

The Use of Soil and Plant Analysis in  
the Diagnosis of Zinc Deficiency in Oregon

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Responses to zinc (Zn) fertilizer have been observed with some soils and crops in Oregon and research has been conducted on the use of soil and plant analyses as tools in the diagnosis of Zn deficiency. Currently soil and plant analysis is being used in Oregon by the departments of Soil Science and Horticulture to determine the need for Zn fertilization.

At OSU the DTPA procedure of Lindsay and Norvell (6,7) is used to extract Zn from the soil. In the determination of Zn in petioles and leaves the Department of Soil Science uses a nitric-perchloric digestion and atomic absorption and the Department of Horticulture uses an arc emission spectrometer. Leaf analysis for Zn is performed routinely by the Department of Horticulture in diagnosing the Zn fertilizer needs of tree fruits. Special arrangements for sampling and analysis are required for Zn foliar analysis by the Department of Soil Science. Zn soil analysis is done routinely by the Department of Soil Science soil testing laboratory.

The Effect of Zn on the Yield and Chemical Composition of Sweet Corn in the  
Willamette Valley (5)

Crop - Sweet Corn

Soil - Sifton Gravelly Loam (contains volcanic ash)

Location - Marion County, Oregon

Soil Test for Zinc - 50 ml 0.1N HCl, 5 gm soil, 45 min. shaking  
- atomic adsorption spectrophotometer

Zn Fertilizer - Zinc Sulfate coated on ammonium sulfate and banded 2" x 2"

Zn Plant Analysis - Whole corn plants, 6 weeks old

a. Experiment 1

Soil Test - 1.3 ppm Zn  
Response to Zn

Zn Treatment	Yield Marketable Ears	Zn Content of Plants
lbs/A	T/A	ppm
0	2.30	22
4	4.34	40

b. Experiment 2

Soil Test - 1.9 ppm Zn

Zn Treatment	Yield Marketable Ears	Zn Content of Plants
lbs/A	T/A	ppm
0	2.5	16
1	6.2	27
2	5.9	30
4	6.8	43
8	7.6	63
LSD 1%	2.0	15

c. Experiment 3

Soil Test - 1.5 ppm Zn

Zn Plant Analysis - top leaf at tasseling

Zn Treatment	Yield Marketable Ears	Zn Content of Plants
lbs/A	T/A	ppm
0	2.0	10
2	3.4	15
4	4.2	20
8	4.5	28

Conclusions

1. Zn fertilizer increased marketable corn yields in each experiment.
2. Soil test values for Zn (0.1 N H Cl extractable) ranged from 1.3 to 1.9 ppm.
3. The Zn content of 6 week old Zn-deficient corn plants equalled 16 and 22 ppm and in Zn-fertilized corn plants the Zn concentration ranged from 27 to 63 ppm.

Zinc Fertilization of Alfalfa (8)

Zinc fertilization of alfalfa was studied in a field trial in Wasco County on a portion of a field where topsoil had been removed and the DTPA soil test for Zn was only 0.15 ppm.

Zn fertilization failed to increase the yield of alfalfa in this trial thus indicating that alfalfa is comparatively tolerant to low soil levels of available Zn.

### Zinc Levels in Potato Petioles (4)

In an experiment on a neutral soil in Malheur County in eastern Oregon banded ammonium sulfate resulted in a substantial increase in Zn absorption by potatoes.

Banded Ammonium Sulfate	Zn Conc. in Petioles	No. 1 Potato Yield
lbs N/A	ppm	Cwt/A
0	8	227
80	31	299

The results of experiments in Oregon indicate that at the  $\frac{1}{2}$ " diameter stage of tuber growth that 10 ppm Zn in the leaf petiole is a critical level and 15 ppm Zn a sufficiency level. (2)

### Nutrient Uptake by Russett Burbank Potatoes as Influenced by Fertilization (3)

Soil - Laki Loam

Location - Klamath County, Oregon

Soil Test - 0.35 ppm Zn (DTPA) pH 8.4

Plant Analysis - used 4th petiole - larger tubers 1.5 to 2.0 cm diameter

Zn Treatment	Yield No. 1 Potatoes	Zn in Petioles
kg/ha	tons/ha	ppm
0	17.15	21
5.7	19.51	25

### Conclusions:

1. Zn fertilization increased the yield of no. 1 tubers in an alkaline soil when DTPA extractable Zn was 0.35 ppm.

### Zinc Deficiency in Peas (1)

A high rate of liming (6 T/A) of a moderately acid Woodburn si cl soil in the Willamette Valley resulted in Zn deficiency in peas.

The Zn content of non-limed pea plants was 32 ppm and of limed plants was 8 ppm. The limed plants were chlorotic and the non-limed plants were green in color.

### The pH of Muck Soil and the Zn Content of Onions (1)

The degree of liming of muck soil in the Lake Labish area of the Willamette Valley has induced a wide range of pH values in the soil.

The following data was obtained in a survey of onion fields:

Soil pH	Zn Concentration in Onion Plants
	ppm
below 5.0	53
5.0 - 5.2	29
5.3 - 5.6	25
5.7 - 6.1	18

### Zinc Levels in Tree Fruit Leaves (2)

Suggested adequacy levels for Zn in tree fruit leaves are reported in Oregon tree fruit fertilizer guides. These levels are reported in the following table for mid terminal leaves which are sampled in August.

Tree Fruit	Zn Conc. in Leaves	Oregon Fertilizer Guide
	ppm	
Apple	14	23
Cherry	17	25
Pear	14, 17	26, 59
Peach	17	53

### Zinc Soil Test Values

Suggested adequacy soil test levels for Zn are reported in certain Oregon fertilizer guides. These levels for some crops are reported in the following table.

These values are for DTPA extractable Zn.

Crop	DTPA Extractable Zn	Zone	Fertilizer Guide
	ppm		
Sweet Corn	1.0	W. Oregon	11
Field Corn	0.8	W. Oregon	10
Pole Beans	1.0	W. Oregon	12
Irr. Pasture	0.8	E. Oregon	21
Bush Beans	1.0	W. Oregon	28
Potatoes	0.8	E. Oregon	58

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