

Improving Containers Copper is Not the Answer

Carl Whitcomb, Ph.D.

Lacebark Research Farm, 2104 N. Cottonwood Rd. Stillwater, Ok. 74075

Extensive promotion of the use of copper either sprayed on the inside of conventional containers or incorporated into the plastic sidewall has been done and continues to occur. Copper toxicity for the killing of root tips is NOT a practice I endorse.



Consider the following Facts:

- 1) Copper is elemental. It does not break down like most pesticides and other compounds placed in the environment. It started out as copper and will always be copper.
- 2) In order for copper to be effective in causing roots to branch, it MUST be soluble at a level that will KILL root tips by toxicity. It is death of the root tip that removes dominance of the root tip, which allows secondary branch roots to develop. This is the same phenomenon that makes a hedge dense after shearing.
- 3) Huge quantities of copper leach from treated containers into surrounding soil and into runoff water, then into the environment or recycle ponds. When soil in drainage areas from copper treated pots turns blue, copper levels are huge.

Dr. John Ruter with the U. of Ga. Published 'Cross-Country Containers' in American Nurseryman, Feb. 1, 2000. Dr. Ruter noted that "A copper concentration of about 3,000 parts per million not only controlled roots but helped maintain the integrity of the fiber containers". The reason that the fiber pots did not degrade is the fact that copper is toxic to bacteria and fungi that would otherwise cause the fiber to break down. Mycorrhizal fungi that aid growth of most plants are also killed along with other beneficial microorganisms.

Dr. Ruter goes on to say that it would take 8,800 copper treated one-gallon pots per acre to equal a season long application of copper fungicide at the rate of 2 pounds per acre. The problem with this conclusion is that a typical container grower has from 60,000 to 110,000 one-gallon containers per acre. If Dr. Ruter figures are correct, then from 14 to 25 pounds of copper could be applied per acre each year and if the nursery had just 30 acres of plants in one gallons, that would be 420 to 750 pounds of copper going somewhere each year. For plant growth in field soils, 0.5 to 1.0 ppm of copper is sufficient. In 'Trace Elements in Plants and Soils' CRC Press, 1984, they note copper is highly toxic and in the USA, natural levels of copper in soils ranges from 6 to 60 ppm and 100 ppm is the threshold where copper toxicity begins with many species. Beginning with a soil with 30 ppm copper, then by using copper treated pots, within 6 years the toxicity level could be reached. There is no treatment that will return soils to their normal productivity once excess copper accumulates.

- 4) Copper is an essential element for plant growth. However, excess copper is as restricting to plant growth as is a deficiency. The optimum amount of copper for plant growth in container life is quite specific. I was able to obtain USA PATENT # 4,328,025 because I was able to show very specific relationships and interactions between the level of copper and iron, copper and boron and other essential micronutrient elements that were previously unknown. The result of this research and patent is MICROMAX micronutrient fertilizer, originally licensed to Sierra Chemical Co. and now with the

SCOTTS Co. As part of that research, if the level of copper was in proper synchronization with the other micronutrients plant growth was excellent, but if the copper level was higher or lower, plant growth was less but symptoms were visible only with extremes.

5) Copper, when in excess, interferes with the absorption of iron by plant roots, thereby causing copper – induced iron chlorosis. Applying iron to the containers with huge levels of copper provides little benefit, but applying iron directly to the foliage by sprays does help reduce the problem.

6) Copper, when in excess, also interferes with phosphorus and calcium nutrition.

7) Some species of plants grown in copper coated containers are stunted and slow to root-out following transplanting. For example, T.J. Brass and others at Auburn University, *Journal of Environmental Horticulture* Vol. 15, June 1997 reported that Magnolias grown in copper treated containers were shorter and had less trunk diameter versus those in untreated pots and were slower to establish and grow in the landscape. Also, growth of Blue Princess Holly was 19% less in copper treated pots and roots produced in the landscape was less compared to untreated pots. In another paper, T.J. Brass and others at Auburn, *J. Env. Hort.* Vol. 15, Sept. 1997 reported that with flowering dogwood, plants in copper treated pots were shorter and had more slender stems and fewer roots versus untreated pots. Beeson and Newton at the U. of Florida, *J. Env. Hort.* Vol. 10, 1992 reported less trunk diameter growth of sweet gum and weeping willow grown in copper treated pots versus untreated pots.

In my research into copper coating of containers in the early 1970's when the plants were planted into the landscape, then excavated several months later, the root growth out was mostly from the bottom and top of the original container root-ball and very little from the sides. Because I could not get consistent results and often measured stunting, I never published my findings.

8) Copper toxicity to roots does stimulate root branching on some species with naturally fibrous root systems. Unfortunately most of the studies done and photos shown in advertisements are of species with naturally fibrous roots. In the paper by Dr. Ruter, roots are shown of Buddleia, and other test species were Abe-

lia, Gardenia, Euonymus and Juniper all of which have fibrous roots. However, on oaks, bald cypress, ash, red-buds and other legumes and most Viburnums and other species typically NOT with fibrous roots, the benefits to root branching are minimal if at all.



9) Copper toxicity also interferes with terminal bud development. The result is abnormal growth of trees and poor rooting of some cuttings where stock plants were exposed to toxic levels of copper in the roots. *Travel At Your Own Risk* (Published in *NM Pro*, Pages 76-78, February 2001)