ROOTING OF *LIQUIDAMBAR STYRACIFLUA* CUTTINGS

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ABSTRACT

Past experience and current research on the rooting of sweetgum cuttings (**Liquidambar styraciflua** L.) is scanty. Sweetgum is a difficult-to-root species. Better results have been obtained with root cuttings than with shoot cuttings. Rooting success seems to vary with growing season and age of the tissue. A current study shows promise in certain combinations of root stimulants, shoot growth inhibitors, fungicide and sugar.

INTRODUCTION

American sweetgum (*Liquidambar styraciflua* L) is the only species of the genus *Liquidambar* native in the New World. It ranges from Connecticut south to central Florida and eastern Texas and as far west as Missouri, Arkansas, Oklahoma, and southern Illinois; it also occurs in scattered locations in Mexico and Central America.

Sweetgum occurs on various soils and sites but grows best on rich, moist, alluvial clay and loam soils of river bottoms. One of the important commercial hardwoods in the United States, sweetgum is used for pulpwood, lumber and decorative plywood panels. With its straight bole, pyramidal crown, and brilliant autumnal foliage, sweetgum is also a desirable ornamental tree.

REVIEW OF LITERATURE

Since individual clones provide genetically uniform populations, they are desirable material for studies dealing with physiological processes, pathology, environmental adaptations, or simply for propagation and perpetuation of certain forms or variations of a species. In spite of the economic importance of American sweetgum, the literature on its vegetative propagation is very scanty, probably because of the many failures.

Although sweetgum reproduces itself naturally by root suckers and stump sprouts it is difficult to propagate by rooted stem cuttings. Grafting and air-layering are logical substitutes for cuttings, though more tedious and expensive. Bonner (1963) reported successful air-layering of low lateral branches on 5 to 20-year-old sweetgum trees. June appeared to be the best time of year to initiate air-layering; the corresponding success values for April, June and August were 14%, 20% and 6% respectively. Indole-butyric acid (IBA) did not stimulate root formation to an important extent; an average success of layers with IBA was about 17% as compared with 14% of the controls. The

research group at North Carolina State University at Raleigh resorted to grafting after attempts to root limb cuttings of sweetgum had failed almost completely (R. C. Kellison, pers. comm.). They have used side grafts for a number of years with success ranging between 65% and 80%.

Brown and McAlpine (1964) used root cuttings of three-year-old seedlings and 20-year-old trees to propagate sweetgum clones. In mid-July, 10-cm sections of tap roots of seedlings and of lateral roots of three older trees were placed vertically in a 1 : 1 mixture of fine sand and peat. High relative humidity was maintained by mist from adjacent parts of the propagation bed. After 90 days, about 90% of seedling root cuttings had budded, while average budding of root cuttings for the individual older trees was 73%, 20% and 93%. Cuttings from the seedlings produced more buds from each cutting, earlier, and with faster-growing shoots than those from older trees. The authors concluded that the small success of budding in cuttings from tree 2 indicated that it had a low inherent ability to propagate vegetatively. They also concluded that in this experiment kinetin did not have an apparent effect in stimulating earlier, more numerous adventitious buds.

The only known literature on the propagation of sweetgum by shoot cuttings is the use of softwood stem cuttings by Farmer (1966). He reported on successful rooting of softwood cuttings taken from suckers cultured on excised lateral root of trees 7 to 85 cm d.b.h. and from naturally occurring root suckers from a previously clearcut stand. The root sections for culturing suckers were 40 to 80 cm long and 10 to 60 mm in diameter. They were collected in May and planted in nursery beds one to two cm deep. Suckers were produced from mid-July until early September. Cuttings were made from apical portions of suckers when they were 5 to 10 cm high. One of the paired cuttings was soaked for 24 hours in 50 ppm IBA solution in water; the second member served as a control. Paired cuttings were planted in clay pots filled with either sand or 1 : 1 mixture of sand and peat, and the pots were placed in a chamber under a mist of distilled water.

The results of five tests initiated between the middle of August and early September are presented in Table 1. Sand-peat mixture was superior to pure sand as a rooting medium; rooting success was 67% to 100% and 0% to 67%, respectively. IBA did not increase rooting. Cuttings from naturally occurring suckers rooted as well as those cultured in nursery beds. The age of the trees producing suckers did not affect the success of rooting.

TABLE 1—Rooting of greenwood sweetgum root suckers at 6 weeks as affected by rooting medium and IBA. (Farmer, 1966).

Test Number	Sand-peat		Sand	
	Control	IBA	Control	IBA
	— — — — — — — — Percent — — — — — —			
1	100	93	0	0
2	100	100	44	67
3	83	100	0	50
4	91	91	7	7
5	67	72	0	25

CURRENT STUDIES

To assess the current work on vegetative propagation of sweetgum by shoot cuttings, about 30 inquiries were sent to researchers within the natural range of this species. Apart from my work at Stephen F. Austin University the only research on vegetative propagation of sweetgum is being done at the University of Georgia by C. L. Brown and P. P. Kormanik; they will report in their own paper. My preliminary findings are summarised here.

Our propagating benches are maintained in an air-conditioned greenhouse. The temperature of rooting media, consisting of either coarse builder's sand or of 1 : 1 vermiculite-perlite mixture, is maintained at 25°C by heating cables. A 75-cm transparent polyethylene structure was built over the benches to maintain high humidity produced by automatic mist nozzles working for five seconds every ten minutes.

Three hundred cuttings were collected in mid-October from three-year-old trees growing in our nursery. Lateral branches were cut into five 10-cm sections. The consecutive sections of a branch were numbered 1 to 5 beginning with the base. The foliage was retained on half of the cuttings and was stripped off the remainder.

Bases of the cuttings were dipped in rooting powder consisting of powdered talc with various mixtures of IBA, 1-phenyl-3-methyl-5-pyrazalone (PMPZ), sugar, Captan 50W (50% wettable powder) and B-9 (N-dimethylamino-succinamic acid) as indicated in Table 2.

TABLE 2—Concentration of various ingredients in talc used as powder for basal dipping of sweetgum cuttings.

Treatment	IBA	PMPZ	Sugar	Captan 50W	B-9
	— — — — — — — — Percent — — — — — — — —				
1	1.0	1.0	10.0	10.0	1.0
2	0.8	0.8	0.0	0.0	0.0
3	0.8	0.0	10.0	5.0	1.0
4	1.0	1.0	20.0	5.0	1.0
Control	0.0	0.0	0.0	0.0	0.0

Because the stripped cuttings failed to root regardless of treatment, Table 3 summarizes only the results of cuttings on which foliage was retained. Control cuttings with retained foliage (treated only with talc) also failed to produce any roots. Rooting in the four remaining treatments ranged between 20% and 40%. With the exception of treatment of 4 in sand, rooting media did not seem to affect rooting percentage.

The closeness of a cutting to the tip of the branch seemed to be a very important factor in all successful treatments. Rooting percentage was highest in cuttings from the tips, decreasing gradually to nil in cuttings from the bases of the branches.

A similar relationship was found in another experiment using stem cuttings from dormant one-year-old sweetgum seedlings. Rooting percentages for dormant cuttings from apical, middle and basal stem sections were 20%, 2%, and 4%, respectively, after six weeks in the propagation bench.

TABLE 3 — Rooting percentages of cuttings with retained foliage

Origin of cutting on a branch	Sand medium					Vermiculite-perlite medium					Both media all treatments
	Treatment*				Control	Treatment*				Control	
	1	2	3	4		1	2	3	4		
	Percent										
1 (Basal)	0	0	0	0	0	0	0	0	0	0	0.0
2	0	0	0	50	0	16	0	16	33	0	11.7
3	16	16	16	33	0	16	16	50	33	0	20.0
4	33	50	33	83	0	33	50	50	16	0	35.0
5 (Apical)	66	33	50	33	0	50	33	50	33	0	35.0
All Sections	23	20	20	40	0	23	20	33	23	0	20.3

*Concentrations of treatment ingredients are presented in Table 2.

CONCLUSIONS

On the basis of the very skimpy literature and scant current work the following conclusions can be made about the propagation of sweetgum by rooting of stem cuttings:

1. Sweetgum is a difficult-to-root species.
2. Shoot cuttings are more difficult to root than root cuttings.
3. Cuttings with foliage root better than cuttings stripped of foliage.
4. The time at which cuttings are set may play an important role in stem rooting.
5. Success in rooting seems to decrease with age of the tissue.
6. Conventional root initiation stimulators do not seem to stimulate rooting when used singly, but there seems to be promise in certain combinations of root stimulants, shoot growth inhibitors, fungicide and sugars.
7. Cuttings from certain individual plants are harder to root than those from the others.
8. Much more work is needed before reliable methods can be developed.

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