COPPER CARBONATE--BOON OR BANE?

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Copper carbonate, a chemical frequently used to repel rabbits from outplanted southern pine seedlings, appears to have caused high seedling mortality in north Mississippi. In a recent test of rodent repellents, loblolly seedlings treated at the nursery with copper carbonate and then baled and shipped to the planting site suffered considerably more first-year mortality than did untreated seedlings. Independent survival counts of copper-treated seedlings planted elsewhere in north Mississippi also showed above normal mortality.

In the test, five separate repellents containing copper carbonate, each mixed with a different emulsifiable sticker, were compared with untreated controls. The repellents were formulated with the recommended concentration of 80 pounds of copper carbonate (55 percent metallic copper) per 100 gallons of water-emulsion mixture, and were applied by high-pressure spray. The treated seedlings were lifted from the nursery beds, packed in Forest Service bales, and transported to the planting site, where they were planted within 48 hours of being baled.

Five hundred seedlings were planted early in December 1957 and an equal number early in January 1958. Individually numbered seedlings were examined at monthly intervals through April 1958 and again at the end of the growing season, in October. The results of these examinations are summarized in table 1.

TABLE 1.--Mortality of loblolly pine seedlings sprayed at the nursery with copper carbonate

Examination date	Copper carbonate in mixture with emulsions of:					Untreated control
	Oil	Wax	Asphalt	Plastic	Latex	
April 1958	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
December planting.....	14	7	26	15	8	0
January planting.....	11	4	13	6	4	0
Total planting.....	13	6	19	10	6	0
October 1958						
December planting.....	19	27	53	40	31	8
January planting.....	58	50	48	35	28	10
Total planting.....	39	38	50	38	30	9

Seedlings treated with copper carbonate in asphalt emulsions, the most frequently recommended repellent, suffered the highest mortality, 50 percent. The copper-latex mixture seemed least harmful, mortality of seedlings treated with it being 30 percent. Although there appeared to be a considerable variation among the sticklers, the differences proved to be statistically nonsignificant. The overall year-end mortality of seedlings treated with copper carbonate averaged 39 percent, whereas that of the untreated seedlings averaged 9 percent.

In April 1958, an examination was made of some nonstudy seedlings (planted during December 1957 and January 1958) to determine the extent and severity of what at first

appeared to be cold-weather damage. The seedlings had been treated with the copper-asphalt rabbit repellent. Of the more than 2,500 seedlings examined in April, 37 percent were green, 38 percent were brown but had green buds, and 25 percent were dead. By October, 57 percent of the brown seedlings and 26 percent of the green seedlings had died--a total year-end mortality of 58 percent.

Another independent measurement of mortality associated with the copper carbonate repellent was found in the survival figures of seedlings planted on the Yazoo-Little Tallahatchie flood prevention project during the 1957-58 planting season. Over 5,500 seedlings planted from December 1957 to March 1958 were examined in October 1958. The mortality averaged over 36 percent for the entire planting season. This figure and the "cold-weather" mortality of 58 percent substantiate the findings of the repellent test.

One unusual feature, apparent in April and associated with these high mortality rates, was browning. This is somewhat similar to winter kill.

Though copper carbonate is quite insoluble in water, it appears that toxic doses can be assimilated over a prolonged period in a saturated environment. Baling seedlings for storage or transport seems to provide such an environment. Duncan and Whitaker[1] reported virtually no injury to slash pine seedlings treated with the, copper-asphalt repellent shortly before planting but noted serious injury to those that had been treated and then baled for several days prior to planting.

It appears that copper carbonate should not be applied to seedlings in the nursery. Its use should be reserved for on-site applications by top-dipping or spraying. Where nursery application is the only measure deemed economically feasible, compounds other than copper carbonate should be used.

[1] Duncan. D.A.. and Whitaker, L.B. Repellents reduce cattle browsing on pines. U.S. Forest Serv. South. Forest Expt.. Sta. South. Forestry Notes 119. 1959.