BOILER TREATMENT COMPOUNDS

Jay S. Koths
Extension Floriculturist
and
Roy W. Judd, Jr.
Extension Horticulturist

Just five days after potting, the new growth on some pot mums began to turn a beautiful white. This went beyond the usual chlorosis; the chlorophyl completely disappeared. The only way these plants could stay alive was to draw on food manufactured by the older leaves which did not become chlorotic.

This looked like a response to an herbicide, possibly amino triazole. A test was set up with the same cultivars. Amino triazole treatments produced identical symptoms (Figure 1). But the original plants came from a range where amino triazole had not been used. The potting mix, ProMix B, was free from herbicide contamination.

To check the possibility that the clay pots were contaminated, some pots were emptied and repotted with new cuttings in new ProMix B. These cuttings became chlorotic (Figure 2) when the roots grew to contact the pot. Growth was interesting. In one pot,

Figure 1. Amino triazole induced chlorosis on pot mums.

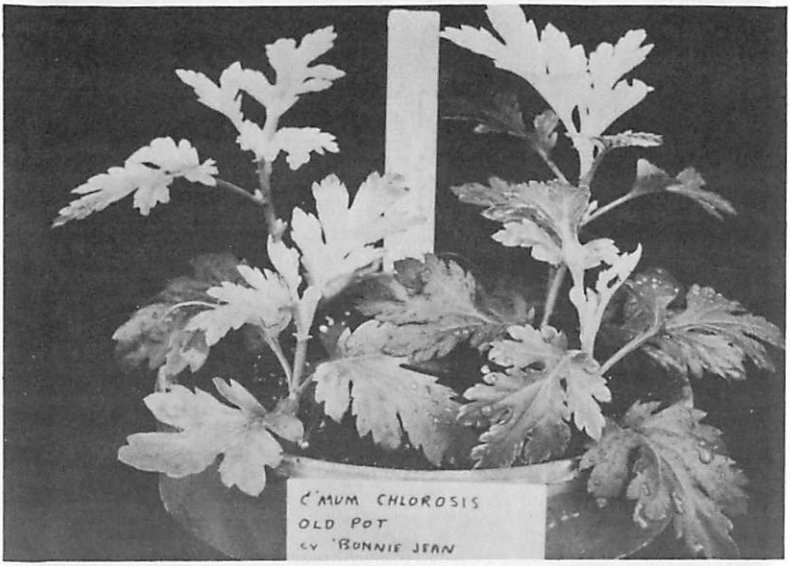

Figure 2. Chlorotic chrysanthemums grown in pot contaminated by leaking steam.

one of the 5 cuttings (Figure 3) escaped. It didn't show chlorosis until three weeks later when it finally became chlorotic.

A couple of pots were set aside for observation. Two or three months later the effect wore thin and weak but more normal growth appeared. From this, two conclusions were drawn. The material was unevenly distributed in the pot and was either leachable or degradable.

At the same time, similar but less severe symptoms were observed on cut mums in ground benches. A row down the middle and the outer rows of the bench were most frequently affected. This aroused speculation that something in the steam might be toxic.

The boiler treatment compound used in this range, Mogul 7300, is an amine formulation used to control

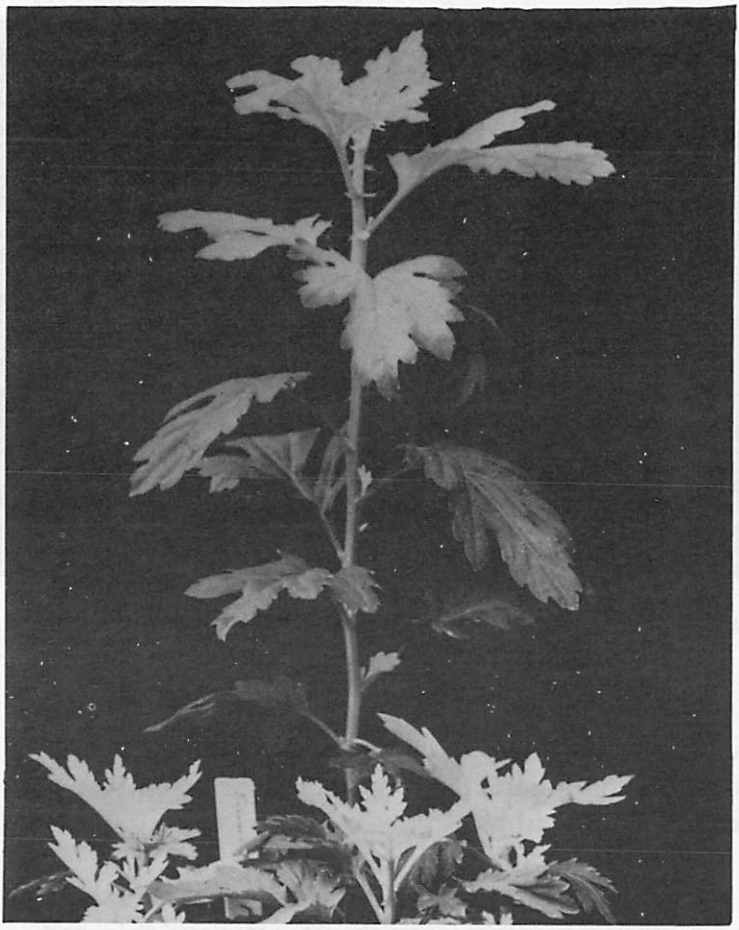

Figure 3. Chrysanthemum 'Bonnie Jean' grown in contaminated pot, the tall plant escaped chlorosis until roots grew around the pot to contact the contaminant.

the pH of the steam condensate. To ascertain the phytotoxicity of this material, it was applied at .001, .01, .1, 1.0 and 10 ml (in 100 ml H_2O) to chrysanthemums growing in a 3(compost):2(peat):1(sand) mixture in 3" peat pots. While at 10 ml the plant died, at 1 ml the plant did survive. This is an extremely high rate and indicates a low level of phytotoxicity. But at lower rates, chlorosis developed.

Distillation and condensation on soil or chemical breakdown was postulated to result in a phytotoxic product. To approximate greenhouse boiler operation, a 10% v/v mixture of Mogul 7300 and water was boiled for 90 minutes, the steam being directed to a half bushel hamper containing 3" clay pots and 2 soil samples (ca 1 liter each) wrapped in cheesecloth. The hamper was loosely but thoroughly enclosed in newspaper. On the following day, rooted chrysanthemum cuttings were planted into this and untreated soil in treated pots.

All plants were affected. A varietal response was noted (Figure 4). 'Southern Sun' became distorted. 'Nimbus' and 'Symphony' showed the typical chlorosis. An unnamed cultivar showed only slight chlorosis.

During these experiments, other reports were noted in the literature. Drummond and Vasiloff reported phytotoxic contaminants in steam in the Abstracts of

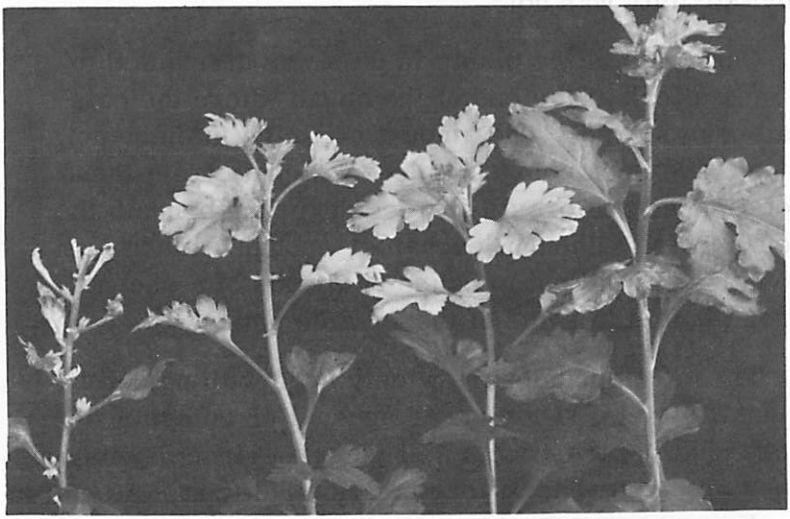

Figure 4. Chrysanthemum response to distillate from Mogul 7300. Cultivars are, left to right, 'Southern sun,' 'Nimbus,' 'Symphony,' and unknown.

the 1974 Annual Meeting of the N.E. Division of the American Phytopathology Society. They indicate that cyclohexylamine or 2hydroxyethylamine might be the toxic chemicals.* Hughes and Sangster reported two instances of phytotoxicity in Grower Notes, Feb. 1975 (Ontario, Canada). The pattern on ground benches was the same; phytotoxicity where the steam was injected and at the edges where the cover was held down. Another instance was observed in Massachusetts by one of the authors.

The heating system in the range where this occurred was designed so that the boiler was actuated directly by the thermostat. This meant that, after firing, the boiler would gradually cool, allowing quantities of the amine to distill over into the steam mains. When the steam was turned on to pasteurize a bench, some of this rather concentrated material probably was injected. Droplets blown in with the steam probably caused the phytotoxicity along the bench edges since condensation should have been rather uniform along the bench but phytotoxicity was not.

Chlorosis of the plants in pots was atrributed to a steam leak at the end of the house where the pots had been stored. The amount of amine in these pots must have been considerable. Leachate from these pots induced chlorosis of weeds growing beneath the bench. And although leachable, enough amine remained in the pot to cause chlorosis of a second crop planted in some of these same pots.

These compounds are widely used with no detrimental effects. Only under unusual circumstances does phytotoxicity occur. If you experience symptoms such as these, check your boiler treatment. As stated earlier, these volatile amines can and should be carefully controlled by a pH test.

*Mr. K. J. Zinkan of The Mogul Corporation, Chagrin Falls, Ohio 44022 stated that several types of volatile amines are available including morpholene, cyclohexylamine and dethylaminoethanol (DEAE).