NITRITE VS. AMMONIUM TOXICITIES IN CONNECTICUT GREENHOUSE SOILS

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For several years ammonium nitrogen (NH_4-N) has been blamed for toxicities in greenhouse soils. Symptoms may include chlorotic appearance, slow start, stunting and brown roots. Several articles have been written concerning the problem (Connecticut Greenhouse Newsletter Nos. 21, 30, 39). But some doubt existed. Was it really NH_4-N? Perhaps it was nitrite nitrogen that caused these symptoms.

NH_4-N occurs in soil from fertilizers containing NH_4-N or urea as well as from manures and fresh organic matter. It is oxidized by the soil microflora to nitrites principally by one group of microbes (Nitrosomonas). The nitrites are oxidized to nitrates by another group (Nitrobacter).

If NH_4-N is low, nitrites are almost never found. But if NH_4-N is high, perhaps complete oxidation to nitrates is partially blocked and nitrites accumulate. In the past, commercial soils were not analyzed for nitrites. With the acquisition of automated nitrite analysis equipment in our soil testing laboratory, we could now test for it. An ammonium nitrogen (NH_4-N) reading of 15 ppm or over is considered suspect in causing plant growth reduction or root damage. While 15 ppm NH_4-N is on rare occasions obviously detrimental, in some instances levels above 30 ppm NH_4-N are tolerated by crops.

In the fall of 1971, 25 samples testing 15 ppm NH_4-N or above were received from commercial greenhouses by the soil testing laboratory. Another 55 were received during the winter months. The distribution of the NH_4-N levels of these samples was as follows:

ppm NH_4-N	Fall	Winter	Total
15	8	22	30
20	2	9	11
25	0	7	7
30	5	10	15
Over 30	10	7	17
Total	25	55	80

Of these samples, only one contained more than 0.2 ppm nitrite. A level of 2 ppm is considered probably toxic. The one sample that exceeded this level (testing over 3 ppm) was from geranium stock plants that were severely damaged. The soil analysis was as follows:

Magnesium	7
Potassium	53
Phosphorus	12
Nitrites	3+
Ammonium	15
Nitrate	30
Calcium	210
pH	6.2
Soluble Salts	70

This high nitrite soil had been treated with methyl bromide and the stock plants fertilized with 20-20-20. The Nitrobacter species and other nitrite oxidizers

had apparently been completely eliminated and normal reinoculation had not occurred. Nitrites had accumulated.

It may be noted that for this sample, test values are within recommended levels, except NH_4-N and nitrites. The sample was analyzed November 12, the nitrite analysis made on December 9. By the time of the next sample on December 20, the NH_4-N had dropped to 12 ppm and growth was improved.

The occurrence of toxic nitrites in a sample where NH_4-N was at the minimum toxic level while 50 of the 80 samples contained higher NH_4-N levels indicates a lack of correlation between NH_4-N and nitrites. We can't predict nitrite toxicity just because NH_4-N is high. This is not inconsistent since the two separate steps are necessary to convert NH_4-N to nitrate.

Perhaps we should analyze for nitrites more regularly to determine the frequency with which nitrite toxicity occurs. This is time consuming, expensive and not likely to happen.

The data presented here lends credence to the hypothesis that NH_4-N does cause root damage and/or reduced growth in greenhouse soils. Nitrite toxicity appears to be separate.

To avoid toxicity, it would appear more feasible to restrict the use of ammonium and urea fertilizers during the months following steam or chemical soil treatment and during cold months when soil temperatures are below 60^{o}. For bedding plants or other crops grown on the ground, be especially careful.

Note: The authors express relief that these analyses substantiate previous articles published on NH_4-N toxicity. They also solicit comment from anyone with experience in nitrite toxicities in greenhouse soils.

Can you answer YES to these questions?

BUILDINGS

Is broken glass replaced right away?
Is every stairway well lighted and in good repair?
Is combustible material stored in metal containers?
Are walks in good repair and free of defects?
Are greenhouses designed and built to withstand heavy snow and wind loads?
Are requirements of the William-Steiger Occupational Safety and Health Act complied with?

THINK SAFETY

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