



Zinc fertilization is necessary for successful bean production in many areas of southern Idaho. Zinc deficiency of beans occurs most often following heavy phosphate or manure application or after sugar beets. If fields have been leveled, zinc deficiency may show on spots where the highly calcareous subsoil has been exposed.

#### Effect of Zinc Deficiency on Beans

Zinc deficiency on beans usually appears as a yellowing, mottling or bronzing of the leaves, with veins remaining green (See figure above). In more severe cases, leaves will die and fall off. When zinc deficiency is slight, bean plants may appear normal but nevertheless will grow more vigorously when zinc is applied. In the Magic Valley area, bean maturity is delayed by zinc deficiency. Early maturity is extremely important in years when early frosts may seriously damage immature beans.

Most zinc-containing materials on the market are suitable zinc fertilizer sources, but all are not equally effective.

#### Experimental Results

A field experiment conducted on Portneuf silt loam at Kimberly, Idaho, was designed to test the effectiveness of several particle sizes of commercial organic and inorganic zinc fertilizers. Three granule sizes of five organic and inorganic zinc fertilizers were tested on a field which had been in sugar beets the previous 2 years.

Sanilac beans grown on plots receiving no zinc or coarse zinc oxide initially were lighter in color and grew slower than plants supplied with adequate zinc from smaller particles of zinc oxide or from other zinc fertilizers. However, there were no severe symptoms of zinc deficiency on any plot.

The zinc-deficient plants outgrew the disorder and appeared to be normal; however, at harvest

# Zinc Fertilizers For Beans In Southern Idaho

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time differences in maturity were obvious (See figure below). Plants supplied with powdered zinc fertilizers were mature enough to harvest 95 to 99 days after planting, whereas the check or coarse particle-fertilized plants were still green. Yields were measured as the plants matured.

The number of days from planting to harvest are shown in Table 1. The coarse particles (about pea size) were not as effective in hastening maturity as were intermediate (pinhead size) particles or powdered zinc materials. Without added zinc, plants required 121 days to mature compared to 95 days for the plants on the earliest maturing zinc-fertilized plots.

#### Zinc Oxide

Zinc oxide is an inexpensive zinc source, and is sold in a wide range of materials from 18 to 80% zinc. It is sparingly soluble and not suitable for



The maturity date of beans grown on slightly zinc-deficient soils can be advanced a week or more by zinc fertilization as shown by this picture. The plots with adequate zinc are mature. Beans without zinc fertilizer cannot be harvested for a week or more.

Table 1.—Effect of particle size of several fertilizers at 10 lbs. zinc per acre on maturity of Sanilac beans.

	Coarse	Intermediate	Powder
	Days from planting to maturity*		
Zinc Oxide (78% Zn)	115	112	99
Zinc Sulfate (35% Zn)	106	103	98
Zinc MNS (15% Zn)	103	102	96
Zinc Rayplex (11% Zn)	99	98	95
Zinc EDTA (6.3% Zn)	97	97	98

\*Beans matured in 121 days without added zinc.

use as a liquid or mixing with liquids. It should be applied as a powder and mixed well with the top 6 inches of soil. Granules or band placement have not always given satisfactory results.

#### Zinc Sulfate

Zinc sulfate is a common, inexpensive, soluble, inorganic zinc source. It usually contains 35% zinc. Zinc sulfate may be used as a foliage spray, but may not be compatible with other materials that are sprayed. For best results, zinc sulfate should be applied as a powder and mixed well in the root zone.

#### Zinc MNS

Zinc MNS (zinc ammonium sulfite) is a relatively inexpensive mixture of zinc with manganese, nitrogen and sulfur. The zinc content is 12 to 15%. It is somewhat more soluble than zinc oxide and less soluble than zinc sulfate. It is suitable for soil application when mixed well with the soil.

#### Zinc Rayplex

Zinc Rayplex (zinc polyflavonoid) is a soluble organic source derived from Western Hemlock bark containing about 11% zinc. Zinc Rayplex is soluble enough to be used for foliar applications, and it can be mixed with most liquid fertilizers except ammonium nitrate or aqueous ammonia. It is somewhat more mobile than inorganic sources but should be mixed thoroughly with the soil in order to obtain satisfactory results.

#### Zinc Chelates

Zinc chelates are marketed under a number of brand names. These synthetic organic materials contain 6 to 15% zinc. They are soluble and mobile in the soil. Powder or granular materials are equally effective as a soil application. Zinc chelates may be mixed with most fertilizers and insecticides for use as foliar sprays.

#### Other Zinc Fertilizers

Minerals, byproducts of mining or manufacturing, etc. containing zinc, may be offered for sale as zinc fertilizers. If they are finely powdered and mixed well with the soil, they are usually suitable sources of zinc. One exception is zinc sulfide (sphalerite) which is too insoluble to use as a zinc fertilizer.

Research results indicate that adequate zinc can be supplied by applying rates lower than previously recommended (University of Idaho Current Information Series No. 31, May 1966). Organic zinc fertilizers appear to be somewhat more effective than inorganic sources. Results of other

investigators indicate the ratio of effectiveness may be 5:1, but this ratio has not been adequately tested under southern Idaho conditions. Organic zinc fertilizers are generally more mobile than inorganic zinc fertilizers and may cause nutritional imbalance unless used with caution.

#### General Recommendations

An application of 5 pounds of actual zinc per acre in the inorganic form is recommended each year beans are grown. An exception to this would be continuous beans, for which 10 pounds of zinc per acre every third year is adequate. Where zinc deficiency is severe or where fields are severely cut, 10 pounds of zinc per acre may be necessary. Present evidence indicates that zinc may be applied at any convenient time before seeding. The fertilizer should be mixed well with the upper 6 inches of soil before plowing in order to avoid bands of high zinc concentration and areas with no zinc.

To correct zinc deficiency after the crop is up, use a foliar application of 2-1/2 pounds of zinc per acre. Zinc sulfate or other soluble sources are suitable for foliar application. Always apply foliage fertilizer sprays in the early morning or late evening, because applying in sunlight when temperatures are high may cause leaf burning. Wetting agents aid in zinc absorption by leaves.

Other crops grown in southern Idaho may give economical response to zinc fertilizer applications, but the need has not been thoroughly tested in controlled experiments. In general, the zinc needs of crops such as potatoes, corn and sugar beets are generally met by growing these crops in a rotation with zinc-fertilized beans.

A number of factors affecting zinc fertilization have not been adequately tested. Some of these are residual effects, timing of application, water management, and toxicity. The relationship of zinc requirement to the supply of other micro-nutrients, particularly iron, manganese and copper, also needs clarification. Research is continuing on these and other problems and results will be released as they are obtained.

#### Joint Contribution

This publication is a joint contribution from the Northwest Branch, Soil and Water Conservation Research Division, Agricultural Research Service, USDA, and the Idaho Agricultural Experiment Station.

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