

OCCURRENCE AND CONTROL OF ZINC DEFICIENCY IN TOMATOES IN THE MANATEE AREA

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It is a little too early, really, to call the malnutrition symptoms which I am about to discuss zinc deficiency symptoms. From the standpoint of certain knowledge, it would be safer to say only that the condition was prevented in such of our field test plots as received dilute sprays containing commercial zinc sulfate a year ago this spring. However, the symptoms observed are very similar to those described by Dr. Hoagland on tomato plants grown in the greenhouse in California, when extraordinary precautions were taken to exclude zinc from the plants. Also, the symptoms in no way resemble those produced by deficiencies of any other known nutrients on the tomato.

In commercial fields where this was very severe, both last fall and a year ago, it commonly occurred with manganese deficiency, and the combination resulted in almost a complete loss of the crop in some cases. No such instances were brought to our attention at the Vegetable Crops Laboratory where zinc and manganese sprays were used.

Briefly, I want to give a resume of the field experiment in which this trouble was found to have been controlled by sprays of commercial zinc sulfate. This trial was conducted a year ago this spring on a Manatee fine sandy loam, with a pH of about 7.0. The variety planted was Newell, one of the new Fusarium wilt resistant varieties bred and selected by Dr. Weber and Mr. Kelbert. The field arrangement was a 6 x 6 Latin square, with six treatments and six replications of each treatment. The different treatments were as follows:

1. Check—no spray treatment applied.
2. Received spray made with 2 lbs. 65% manganous sulfate per 50 gallons of solution.
3. Received spray made with 1 lb. 88%

zinc sulfate per 50 gallons of solution.

4. Received spray made with 2 lbs. ferrous sulfate (Copperas) per 50 gallons of water.

5. Received spray made with 1 lb. borax per 50 gallons of water.

6. Received spray made with 2 lbs. 65% manganous sulfate + 1 lb. 88% zinc sulfate per 50 gallons of water.

These sprays were applied five times during the growth of the crop, at intervals of 10 days to two weeks.

Following the heavy rains of March, 1941, several growers brought in plants afflicted with a trouble which became known locally as "galloping rust". We sent specimens to several pathologists with the idea of identifying the organism causing the difficulty. All reports were negative—no causative organism was found. About the same time, it was noticed that in our secondary element spray plots, some of the plots were mildly affected by the same trouble, whereas others had much less. A count was then made of affected plants in each of the plots. The following data resulted:

Treatment	blk.	blk.	blk.	blk.	blk.	blk.	total
Number	A	B	C	D	E	F	
1. Ck.	23	25	16	24	28	11	127
2. Mn	11	21	38	22	27	13	132
3. Zn	2	4	2	4	5	3	20
4. Fe.	9	13	9	28	13	10	82
5. B	8	9	6	8	3	4	38
6. Mn + Zn	9	0	6	6	6	5	32

On analyzing these data by approved statistical methods, it was found that treatments 3, 6 and 5, in order, were superior to all other treatments, with treatment 4 superior to both 1 and 2.

At first glance, it would appear that the trouble was controlled equally well by applications of both boron and zinc, and partially controlled by iron. As the figures show, this

was indeed the case, but it should be remembered that crude salts were used in all cases. The boron was applied as borax—purchased in a local grocery. The iron was supplied as technical grade copperas. All sprays were applied by means of Champion knapsack sprayers. The water used was deep well artesian water. All of these factors may have contributed zinc to the spray, and it is believed that this was the case, for several reasons.

In the first place, the symptoms of boron deficiency on the tomato plant are well known and in no way resemble this necrotic spotting. Boron deficiency shows first of all in the growing point—this showed in the older leaves first and then on younger leaves as they developed.

Iron deficiency, too, shows symptoms on

the tomato which could not be confused with this spotting. Iron deficiency develops as a leaf chlorosis.

Also, it is known that the trouble was not at all severe in these plots—all plants fruited well, and no yield differences between treatments were found. It is apparent that a mild spotting such as developed in these plots is not of commercial importance. It is unfortunate that the area where these tests were conducted was not more deficient in zinc, so that yield differences would have shown up. The trouble was much more severe in some commercial fields.

We have further tests going this spring, and it is hoped that the results will be more positive. Nevertheless, all indications are that the trouble is zinc deficiency, and we are recommending zinc sprays wherever such trouble occurs in the area.

THE USE OF ZINC SALTS WITH COPPER FUNGICIDES ON TOMATOES IN DADE COUNTY

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One of the most interesting results from spray tests on tomatoes in Dade county has been the demonstration that the addition of zinc salts to copper sprays consistently increases the yields of marketable fruit. Zinc sulfate has given excellent results without injury to the plants and is considered safer to use than zinc oxide.

Zinc sulfate was first used with copper sprays on tomatoes in Dade county during the 1937-38 season. It was added to basic copper sulfate as a copper depositor at the suggestion of Mr. P. E. Kaspar. It was used at the rate of two-thirds of a pound to 50 gallons of spray. Basic copper sulfate was being tested comparatively with bordeaux mixture. Since zinc sulfate is known to possess some fungicidal properties, it was added to bor-

deaux mixture in one of the treatments. An increase of 35 field crates per acre of marketable tomatoes resulted from the addition of the zinc sulfate to the bordeaux mixture.

This was a promising lead and each year since 1938 the combination of zinc sulfate with certain of the copper sprays has been compared with the same copper fungicide without the addition of the zinc salt. In all tests that were carried to completion the addition of the zinc sulfate resulted in increases in yield of marketable tomatoes. These increases ranged from as low as 12 to as high as 64 field crates per acre and were definitely worthwhile considering the cost of the treatment.

In 1940, a test was conducted to determine the optimum amounts and number of applications of zinc sulfate or zinc oxide for Dade