Manganese in Brussels Sprouts

lime applied to acid soil corrected incidence of manganese toxicity of Brussels sprouts in field tests near Pescadero

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Stunted and yellowed Brussels sprouts were observed in many fields in San Mateo County in 1957. The affected plants grew very slowly after transplanting and interveinal yellowing or chlorosis developed shortly. As the plants developed, the older leaves cupped upward and developed small, necrotic spots near the margins. The plants seemed more severely affected while they were young, but tended to outgrow the trouble after a few months. The yields were drastically reduced and maturity was delayed.

Preliminary trials of zinc, manganese, iron, and magnesium sprays were made in San Mateo County in 1957 in an attempt to identify the malady. No correction was achieved. Manganese sprays seemed to aggravate the trouble. Soil and leaf tissue samples were taken from affected as well as normal areas to aid in the diagnosis of the disorder. Laboratory analyses of the soil and plant tissues gave the first clues to a possible solution.

The pH—relative acidity-alkalinity—of the soil, and unclassified marine terrace, was much lower and therefore of greater acidity than is ordinarily found in California. Since this area recently came under irrigation and intensive farming, the pH is probably near that of the virgin soil.

The manganese content of the chlorotic leaves seemed at least 10 times more than is necessary to maintain good growth. Even the normal leaves contained 3–5 times the manganese concentration of most species growing on fertile soils. The high manganese concentration in the leaves was thought to be due to the low soil pH. The manganese in soils of low pH is more soluble and therefore more easily absorbed by plants. Similar troubles have been reported in England in cabbage, broccoli, and Brussels sprouts.

Soil pH and Manganese Contents of Brussels Sprouts from Normal and Affected Areas

	Soil pH	Leaf manganese ppm
Chlorotic areas	4.0–4.4	1100–1800
Normal areas	5.0–5.5	300–550

Hydrated lime was applied to some plots where affected plants were already growing in 1957, but little response was observed. This may be attributed to the fact that the plots were established too late in the season.

However, in 1958 an extensive soil liming test was established using two different materials. Agricultural dolomite at broadcast rates of 0, 4,000, and 8,000 pounds per acre and high magnesia hydrated lime at broadcast rates of 0, 1,000, and 2,000 pounds per acre were applied in replicated plots about two weeks prior to planting. Soil lime requirement tests in the laboratory had indicated 4,000 pounds of dolomite should be sufficient to raise the soil pH to almost neutral—between 6.5 and 7.0.

Brussels Sprouts Growth Response and Soil pH as Affected by Different Liming Materials Applied at Different Rates

Material	Rate lbs./A	Growth response	Soil pH 3 months after application
Dolomite	0	poor	4.4
	4,000	good	4.6
	8,000	excellent	4.8
Hydrated lime	0	poor	4.4
	1,000	fair	4.5
	2,000	good	4.7

The magnitude of the growth response indicated in the table in this column is illustrated in the photograph. The plots receiving lime started producing a month earlier than the check plots and yields were much greater.

The slight effect of the lime on the soil pH was surprising in light of the laboratory tests. Either the lime had not had sufficient time to react with the soil to change the pH, or some other factor or factors were restricting the effect of the lime.

Leaf tissue samples were taken and preliminary analyses indicated sharp reductions in the manganese content of the leaves were achieved by the applications of lime.

Further tests are planned to study residual effects of the lime, and its possible effects on other crops that are grown in the area.

***Left*—A young Brussels sprout plant affected by manganese toxicity. *Right*—effect of dolomite on the growth of Brussels sprouts.**

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