Captan and Malathion Used

Pesticide Treatments on Saligna Eucalyptus, Australian Toon Seedlings Affect Dieback But Not Survival

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Treatment with dif'ering rates o f Captan and Malathion did not significantly affect survival o f Australian loon and Saligna eucalyptus seedlings in a Hawaiian nursery study. But dieback and related height growth were a different story....

Australian toon *(Toona australis)* and saligna eucalyptus *(Eucalyptus saligna)* are the main species grown at the Hawaii State Tree Nursery for reforestation. Before seedlings of these and other species are shipped throughout the State, they are dipped in a chemical solution to kill fungi and insect pests. The solution is made up of 2 pounds of Captan-40W (a fungicide) and 1 quart of Malathion-57% (an insecticide) per 100 gallons of water: Broad experience with field planting these species bare-root in Hawaii indicates that survival rate is generally good for Australian toon, but poor for saligna eucalyptus. Both species suffer dieback after field planting. The cause of the mortality and dieback is not known, but the pesticide treatment may be involved.

To find out whether pesticide treatment affects survival, dieback, and growth of tree seedlings shipped from the nursery, bare-root Australian toon and saligna eucalyptus seedlings were treated with different rates of Captan, Malathion, and combinations of these pesticides.

Survival of both species was not affected by pesticide treatments. But Captan and the Captan-Malathion combination affected dieback in Australian toon, though not the saligna eucalyptus. Height differences were related to dieback.

Methods

Typical State Tree Nursery seedlings of Australian toon and saligna eucalyptus were lifted for this study, which required 520 seedlings of each species. The seedlings were randomly sorted by species into 13 bundles of 40 individuals each. One bundle of each species was given one of 12 pesticide treatments (table 1). The control bundle for each species was dipped in water. The treating process involved fully immersing each bundle in a solution,- and making sure that all seedlings in the bundles were treated.

All seedlings were planted in nursery beds within 1 hour after being lifted and treated. The soil was moist from watering the day before. About 2 hours after planting, when the chemical had dried on the seedlings, the beds were sprinkler irrigated.

The experimental layout was the same for each species-a randomized complete block design: four blocks for each species; each block held 13 plots of 10 trees each. Spacing was about 1 foot by 1 foot.

Seedling heights were measured on the day of planting and after 1 and 2 months. For saligna eucalyptus only, crown density was rated "full," "normal," or "sparse" on the day of planting. Vigor and dieback were recorded after 1 and 2 months.

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Results and Discussion

Australian Toon

Survival-Seedling survival was *not* affected by the pesticide applications-only 1 seedling of the 520 seedlings planted died (Table 1).

Dieback-An overall average of 35 percent of the seedlings treated with Captan, Malathion, or Captan-Malathion pesticides died back, 15 percent more than the control seedlings. The number of seedlings which died back varied significantly (1 percent level of statistical significance) among the different pesticide treatments, but this difference was not related to concentration (table 1).

The Captan treatments-as a group-caused the most dieback, averaging 41 percent. Dieback varied with different Captan treatments (table 1). The number of stems which died back was significantly (5 percent level) greater for the standard (x) concentration than for the other concentrations. Differences among the 2x, 1/2x, and 1/4x concentrations were not significant.

An average of 28 percent of the seedlings treated with Malathion died back, with little variation between treatments. However, none of the Malathion treatments resulted in significantly different seedling dieback from the control group.

The Captan-Malathion treatments caused dieback in 37 percent of the seedlings (about midway between the effects of Captan and Malathion used separately). Dieback ranged from 10 percent for seedlings given 1/4x concentration to 62 percent for seedlings given the 2x concentration-a significant difference (1 percent level). Dieback percentage for the standard (x) and the 1/2x concentration was about midway between that for the 1/4x and the 2x concentrations. Combining Captan and Malathion appeared to have an additive effect only at the 2x concentrations-where the effect of the combination was greater than that of either pesticide individually.

Extent of dieback on a stem and the concentration of pesticide applied were not related. Some seedlings died almost back to ground level; others died back only slightly before new growth began. Once

TABLE 1.—*Survival, height differences, and dieback of Australian toon and saligna eucalyptus seedlings 2 months after being dipped in pesticide solutions and planted*

Pesticide treatment[1]	Australian toon			Saligna eucalyptus					
	Seedling survival	Height difference	Seedling dieback	Seedling survival	Height difference	Seedling dieback	Crown density[2]		
							Full	Average	Sparse
	(*Percent*)	(*Inches*)	(*Percent*)	(*Percent*)	(*Inches*)	–	– – (*Percent*) –		– –
Captan 2x	100	-0.5	45	40	6	56	45	40	15
Captan x	100	-2.0	53	12	3	80	20	48	32
Captan 1/2x	100	-0.9	25	25	2	90	35	38	27
Captan 1/4x	100	-1.5	40	12	3	100	25	38	37
Malathion 2x	100	-0.6	22	22	4	78	35	35	30
Malathion x	100	-0.2	30	10	5	75	8	35	57
Malathion 1/2x	100	-0.5	35	30	6	83	35	45	20
Malathion 1/4x	100	-1.0	25	25	3	100	38	32	30
Captan-Malathion 2x	100	-2.2	62	28	2	91	10	40	50
Captan-Malathion x	100	-1.2	40	10	3	75	10	50	40
Captan-Malathion 1/2x	100	-1.4	38	28	3	81	48	35	17
Captan-Malathion 1/4x	100	-0.2	10	8	6	100	22	48	30
Control[3]	98	-0.3	20	20	2	100	13	55	32

[1] x = standard concentration of the fungicide Captan (2 lbs./100 gal. water) or of the insecticide Malathion (1 qt./100 gal. water).

[2] At time of planting.

[3] Dipping in water only.

growth began, the effects of dieback became obscure.

Growth-All seedlings were rated "vigorous" at 2 months. However, in all cases, seedlings in a treatment were on the average shorter than when they were planted (ta

ble 1).

Saligna Eucalyptus

Survival-Captan and Malathion do not cause poor survival rates in saligna eucalyptus. The control seedlings had 20 percent survival, about the average rate for all treat

ments combined (table 1). Survival rates ranged from 8 percent for the seedlings given one-fourth the regular concentration of Captan-Malathion to 42 per cent for those given twice the regular concentration of Captan.

During planting, I observed that some seedlings had no leaves, while others had many. Top-pruning several weeks before was the apparent cause of crown variations. Before top-pruning, the tall seedlings had many leaves, mostly on the upper part of the stem, but after top-pruning few leaves remained. Shorter seedlings were not as affected by top-pruning and generally had normal to full crowns.

Survival was directly related (1 percent level) to the number of leaves present when planted:

Crown density	Seedlings (*No.*)	Survival (*Pct.*)
Full	137	31
Normal	216	23
Sparse	167	10

The number of seedlings in each crown density category given a particular pesticide treatment was random. The high survival rate of

normal or full crowns. The lack of significant relationship suggests that the crown density of the seedling at the time of planting was more important than the concentration of the pesticides. Even with many seedling leaves present at the time of planting, however, survival rate was far less than acceptable. The cause of this mortality was not determined.

Dieback-About 85 percent of all saligna eucalyptus stems died back - ranging from 56 percent for seedlings given the Captan 2x treatment to 100 percent for those treated in other ways: Captan 1/4x, Malathion 1/4x, Captan-Malathion 1/4x, and control (table 1). However, dieback apparently was not caused by the pesticide because there was 100 percent dieback in the control group and in the seedlings treated with the weaker concentrations of pesticides. As a matter of fact, the Captan treatments may have reduced dieback; dieback increased as the Captan concentration decreased. Dieback could have been caused by a fungus introduced by top-pruning, and may have been partially controlled by strong Captan solutions.

Growth-All surviving saligna eucalyptus seedlings grew taller in the 2 months of the test. The average height increase over the original average height ranged from 2 to 6 inches (table 1). Net growth depended on the number of seedlings which died back, extent of dieback on each stem, and growth of seedlings that did not dieback. Neither the number of seedlings which died back nor extent of dieback on each stem was related to pesticide treatment.

Conclusion

The Captan-Malathion solution used before seedling packing causes dieback of Australian toon seedlings. If a weaker solution will accomplish the objective for avoiding fungi and insect pests, it should he used. If not, another treatment that accomplishes the objective without damaging the seedlings must be found.

The pesticides were not a significant factor in the generally poor survival of saligna eucalyptus seedlings. Survival is apparently related to the vigor of the seedlings at the time of planting. Survival rate for seedlings with good crowns was significantly higher than for those with nominal crowns. However, survival of seedlings with good crowns was still far below an acceptable level. Until improved techniques or treatments are developed, nurserymen can expect poor survival on field plantings of bare-root saligna eucalyptus.