

creased the yield and growth as compared to no lime. The yield and plant growth were larger for the 1200 pound rate than for the 2400 pound rate. On the Blanton soil, both lime applications reduced the yield and growth. There was no difference in yield or plant growth between the two rates.

#### LITERATURE CITED

- Brooks, A. N. and R. E. Nolen. Investigations relative to certain diseases of strawberries of importance to Florida. Fla. Agr. Expt. Sta. Ann. Rpt.: 86. 1935.
- Lineberry, R. A. and E. R. Collins. Fertilizing strawberries in North Carolina. N. Car. Agr. Expt. Sta. Bul.: 332. 1942.
- Matlock, D. L. Strawberry Nutrition, Fruit Nutrition 684-726. 1954. Horticultural Publications, Rutgers University, New Brunswick, N. J.

## LIME-INDUCED MANGANESE DEFICIENCY OF STRAWBERRIES

C. B. HALL AND R. A. DENNISON

*Florida Agricultural Experiment Station*  
Gainesville

A chlorosis was noted on the leaves of strawberry plants growing in two fields in the Starke area during the 1955-56 season. The chlorosis was most severe on the lower leaves. These leaves were usually a dark yellow with only the veins remaining green. The upper leaves were less chlorotic with the youngest leaves nearly a normal green. These symptoms appeared to be typical of those described by Lott (1946) for manganese deficiency. The fact that the soil in each field had been limed during the summer prior to planting also pointed to manganese deficiency as the cause of the chlorosis. Besides being chlorotic, the plants were generally stunted in growth.

The chlorosis and stunting were not general throughout the fields but were found in irregular areas. Many of these areas coincided with lighter colored phases of the soil or with slightly higher elevations.

A study was made of the relationship between the soil pH, the manganese content of the leaves of the plants, and the visual appearance of the plants. Samples for analyses were taken of both the plant leaves and the soil in the area in which the plants were growing.

#### METHODS

Soil and leaf samples were taken from each of the fields on January 11, 1956. The lower leaves of a number of plants growing in the

same area constituted a single sample. A corresponding soil sample was obtained for each foliage sample by compositing a number of cores taken throughout the same area. The predominating soil type of one field was Rex fine sand and of the other Blanton fine sand, shallow phase.

Twelve samples were taken from each field. Six soil and six foliage samples in each field were obtained from areas showing severe chlorosis and the other six samples were taken from the normal or near-normal appearing areas in the field.

The leaves were washed by tap water to remove soil particles before drying in a forced draft oven at 70° C.

Manganese was determined by the official A.O.A.C. method (1955). The pH of the soil samples was determined as outlined by Volk (1944).

#### RESULTS

On both soil types moderate or severe chlorosis of the leaves was associated with a soil pH of 6.60 or higher and a manganese content of 16 ppm or less on a dry weight basis (Table 1). In the pH range of 5.90 to 6.30 there was no chlorosis or only slight chlorosis and the manganese content ranged from 20 to 64 ppm. In the pH range of 5.10 to 5.30 there was no chlorosis and the manganese content ranged from 94 to 222 ppm.

These results indicate that severe manganese deficiency of strawberries would be expected in such soils in the Starke area when they are limed to pH levels above 6.5. Slight manganese deficiency could be expected if the soil pH is in the range of 6.0 to 6.5.

Table 1. - The Relationship of Soil pH, Manganese Content and Chlorosis of Strawberry Leaves.

Variety	Sample No.	Severity of Chlorosis	Soil pH	PPM Manganese on Dry Weight Basis
<u>Rex Fine Sand</u>				
Florida 90	1	Severe	7.00	13
	2	Severe	7.35	12
	3	Severe	7.10	10
	4	Severe	6.90	10
	5	Severe	7.12	12
	6	Severe	6.73	16
	7	None	6.30	31
	8	None	6.12	29
	9	None	6.05	20
	10	None	5.25	94
	11	None	5.10	200
	12	None	5.30	222
<u>Blanton Fine Sand, Shallow Phase</u>				
Missionary	1	Severe	7.15	9
	2	Severe	6.60	9
	3	Severe	6.70	11
	4	Severe	6.90	11
	5	Slight	6.25	21
	6	Slight	6.20	32
	7	Slight	6.15	28
	8	Slight	6.23	27
Florida 90	9	Moderate	7.00	8
	10	Moderate	6.96	10
	11	Very Slight	5.90	64
	12	Very Slight	6.17	43

## LITERATURE CITED

- Association of Official Agricultural Chemists. Official Methods of Analysis, Eighth Edition, 1955.  
 Lott, W. L. Strawberries need small amounts of manganese and zinc, North Carolina Agr. Expt. Sta. Ann. Rpt. 69:66. 1946.  
 Volk, G. M. Soil reaction (pH), Fla. Agr. Expt. Sta. Press Bul. 606. 1944.