



Zinc, the Miracle Micronutrient

Written by Nutra-Flo Company

The same zinc that protects galvanized steel from rusting and the same zinc that is inside our pennies is the same zinc needed in infinitesimal amounts for all living things. An acre of healthy oats contains only one ounce. Yet, without this essential ounce of zinc no crop would grow at all! A grown man needs only seven one-thousandths of an ounce of zinc per day. Yet this small amount helps build body protein, generate energy, promote growth, and enhances taste and smell. Only two ounces of zinc per ton of feed will prevent parakeratosis, or elephant hide, in hogs, promote hair growth on cattle, and generate healthy egg and chick development. Zinc is really a miracle micronutrient for plant life ...an acre of corn needs only two ounces! But, this two ounces can increase yields by over 60 bu. per acre. Zinc is involved in most plant growth functions. Zinc helps produce auxins. Zinc is a growth promoting substance that controls the development of the shoot. Zinc also forms enzyme systems which regulate plant life. Yet zinc is the most common micronutrient deficiency in agriculture today! Zinc deficiency can limit yields of corn, beans, wheat, cotton, sorghum, fruits, and vegetables.

Zinc Deficiency Common Throughout United States

Your soil is probably zinc deficient. In a recent survey 42 out of 48 states in America showed zinc-deficient soils. In fact, a survey of Midwestern states revealed that 92.3% of soil tests showed medium to serious zinc deficiencies. Fortunately, these deficiencies are easily corrected by adding only small amounts of zinc to fertilizer programs. The price is very low, costing less than one-half bushel of corn.

The barrel theory illustrates the “law of the minimum.” You might apply enough nitrogen, phosphorus, and potassium fertilizer to reach a yield goal of 175 bushels per acre, but if there is only enough zinc to grow 150 bushels, your maximum yield will be only 150 bushels per acre. Crop yield is limited by the nutrient in shortest supply! A fertility program without zinc costs you money ... yields go down, profits go down, costs per bushel go up, and valuable fertilizer is wasted. Adding zinc to your fertility program will allow you to reach your yield goal at the lowest cost per bushel.

The visual symptoms of severe zinc deficiency in corn are:

- yellow streaks between veins
- dead areas in older leaves
- shortening of the internodes
- stunting of the plant.

A crop with less severe zinc deficiency often does not show visible symptoms. Plants develop a “hidden hunger” for zinc which can cause losses of 10 to 20 bushels per acre or more. Young corn plants can suffer a “phosphorus induced” zinc deficiency when high-phosphate fertilizers are used without applying additional zinc. The phosphorus tends to “tie up” any zinc in the soil and make it unavailable to the plant. The most common natural causes of zinc deficiency are: high pH soils, high organic matter soils, sandy soils, high clay soils, cool soils, wet soils, and soils naturally high in phosphorus. There are also man-made causes of zinc deficiency. They are: application of high phosphate fertilizers, land renovation, soil compaction, and heavy cropping which removes great quantities of zinc from the soil. Table 1 lists the amount of zinc removed by various crops.

TABLE 1. Amount of Zinc Removed by Various Crops	
Yield of Crop per Acre	Pounds of Zinc Removed
150 bu corn, as grain	0.15
150 bu corn, as silage	0.30
50 bu soybeans	0.10
4 tons alfalfa	0.42
50 bu wheat and small grain	0.18
20 tons sugar beets	0.20

Let's explore the chemical characteristics of zinc. As stated before, zinc can be "tied-up" by high pH soils, soils high in phosphorus, wet soil, and cool temperatures. Table 2 shows how the effect of phosphorus/zinc imbalance is to "tie-up" zinc by phosphorus. The soil was low in zinc and low in phosphorus. The check yielded 100 bushels per acre. When 80 pounds of phosphate was applied without zinc, the yield dropped to 73.4 bushels! When 80 pounds of actual phosphate was applied and 10 pounds of zinc per acre was added to the fertilizer program the yield jumped to 162 bushels per acre. The rule of thumb is, "always apply zinc when applying phosphate fertilizers!"

TABLE 2. Effect of phosphorus/Zinc Imbalance (low P/low Zn soil). Kansas data.	
	Corn Yield—Bushels per Acre
Check	100.9
80 lbs Phosphorus, no zinc	73.4
80 lbs phosphorus + 10 lbs zinc	162.2

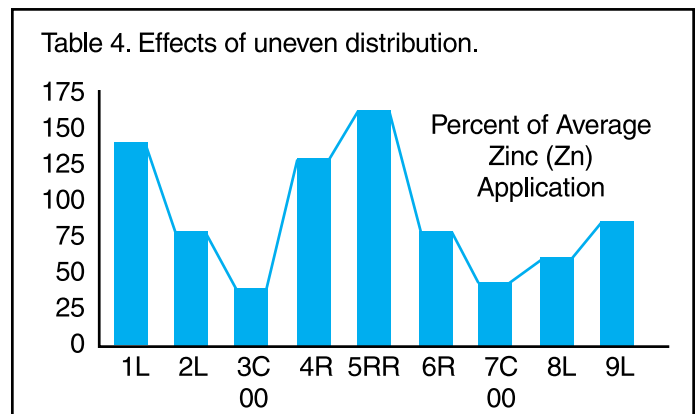
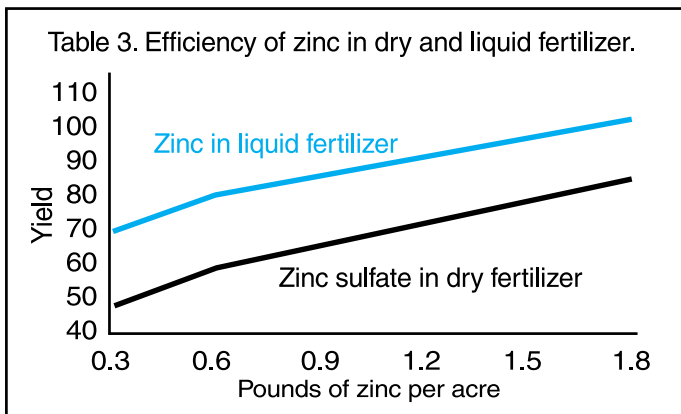
Zinc Is Immobile

An important property of zinc is that it is highly insoluble and immobile. That is, it is concentrated on the soil surface and does not move down through the soil profile with water. For hundreds of years zinc has been pumped from the subsoil by plant roots. Residue has decayed and left zinc in the upper two to three inches of soil. This immobile characteristic tells us that to prevent zinc deficiency, zinc should be applied under the subsoil with a pre-plant band of liquid fertilizer and a liquid starter at planting time

Liquid Zinc vs. Dry Zinc Granules

There are a number of zinc products on the market today, either in dry granule or liquid form. Using liquid fertilizer to apply zinc on reduced tillage fields offers much greater efficiency than dry zinc granules.

Because zinc is highly immobile, broadcasting dry zinc on top of residue without incorporation, means little zinc is available to root systems below the surface. Adding liquid zinc to a band application of liquid fertilizer supplies plants with a concentrated band of nutrients in the root zone. Because of the greater efficiency, only small amounts of liquid zinc are needed. In this test (Table 3), it took four pounds of dry zinc per acre to increase yields the same as one pound of liquid zinc applied in a band of liquid fertilizer. That's an efficiency ratio of 4 to 1.



Even distribution over the entire field is another problem with dry zinc granules. Zinc granules used in dry bulk blends are twice as heavy as the granules of nitrogen, phosphate, and potash. When fertilizer is spread with a double-spinner applicator zinc concentrates in the outer edges of the swath. Rows in the center of the swath receive little or no zinc. In this test (Table 4) conducted with a double-spinner applicator, there was found to be four times more zinc at the outer edges of the swath than in the middle.

Apply Liquid Zinc In Starter for Best Results

The best, most efficient method of applying zinc is adding liquid zinc to a starter program and applying it below and to one side of the seed at planting time. Tests from Nebraska (Table 5) show that liquid zinc added to starter and banded near the seed can increase yields dramatically. Results are averaged over two years in replicated plots. Notice that only one tenth of a pound of zinc applied per acre increased the yield from 62 to 119 bushels per acre...an increase of 57 bushels! That's right ...57 bushels from only one dollar's worth of zinc!

TABLE 5. Liquid Zinc Added to Starter Increases Yields	
Zinc Applied—Pounds per Acre	Yield—Bushels per Acre
0	62
0.1	119
0.3	127
1.0	135

Nulex[®], the Best Value In Liquid Zinc

Nulex Liquid Zinc is manufactured by Nutra-Flo Company. Nutra-Flo pioneered the use of micronutrients with the invention of Nulex in 1974, the first liquid zinc complex. Originally sold in the Midwest for use on corn ground, Nulex is now in demand nationwide, being used on soybeans, wheat, potatoes, cotton, rice, and many other field crops, as well as, fruits and vegetables. However, Nulex still remains the most asked for liquid zinc by Midwest corn growers.

Nulex is a clear, concentrated liquid zinc complex that offer these benefits:

- Mixer ready
- Flows freely through any size hose
- Noncorrosive
- Stores in mild steel tanks
- Will not damage application equipment
- Stores all winter
- Environmentally safe

Nulex Liquid Zinc blends easily and completely with any liquid fertilizer. Nulex can be applied broadcast, or for maximum efficiency place Nulex in the row with a liquid starter at planting time. Simply add the desired amount of Nulex to obtain the recommended level of zinc per acre. In many cases, as little as one quart per acre is all that is needed. Table 6 shows how much Nulex is required to satisfy soil test recommendations. Table 7 shows how much Nulex is needed to replace zinc removed by crops.

TABLE 6. Amount of Nulex Liquid Zinc Needed to Satisfy Soil Test Recommendation		
Amount of Zinc Recommended from Soil Test	Amount of Nulex 10% to Use	
	Broadcast	Band
1 lb per acre	1 quart	1 quart
2 lbs per acre	2 quarts	1 quart
3 lbs per acre	3 quarts	1 1/2 quarts
4 lbs per acre	4 quarts	2 quarts
5 lbs per acre	5 quarts	2 1/2 quarts
6 lbs per acre	6 quarts	3 quarts
3 quarts	x7 quarts	3 1/2 quarts
8 lbs per acre	7 quarts	3 1/2 quarts
9 lbs per acre	7 1/2 quarts	4 quarts
10 lbs per acre	8 quarts	4 quarts

TABLE 7. Amount of Nulex 10% Needed to Raplace Zinc Removed by Crops.		
Yield of Crop per Acre	Pounds of Zinc Removed	Amount of Nulex 10% to Replenish Zinc in Soil
150 bu corn, as grain	0.15	1 pint
150 bu corn, as silage	0.30	1 quart
50 bu soybeans	0.10	3/4 pint
4 tons alfalfa	0.42	1 1/2 quarts
50 bu wheat and small grain	0.18	1 pint
20 tons sugar beets	0.20	1 1/2 pints

Nulex has been field proven by growers on millions of acres. Nulex has also been university tested. In extensive testing at the University of Nebraska (Table 8), only one quart of Nulex applied in a liquid starter at planting time increased yields by 24.5 bushels per acre! The same research compared Nulex with zinc chelates (Table 9). Nulex Liquid Zinc proved to be as effective as the much higher priced chelated zinc sources.

TABLE 8. Nulex Test Results. University of Nebraska average of yields from four sites over two years (check average 112 bushels). Sandy soils, pH above 7.0, low zinc.		
Nulex per Acre	Average Yield Bushel/Acre	Average Increase Bushel/Acre
1 pint	129.0	17.0
1 quart	136.5	24.5
4 quarts	138.5	26.5

TABLE 9. Nulex Test Results				
	Bushels #2 Corn per Acre			
Zinc Source	1974	1975	1976	Average
EDTA	164	119	143	142
Nulex	165	125	133	141

Summary

The most common micronutrient deficiency in American agriculture is lack of zinc. Yet, zinc deficiency is easily corrected by adding zinc to fertilizer programs. Liquid zinc is more effective than dry zinc granules because it can be applied in a concentrated band deep in the root zone. This is especially important when fertilizing reduced tillage fields. The best value in liquid zinc is Nulex Liquid Zinc, manufactured by Nutra-Flo Company. Nulex is field proven and trouble-free. As little as one quart per acre of Nulex (about the cost of one half bushel of corn) will prevent zinc deficiency and increase yield.

Zinc truly is the miracle micronutrient!