soil.

Precautions

Zinc should be applied only where it is known to be sufficiently deficient to affect the yield of a crop. Limited data indicate that applications to acid soils can be toxic under some conditions. Zinc should only be used for field crops on alkaline soils, soils high in phosphorus and those testing low with DTPA or a similar extractable zinc.

Methods of Application and Distribution

Since small amounts of zinc fertilizers are involved, the distribution in the root zone is more important than with major plant nutrients. Either banding at planting time or broadcasting before planting has been effective. Side dressing has not given consistent results.

Conclusions

If conditions are such that zinc deficiency is suspected:

1. *Confirm deficiency.* Observe deficiency symptoms and use foliar sprays, soil tests and plant analysis to confirm observations.

2. *Spray zinc.* If the deficiency is extensive, spray with a ¼ percent solution of zinc sulfate or zinc chelate.

3. *Zinc fertilization.* Apply a mixed fertilizer or material to supply at least 3.5 pounds of elemental zinc per acre if zinc sulfate is used or at least .4 pounds of zinc when using a chelate. The rate of other sources would depend on zinc content and availability.

4. *Sources.* Several zinc-containing materials are available for soil applications. Zinc sulfate and chelates are the most common, but zinc oxide, zinc ammonium sulfate, zinc ammonium phosphate, zinc carbonate and zinc polyflavonoids sometimes are used. Although some are less water soluble than zinc sulfate, they have been used with satisfactory results under special formulation processes.

Cooperative Extension Work in Agriculture and Home Economics, The Texas A&M University System and the United States Department of Agriculture cooperating. Distributed in furtherance of the Acts of Congress of May 8, 1914, as amended, and June 30, 1914.
2½M—4-76, Revised