which consists of a gallon jug inverted into a holder with a tube and nipple attached.

With this system, the milk is in the nipple so the lambs need to suck only slightly to get a milk flow. The lamb learns to nurse immediately after being held to it once or twice.

The separation of the milk—fat to the top and some of the milk solids to the bottom—has been a problem, even with the newer lamb replacers. This problem was eliminated with this system. The lamb's nursing produces a vacuum in the jug and when the lamb releases the nipple, air bubbles up thus mixing the milk.

The nipple assembly is a Lam-Bar nipple and tube slipped onto a $\frac{5}{16} \times 4$-inch tube bent at a 90° angle. This is then put through a No. 6 one-hole rubber stopper which fits most 1-gallon jugs. The nipple is placed within the pen at approximately the neck level of the jug, about 14 inches from the floor.

A stirring rod attached to an electric drill (see photo) makes an effective method of mixing dry milk powder with water. If a faucet is installed close to the bottom of the mixing container (plastic garbage can or a 120-pound grease barrel, as shown in photo), the jugs can be filled easily without awkward dipping or pouring.

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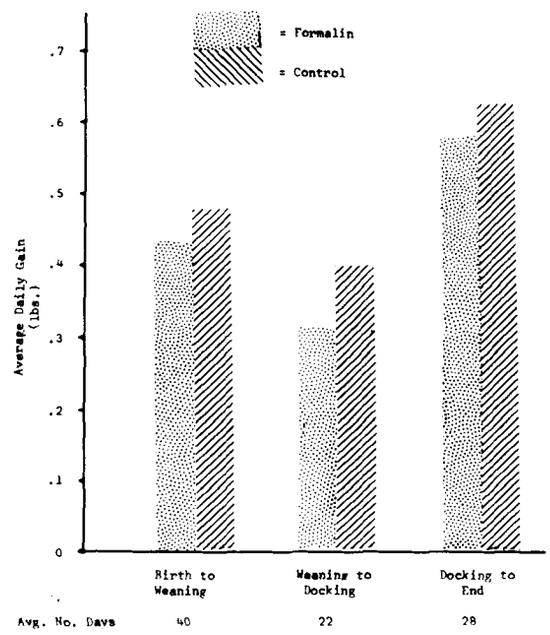
AVERAGE DAILY GAIN BETWEEN BIRTH AND WEANING, WEANING AND DOCKING AND DOCKING TO END OF EXPERIMENT FOR FORMALIN-TREATED AND CONTROL ORPHAN LAMBS ON BOTTLE FEEDING



CHEMICALLY CONTROL ROOT GROWTH IN CONTAIN

TOK FURUTA W. CLAY JONE

Copper naphthenate, or copper sulfate, in a suitable carrier appears useful to eliminate growth of roots on the surface of the root ball of nursery plants in containers. Neither chemical presented a problem with soil ball integrity when transplanting, nor did they inhibit root growth following transplanting. While uptake was not determined, phytotoxicity due to excess copper uptake was not observed.

TWO COPPER COMPOUNDS previously reported to "pinch" roots—copper naphthenate and copper sulfate—and four herbicides known to influence root growth were used to determine their effect on root and top growth of plants grown in containers. The sides and bottom of 1-gallon plastic containers were coated with each chemical. Various dosages were tested. While the containers were wet, they were filled with a soil mixture consisting of 50% loam soil, 23% redwood shavings, 13.5% sand and 13.5% peat moss. Test plants of *Eucalyptus viminalis* or *Jacaranda acutifolia* were then planted.

Following 10 weeks of growth in the 1-gallon containers, plants were harvested for determination of root and top growth. The root systems were divided into two parts—those roots on the surface of the root ball, and the remainder—and the dry weight of each part determined separately. The tops were measured for linear growth and the dry weight of the total growth was determined.

At the same time, plants were transplanted into untreated 5-gallon containers to determine the influence of the chemical treatment on subsequent growth of roots and tops. It was of particular interest to determine the growth of roots from the 1-gallon root ball.

Growth in 1-gal containers

Visual inspection during the test and data on root growth in the 1-gallon containers treated with the two copper compounds confirmed that both chemicals were effective in preventing growth of roots on the surface of the root ball for both species tested (photos 1 and 2 and table 1). Of the two, the copper naphthenate treatment appeared to be slightly more effective. The copper sulfate was mixed with Wilt-Pruf, a polyvinyl chloride material that is used as an antitranspirant. Some surface roots appeared on these copper sulfate-treated containers. These roots were limited in extent and were usually enlarged. It is likely that incomplete coverage caused this development.

The herbicide treatments were not as effective as the copper compound treatments in preventing the growth of roots on the surface of the soil ball. Also, species variations in reactions to the various herbicides were observed. Plants of *Jacaranda acutifolia* were more sensitive to the chemicals than the plants of *Eucalyptus viminalis*. Significant reductions in the amount of surface roots of Jacaranda occurred with all the materials. However, only one herbicide was ef-

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fective on the Eucalyptus plants. None of the herbicide treatments completely eliminated the development of roots on the surface of the soil ball.

Growth of the tops of the plants was influenced by the chemicals. Dry weight of tops of Eucalyptus plants grown in copper naphthenate-treated containers was less than that of the control plants. The plant height was also significantly affected. This appeared to be more a result of the reduction of the root system than toxicity. Uptake of copper by either plant was not determined, but visual symptoms of acute toxicity were not noted.

Growth in 5-gal containers

Growth of roots out of the 1-gallon ball into surrounding soil was inhibited by one of the herbicides used, resulting in an overall smaller root system with Eucalyptus plants. Otherwise, the root growth from the 1-gallon soil ball did not appear to be influenced by the chemical treatment of the 1-gallon container.

Growth of the tops of the plants, especially Jacaranda plants, in the 5-gallon containers was correlated somewhat with the chemical treatment of the 1-gallon containers. Smaller tops were noted, especially following some of the herbicide treatments. Influence on root growth was also noted.

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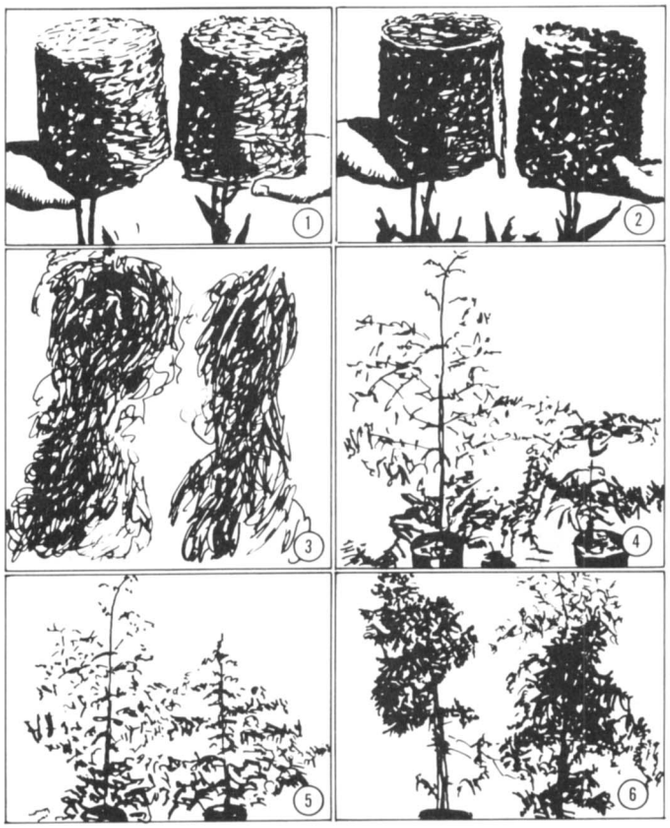

COVER PHOTO

Photo 1. Root system of Eucalyptus viminalis **grown in containers treated with copper naphthenate. (Control of plants in entire photo series are to left.) (2) Root system of** Eucalyptus viminalis **plants grown in containers treated with copper sulfate with Wilt-Pruf as the carrier. (3) Root system of** Eucalyptus viminalis **plants transplanted into 5-gallon containers from 1-gallon containers treated with copper naphthenate. (4) Top growth of Eucalyptus plants in 1-gallon containers treated with copper naphthenate. (5) Top growth of Eucalyptus plants in 1-gallon containers treated with copper sulfate plus Wilt-Pruf. (6) Top growth of Eucalyptus plants transplanted into 5-gallon containers from 1-gallon containers treated with copper naphthenate.**

TABLE 1. GROWTH OF PLANTS IN 1-GALLON CONTAINERS TREATED WITH VARIOUS CHEMICALS TO CONTROL ROOT GROWTH

Plant species	Treatment	Total root wt	Surface root wt	Top wt	Top ht
		gm	gm	gm	cm
Eucalyptus viminalis	Control	3.92	1.56	17.86	103.8
	Herbicides	2.78	0.95	16.30	101.2
	Copper Naphthenate	2.68	0.16	11.90	95.4
Jacaranda acutifolia	Control	1.86	0.56	6.68	30.6
	Herbicides	1.82	0.19	5.63	31.0
	Copper Naphthenate	1.90	0.00	5.10	30.6

TABLE 2. GROWTH OF PLANTS TRANSPLANTED FROM TREATED 1-GALLON CONTAINERS INTO UNTREATED 5-GALLON CONTAINERS

Plant species	Treatment	Total root wt	Top wt	Top ht
		gm	gm	cm
Eucalyptus viminalis	Control	51.0	163.0	178.4
	Herbicides	47.6	154.1	165.7
	Copper Naphthenate	85.0	171.2	163.6
Jacaranda acutifolia	Control	46.2	69.0	74.0
	Herbicides	24.3	56.3	73.9
	Copper Naphthenate	25.2	59.2	70.4