VEGETATIVE PROPAGATION OF FOREST TREES

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During the past several years I have had success in rooting a number of trees and shrubs generally considered difficult to propagate vegetatively. My success has been due mainly to the response of these plants to treatments with concentrated solution dips of several growth regulating chemicals. Because of the inherent "stubborness" of a number of forest trees it was decided to try various treatments which had produced rooting response in ornamental trees to determine if results could be obtained that would be of value to the forester and the geneticist.

The investigations were carried out for three consecutive 12-month periods to determine the proper time for taking the cuttings, the position on the plant from which the cutting wood should be selected, the timing interval which should be used with the intermittent spray system, and the concentrations of root promoting chemicals that would be most beneficial.

It was found to be true with most of the species., that cuttings rooted best which did not come from the most vigorously growing plants. It was also determined that those cuttings taken from the lower branches, often more shaded, rooted better than those taken from the upper branches.

The cuttings were taken from the lateral twigs of the current season's growth and cut to a length of 4 to 6 inches. All the cuttings were taken from the same parent plants for the duration of the study to avoid genetic differences in the woody material used. In each test, 50 cuttings were used and their basal portions were dipped to a depth of 2 inches. The dips were for various time intervals, usually for 10 seconds, but it did vary from one species to an other. The best results were obtained with solutions of indolebutyric acid and distilled water. The solutions were prepared by dissolving the indolebutyric acid crystals in just enough 90% ethyl alcohol to cover them. Then distilled water was added to bring the solutions to the desired volumes. The dip concentrations used were 5,000 ppm, 10,000 ppm and 20,000 ppm.

A well drained greenhouse bench with an intermittent mist system was used for the propagation. This system was an in-bench installation with deflection type nozzles. It was timed to spray the plants for 15 seconds during every 10 minute interval from dawn until one hour after sunset. A coarse grade of bank sand was used as the propagating medium, Soil heating cables were used to maintain the rooting medium temperature at approximately 70 degrees F. during the cold periods of the year. Whenever possible, air temperatures were maintained at a minimum of 72 degrees F. during the day and 62 degrees F. at night.

In the College Park area, cuttings taken in April, May, June, July, and August rooted best. The pink dogwood was not in as great supply as the white form, and for that reason, it was not possible to get as many cuttings as I would have liked. In any case, the response to chemical treatments was very similar to that of the cuttings of white dogwood (table I).

Table I.--Rooting response of Cornus florida to indolebutyric acid (50 cuttings per treatment)

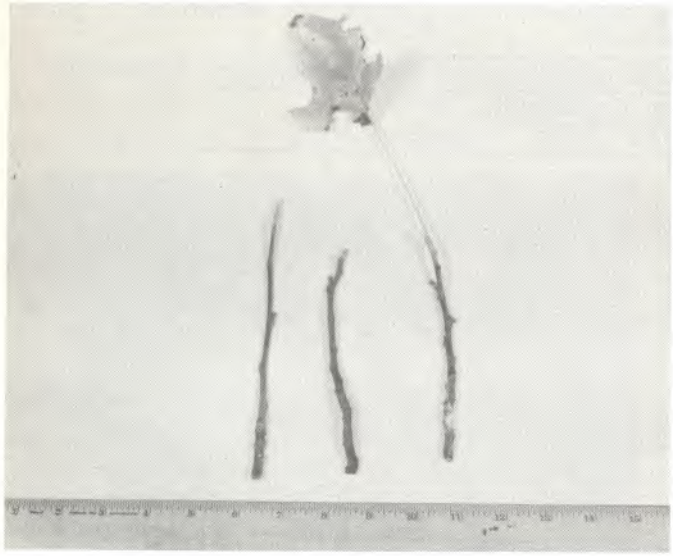
Treatment (ppm)	Date made	Days to root	Percent rooted	Treatment (ppm)	Date made	Days to root	Percent rooted
Control	Feb. 6	--	0	Control	June 1	--	0
5,000		--	0	5,000		39	8
10,000		--	0	10,000		39	56
20,000		43	8	20,000		39	100
Control	Mar. 11	--	0	Control	July 2	--	0
5,000		45	4	5,000		--	0
10,000		45	28	10,000		47	56
20,000		45	76	20,000		47	100
Control	Apr. 7	52	2	Control	Aug. 6	--	0
5,000		52	12	5,000		--	0
10,000		52	72	10,000		46	36
20,000		52	100	20,000		46	96
Control	May 5	--	0	Control	Sept. 9	--	0
5,000		41	24	5,000		--	0
10,000		41	88	10,000		--	0
20,000		41	100	20,000		71	8

A 10-second dip was most satisfactory with yellow-poplar cuttings, as it was with the dogwoods. The rooting response and development was directly pro portional to the concentration of the growth regulators used as may be seen in table 2 and figure 1.

Table 2.--Rooting response of Liriodendron tulipifera to indolebutyric acid (50 cuttings per treatment)

Treatment	Date made	Days to root	Percent rooted	Remarks
Control	June 20	--	0	Discolored - died
5 mg./ml.		--	0	" "
10 mg./ml.		41	8	
20 mg./ml.		41	50	
Control	July 16	--	0	Discolored - died
5 mg./ml.		--	2	" "
10 mg./ml.		46	14	
20 mg./ml.		46	60	
Control	August 12	--	0	Discolored - died
5 mg./ml.		--	8	" "
10 mg./ml.		42	20	
20 mg./ml.		42	78	

Figure 1.--Response of Liriodendron tulipifera cuttings to indolebutyric acid-water treatment



Control

5 mg./ml.

10 mg./ml.

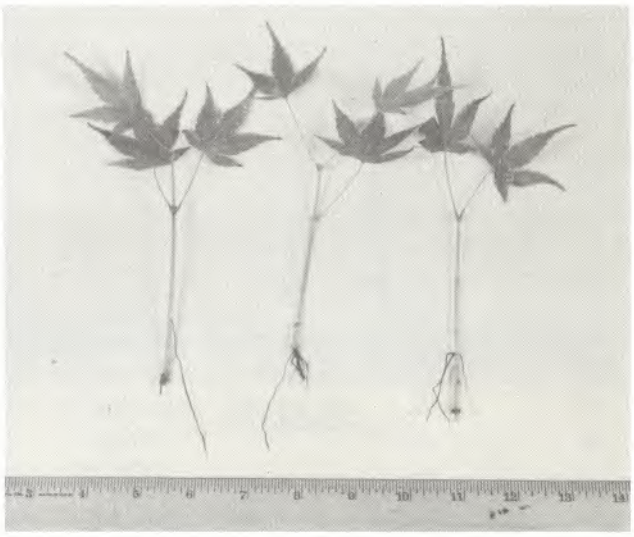
20 mg./ml.

Some of you asked about foliage retention when you visited the University greenhouses yesterday. I feel that I have had the best responses by leaving as much foliage on these cuttings as possible. I remove enough of the leaves to allow me to insert the cutting into the greenhouse bench without any foliage contact with the medium - the rest stays on the plant. To answer another common question - the trees used for stock plants in these studies were all mature plants. If I remember correctly, they were at least 25 to 30 years old. The roots produced on the various types of cuttings were neither fine nor course water roots. They were of a type midway between the two classifications and were more desirable for transplanting work.

A thin, two-inch slice of bark removed from the base of the dogwood cuttings, and a 10-second dip in the IBA solutions was an aid in root instigation. With the species of Acer studied, however, it was found that a dip of only 5 seconds duration was most beneficial along with the wounding (table 3). Typical rooting responses of Acer palmatum to various concentrations of indolebutyric acid are shown in figure 2.

Figure 2.--Response of Acer palmatum cuttings to indolebutyric acid-water treatment.

Control



5 mg./ml.

10 mg./ml.

20 mg./ml.

Table 3.--Rooting response of 4 species of Acer to indolebutyric acid (50 cuttings per treatment)

	Treatment	Acer palmatum		Acer rubrum		Acer saccharinum		Acer saccharum	
		Days to root	Percent rooted	Days to root	Percent rooted	Days to root	Percent rooted	Days to root	Percent rooted
March	Control	--	0	--	0	--	0	--	0
	5 mg./ml.	--	0	--	0	--	0	--	0
	10 mg./ml.	--	0	--	0	--	0	--	0
	20 mg./ml.	--	0	59	16	--	0	--	0
April	Control	--	0	--	0	--	0	--	0
	5 mg./ml.	--	0	--	0	--	0	--	0
	10 mg./ml.	--	0	--	0	41	20	--	0
	20 mg./ml.	48	46	56	26	41	82	50	42
May	Control	--	0	--	0	--	0	--	0
	5 mg./ml.	--	0	--	0	--	0	--	0
	10 mg./ml.	47	54	--	0	40	28	48	12
	20 mg./ml.	47	86	51	78	40	86	48	66
June	Control	--	0	--	0	--	0	--	0
	5 mg./ml.	--	0	--	0	--	0	--	0
	10 mg./ml.	39	58	--	0	36	30	44	78
	20 mg./ml.	39	88	45	90	36	92	44	90
July	Control	--	0	--	0	--	0	--	0
	5 mg./ml.	--	0	--	0	--	0	--	0
	10 mg./ml.	--	0	--	0	--	0	--	0
	20 mg./ml.	42	22	54	76	--	0	49	72

In the first stages of my work I had a great deal of loss after transplanting the rooted cuttings. This problem has been solved by reducing the water supply by one-half each week after the cuttings have been suitably rooted - until they have gone one full week without water - then they are put out, and at this time they are watered heavily in their new location.

You may find my work on Metasequoia and Picea abies, Pinus resinosa and Pinus strobus of interest. The Metasequoia will be reported in the September issue of the Botanical Gazette, and I hope the pine and spruce information will be in an early 1959 issue of the Journal of Forestry.

References

(1) Enright, L. J. 1957. Vegetative propagation of Liriodendron tulipifera. Journal of Forestry. Vol. 55, No. 12.

(2) ---------- 1958. Propagating dogwood by cuttings. American Nurseryman. March 15.

(3) ---------- 1958. Propagation of several species of Acer by cuttings. Journal of Forestry, Vol. 56. No. 6.