39

FACTORS AFFECTING RESPONSE OF SWEET CORN TO Zn IN THE WILLAMETTE VALLEY[1]

T. L. Jackson and J. Hay[2]

This will be in the nature of a progress report on the Zn work underway in the Willamette Valley.[3] Two of these experiments were included in the tour during the 1964 summer meeting of the Pacific Northwest Plant Food Association.

Listed below is a summary of the points presented:

1. Response from Zn has been established (a) in the Stayton area, and (b) on the North Willamette Experiment Station where the response from Zn was greater where lime had been applied.

2. Zinc deficiency is fairly widespread on the gravelly soils in the Stayton area. It is generally very spotted on the fields where it does occur; few fields have more than 15% of the area that is Zn deficient.

3. Soil fertility problems in the Stayton area are fairly complex. The right combination of N, P, K, S, Mg, Zn, and lime are needed for optimum yield of corn and beans on some Zn deficient soils.

4. There did not seem to be a consistent difference between sources of zinc in the experiments carried out during 1964.

5. Reducing the iron content of corn plants where Zn was applied in the Grenz and Gilbert Experiments was one of the most interesting effects observed in the 1964 zinc experiments. This effect is being investigated further.

The complexity of the soil fertility problems in the Stayton area was illustrated by slides. One showed the response from application of Zn where the NPKSMg lime treatment yielded 1.5 tons per acre with the addition of Zn increasing the yield to 4.8 tons per acre. A second showed the response from application of lime where complete nutrients minus lime resulted in a yield of 1.6 tons per acre. This is one of the few situations in the west where it is necessary to add lime in combination with Zn.

There is a possibility that a complex Zn x Fe x P interaction may be responsible for part of the problem on some of these soils. Exceptionally high levels of Fe have been found in the Zn deficient corn plants.

---

[1]Proceedings, Sixteenth Annual Fertilizer Conference of the Pacific Northwest, Salt Lake City, Utah. July 13-15, 1965.

[2]Professor of Soils and Graduate Student, Department of Soils, Oregon State University, Corvallis, Oregon.

[3]This work was made possible by grants from Cominco Products, Inc., Rayonier Incorporated, and Geigy Chemical Company.

Another slide showed the effect that Zn had in reducing the iron content of corn. It is important to note that the total amount of iron as well as the percentage of iron is reduced when Zn is applied. This same effect has been observed in a number of cases where Fe has been added in greenhouse or nutrient solution experiments. This effect with the natural levels of iron found in soils was not anticipated. The relationship of these levels of Fe and Zn in corn plants on the utilization of P is being investigated in this summer's work.

Three sources of Zn were compared on one corn experiment and on one bush bean experiment. Powdered $ZnSO_4$ and EDTA Zn chelate were granulated with ammonium sulfate using diesel oil as a sticking agent. Powdered polyflavanoid Zn was dissolved in water to form a slurry and granulated on ammonium sulfate. Granulating these materials onto ammonium sulfate ensured uniform distribution along the row as the materials were banded at planting time.

There was an increase in yield and Zn content of corn leaves at harvest time where $ZnSO_4$, EDTA Zn chelate, and polyflavanoid Zn were compared. These comparisons were made on acid soils where maximum availability of heavy metals is expected.

The yield and Zn content were significantly higher with two pounds of Zn as EDTA Zn chelate than with the other sources of Zn at 2 lb Zn/A. However, the most important point to note in this experiment is that it took two pounds of EDTA Zn chelate or four pounds of Zn as $ZnSO_4$ to increase the Zn content of index corn leaves at tasselling above 20 ppm of Zn. This is another indication that the high levels of Fe may be complicating the response from Zn.

The second experiment where sources of Zn were compared on bush beans was an experiment where the basic treatments had been established the year before. This limited the Zn source comparisons to border rows where the uptake of Zn could be evaluated but reliable yield data could not be obtained. These Zn source comparisons showed no significant differences in the Zn content of bean leaves where the three sources of Zn were compared.

A survey of sweet corn fields in the Stayton area was included as a part of the 1964 field work. Zinc soil test values were compared with Zn deficiency symptoms. Tentative relationships could be established between soil test values and Zn content of corn leaves. Ninety percent of the fields sampled with less than 2 ppm HCl extractable Zn had Zn levels below 20 ppm in the index leaf at tasselling time. There was wide variation in this relationship between 2 and 3 ppm Zn soil test levels. Approximately 50% of the plants sampled showed levels below 20 ppm Zn. When the soil samples were above 3 ppm Zn, all plant samples had adequate levels of Zn.

Twelve field experiments were carried out on sweet corn during 1963 and 1964. Yield data, plant analyses, and deficiency symptoms were used to evaluate the supply of Zn available to plants. The results indicate that three ppm HCl extractable Zn in the soil is adequate. It must be kept in mind that many of these soils were in the Stayton area where high levels of available Fe in some soils is undoubtedly affecting response from Zn.

Table 1. The Effect of Zn Fertilization on the Fe Content of Sweet Corn. Exp. 424. 1964. OSU.

Zn applied lb/A	Fe Content at 6 weeks	
	PPM	µg/Plant
0	1180	3790
1	360	2180
2	390	2110
4	290	1710
8	350	1990

Zn applied as $ZnSO_4$ banded with fertilizer at planting time.

Table 2. The Effect of Zn Fertilization on the Yield and Zn Content of Sweet Corn. Exp. 424. 1964. OSU.

Zn applied lb/A	Yield T/A #1 Corn	Leaf* Zn ppm
0	2.6	12
1	6.2	15
2	5.9	17
4	6.8	30
8	7.6	58

* Index leaf (1st leaf below top ear) at tasselling.
Zn applied as $ZnSO_4$ banded at planting.