CYCOCEL EFFECTIVELY RETARDS NURSERY HEIGHT GROWTH OF *EUCALYPTUS GRANDIS*

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Sometimes nursery stock must be sown earlier or held later than desired. How to limit seedling growth without affecting outplanting performance a serious problem for nurserymen. Soil drenches containing Cycocel, a growth retarding chemical, kept *Eucalyptus grandis* seedlings from growing too tall during an extended nursery season, and subsequent field growth was not retarded significantly.

Growth retardants are synthetic compounds, temporarily restricting height growth without deforming plants. Cell division, and probably cell elongation, slow down just below the terminal growing point, resulting in compact plants with shorter stem sections between leaves. Unlike growth inhibitors, retardants should not reduce the number of leaves or alter stem dominance. Cathey [1] published a complete review of growth retardants.

We tested Cycocel and another retardant, Phosfon, as soil drenches and foliar sprays (table 1) . Phosfon retards a limited number of species, acts at low concentrations, and persists in the soil. It was ineffective in our tests. In contrast, Cycocel leaches readily and retards numerous species, but many species require high concentrations. We found it effective on this species as a drench. Both products are sold to produce compact growth of potted ornamentals.

[1] Cathey, H. M. Physiology of growth retarding chemicals. Annu. Rev, of Plant Physiol. 15: 271-302. 1964.

When initially treated in April 1964, seedlings were 3 months old, about 17 centimeters tall, and potted in quart containers. Five seedlings, constituted a treatment plot in a randomized-block design with three replications.

TABLE 1.—*Height-growth retardant treatments*

Treatment abbreviation	Chemical	Active ingredient concentration
		Grams per sq. ft. of soil surface
Soil drenches:		
CD–3	Cycocel	3.0
CD–10	_____do._____	10.0
CD–25	_____do._____	25.0
PD–.1	Phosfon	.1
PD–.5	_____do._____	.5
PD–1.0	_____do._____	1.0
		Grams in 100 ml. of finished solution
Foliar sprays:		
PS–.05	Phosfon S [1]	0.05
PS–.1	_____do._____	.10
PS–.2	_____do._____	.20
CS–.1	Cycocel	.10
CS–.3	_____do._____	.30
CS–.6	_____do._____	.60
Untreated	—	—

[1] A compound designed to be less toxic to leaves than Phosfon.

Treatments Reapplied to Unresponsive Seedlings

After initial applications, we measured seedling height weekly and reapplied treatments where growth seemed unchecked. We reapplied any treatment if seedling growth in the current week exceeded average growth for past weeks, or if treated seedlings exceeded untreated seedlings in either current or cumulative growth.

This system defined retardation periods for effective treatments and gave ineffective treatments every opportunity for retardation through repeated application. We applied nonretarding treatments as many as 9 times in 10 weeks, and strongly retarding treatments only once or twice.

Sprays Injurious

Six weeks after initial application, we discarded sprayed seedlings because of excessive chemical injury. Leaves sprayed with Cycocel had upturned margins, yellow mottling, and reddish-purple spots.

Leaves sprayed with Phosfon S showed tip and marginal burn, dead spots, and reddish-purple blotches. Leaves produced after Phosfon S spraying were crescent shaped and puffy or quilted between main veins. Both sprays caused twigs and buds to shed, yet neither significantly reduced growth.

Cycocel Drenches Retard Nursery Growth

Drench treatments, applied as t/-inch irrigations (50 milliliters per pot), caused no visible injury.

Cycocel drenches bracketed the range of effective concentration. Five applications of CD-3 failed to significantly retard height growth, but CD-10 (applied twice) cut growth in half, and CD-25 (applied once) reduced growth two-thirds (table 2). The abnormal leaning of two seedlings suggested that CD-25 approached toxic concentration (fig. 1).

Cycocel drenches also significantly reduced stem diameter (table 2). Since statistical analysis revealed no significant changes in height-diameter quotients, both height and diameter reductions seem proportional to normal development.

Short internodes characterized Cycocel-retarded seedlings. CD-10 plants had internodes only half as long as untreated seedlings, and CD-25 internodes only one-third as long (table 2). In addition, CD-25 also reduced the number of internodes and, therefore, the number of leaves. In proper concentration, growth retardants should not restrict development of leaf, bud, or flower. Curtailed leaves indicate excessive concentration in the CD-25 treatment.

Apparently too low in concentration, Phosfon drenches affected neither height growth, root collar diameter, internode length, nor number of internodes.

TABLE 2.—*Mean nursery development of drenched seedlings*

Drench treatment	Height growth	Root collar diameter	Internode length	Internodes
	Cm.	*Mm.*	*Cm.*	*Number*
Untreated	19.3	5.8	1.4	13.3
Cycocel:				
CD–25	5.9**	4.1**	.5**	9.0*
CD–10	9.1**	4.8*	.8**	11.1
CD–3	16.7	5.0*	1.2	13.1
Phosfon:				
PD–1.0	18.4	5.5	1.3	12.8
PD– .5	20.1	6.0	1.5	14.0
PD– .1	17.5	5.8	1.3	12.8

* Significantly smaller than untreated mean at the 5-percent confidence level as determined by Duncan's multiple range test.

** Significantly smaller than untreated mean at the 1-percent confidence level as determined by Duncan's multiple range test.

Retardation After Outplanting?

In July, three months after initial application, we outplanted drenched and untreated seadlings. During the next six months, height growth ranged from 5.2 feet among CD-25 trees to 6.4 feet for untreated seedlings (fig. 2). This difference was not significant. A January freeze killed the trees almost to ground level. But within seven months resprouts ranged from 6.8 feet tall for untreated seedlings to 5.6 feet for the PD-1 seedlings-again, not a statistically significant difference.

Seedlings growing 5 feet in 6 months are obviously not substantially retarded. Yet, slight, nonsignificant growth differences (fig. 2) might result

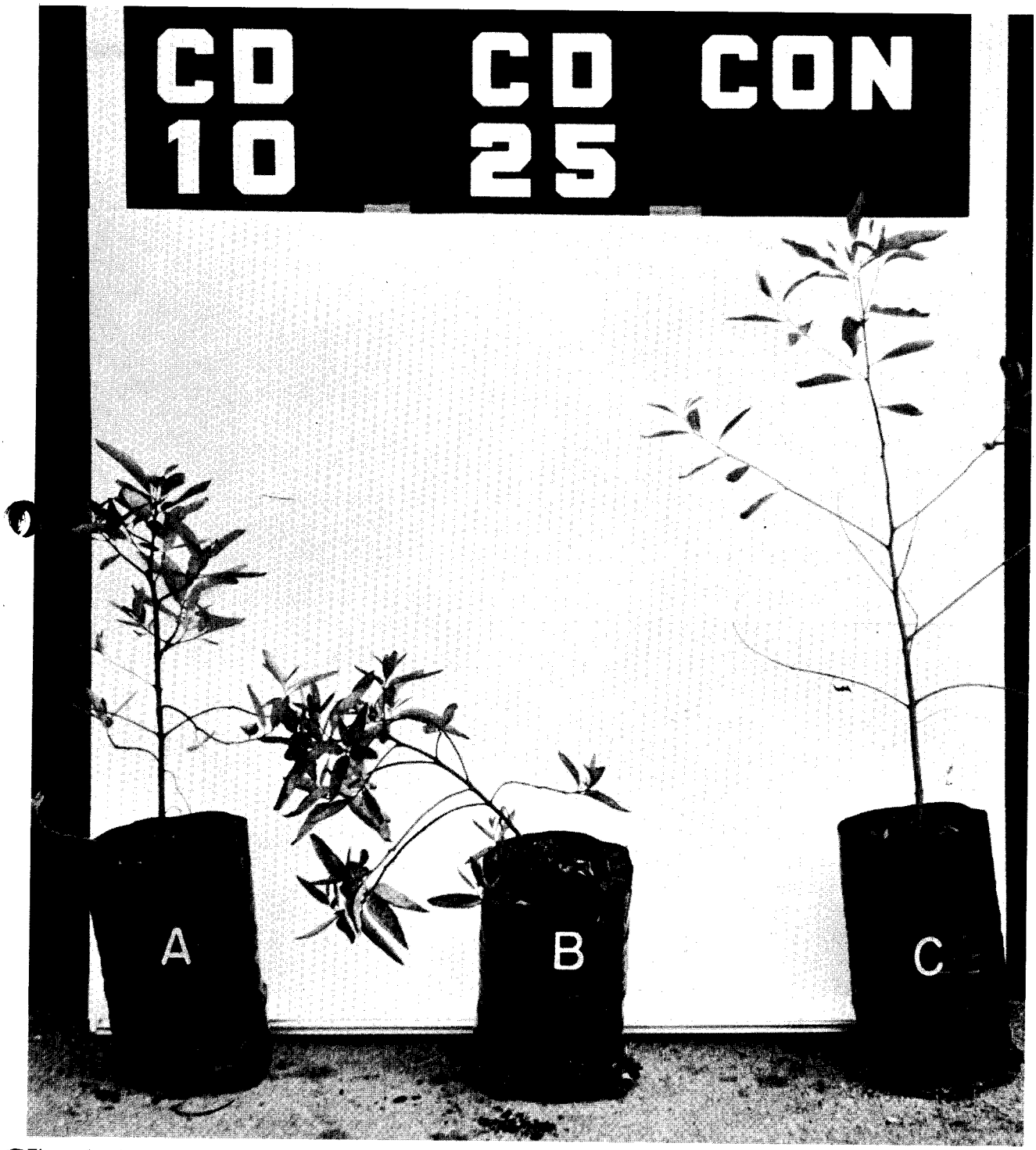

Figure 1.—A retarded, Cycocel-treated seedling, *A*, is compared to an untreated seedling, *C*. Leaning seedling, *B*, is one of two in the CD-25 treatment, suggesting near-toxic concentration.

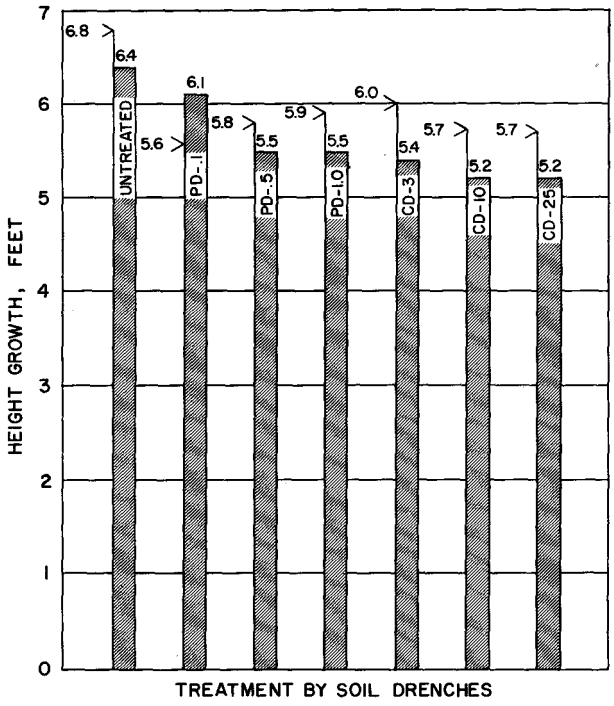

Figure 2.—Bars represent 6-month height growth from outplanting in July until a hard freeze in January. Tick marks denote average height of resprouts 7 months after the freeze.

from absorbed retardant or retardant present in container-grown rootballs.

At 17 centimeters tall, seedlings were more than half the desired outplanting height before we began retardant treatments. Applied to smaller seedlings earlier in the nursery season, retardants might be effective at lower concentrations, and the seedlings have less absorbed retardant carried into the field.

Chemical retardants are currently too expensive for open seedbeds. But they might be useful for seedlings that must be started in seedflats earlier than desired and later transplanted to pots or beds. For example, some eucalyptus germinate best in cool weather, yet require summer outplanting to avoid frost damage. Locally, this requires starting seedflats in early spring and trying to retard seedlings through the droughty spring until summer rains provide outplanting moisture. In this and similar situations, perhaps seedlings could be economically retarded in the seedflats by dipping the flats in vats of reusable retardant solution. This would permit the maximum seedlings treated per square foot with a minimum of retardant solution.