PROPAGATION OF SOME DELTA HARDWOODS BY ROOTING

by

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Natural regeneration is now, and perhaps will always be, the most common means of reproducing the bottomland hardwood forests in the Mississippi River Delta. Planting in this territory is a minor problem, for it has been estimated that possibly only 5 to 10 percent of the land which should be in forest will require planting to restock it with acceptable species. Even this small percentage, however, represents several million acres. If we add the acreage on which it would be desirable to convert the existing stand to one of a better species composition, it is apparent that there is a valid reason for studying planting problems.

Good planting stock of species which can be easily and economically produced and planted is a vital part of any planting program. Recognizing that cuttings promised to be a satisfactory and economical means of propagating such species as would reproduce vegetatively, the Southern Forest Experiment Station in 1939 began to study the rooting ability of bottomland hardwoods, beginning with the native cottonwood (Populus deltoides). In recent years, as results with cottonwood showed the feasibility of using cuttings, the work was expanded to include small-scale investigations with black willow (Salix nigra), sycamore (Platanus occidentalis), green ash (Fraxinus pennsylvanica), sweetgum (Liguidambar styraciflua), and Nuttal oak (Quercus nuttallii). The findings will be reported briefly in this paper.

Cottonwood

Cottonwood was the first species chosen for study because its adaptability to vegetative reporduction was already well known and because it is a desirable species that grows rapidly and is suited to many of the sites in need of planting.

Cottonwood roots easily without special treatment. First-year survivals of 75 to 90 percent have been obtained by observing the following rules. Cottonwood cuttings should preferably be planted as soon as they are made, but cold storage is possible if late planting is necessary. Planting should be done before the buds swat or leaves appear. Cuttings should be taken from dormant one-to three-year-old seedlings or stump sprouts and should be 20 inches long and 3/8 to 3/4 of an inch in diameter at the small end. They should be set 15 inches into the ground to insure that at least a por-

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tion of the cutting will be in moist soil during the dry summer months. Rota are produced along the entire underground portion of the cutting, but only those *in* moist soil remain alive. Site preparation before planting and cultivation during the first growing season by disking are necessary to prevent the trees from being overtopped and killed by competing vegetation.

Cuttings taken from one-year-old wood An the tops of mature or near mature "plus" trees selected for their outstanding desirable characteristics do not root well. Five to twenty percent survival, varying with the individual parent tree, is the best that has been obtained with this type of material. Neither does the survival become materially better as cuttings from the resulting one-year-old sprouts are planted in ensuing years. For example, in 1954 cuttings from a mature tree gave 16 percent survival. In 1955 cuttings from this surviving one-year-old stock gave 22 percent survival and in 1956, 23 percent.

Treating the cuttings by soaking 24 hours,in 60 and 100 parts per million solutions of the root-inducing hormones indoleacetic acid, indolebutric acid, and naphthaleneasetic acid still gave only 20 percent survival for the mature-tree clones as compared with 47 percent for clones originating from seedlings. These results do not offer much hope for the successful and economical propagation by cuttings of older "plus" trees that could provide better than average growing stock.

Cottonwood cuttings can be successfully kept in cold storage at temperatures ranging from 28° F. to 36° F. without losing their ability to root. The bundles of cuttings should be set in the storage room butt end down in a layer of moist sand several inches deep and sprinkled with water twice a week to maintain a humid atmosphere. After seven months of such storage, 75 percent of the cuttings rooted when planted in a greenhouse. Storage for 4 to 6.weeks followed by planting in the field has resulted in 90-percent rooting.

On suitable sites and with favorable weather and freedom from insect attacks, cuttings grow rapidly. First-year heights of 4 to 5 feet are common and under the most favorable conditions height of 12 feet and 1.1 inches in diameter at breast height has been attained.

Black Willow

Black willow roots even more readily than cottonwood and can be propagated by cuttings in the same way as outlined for cottonwood. Experience with this species at the Delta Research Center has bean limited but survival has been high in all cases, usually 90 percent or better, and in one test the cuttings were planted in March after they were in full leaf. This ability of willow to root and survive after leafing out will make late plantings (after flood waters have receded) a more economical undertaking than with cottonwood, since the trouble and cost of cold storage can be eliminated. Height growth of willow averages about four feet the first year.

Sycamore

Tests of the rooting ability of sycamore have been carried on for

three seasons. Hormone-treated and untreated cuttings of the same size as described for cottonwood were planted in the same way. The treatments were a 24-hour soaking in a solution of 20, 60, and 100 parts per million of indoleacetic acid, indolebutyric acid, and naphthaleneacetic acid. Using three-year-old sprouts for cutting stock produced a survival of 45 percent for untreated stock and 62 percent for the best treatment, which was indolebutyric acid at 20 p.p.m. All treated stock rooted better than the untreated but the difference was not statistically significant. A test using cuttings from one-year-old sprouts showed little difference in survival between the treated and untreated cuttings. The results were 83 percent survival for the untreated and 80 percent for treatment with indolebutyric acid at 60 p.p.m. Hormone treatment of this young stock therefore does not appear to be beneficial. The experience of some of our cooperators with field plantings of untreated stock indicates that 2/3 or more of the cuttings will root and survive.

Height growth for the first growing season varies with site and weather conditions but averages 3 to 5 feet.

Green Ash

Green ash cuttings from nne-year-old stock also root rather easily when prepared, planted, and cared for in the same manner as described for cottonwood. Ash cuttings usually are smaller in diameter than cottonwood because one-year-old sprouts do not attain a size equal to that of cottonwoods. Cuttings 1/4 inch or less in diameter, taken from small one-year-old nursery-grown seedlings, have been observed to root and grow very well. All the cuttings were taken just above the root collar and this tissue may be better adapted to rooting than material further up the stem. Additional testing will be required to verify this observation.

'Treatment with hormones as described for sycamore has given slightly higher percentages of survival than for untreated stock but the differences were not statistically significant. Untreated cuttings from one-year-old stock produced 70 percent survival and those treated with indolebutyric acid at 60 p.p.m. produced 88 percent survival. Two and three-year-old stock shows about 10 percent less rooting than do the younger cuttings.

For field planting the average survival ranges from 66 to 75 percent for untreatedstock.

It is essential to plant green ash cuttings with the bud pointing up. All cuttings planted upside down failed to grow. This is a variation from the behavior,of cottonwood and willow, which will grow either way but with some retardation in height growth when planted upside down.

First-year height growth for green ash is also somewhat variable but should average four feet on favorable sites. Unrooted cuttings and seedlings planted side by side made the same height growth in the first season.

Sweetgum

Sweetgum cuttings do not root easily, if indeed they can be made to

do so at all. So far, we have not succeeded in getting even one cutting to root. All the previously mentioned hormone treatments have been tried on both young and old wood. Other hormones and perhaps softwood cuttings should be tried.

Nuttall Oak

From very meager data it appears that treatment with hormones, as described previously for other species, stimulates the rooting of Nuttall oak cuttings from one-year-old stock. Treated cuttings show approximately twice the survival of the untreated--30 percent as compared with 15 percent, There was little difference between the hormones, but the 100 p.p.m. concentration appeared to be the best. Judging by the results shown for red oaks in the publication "The 49 of Auxins in the Rooting of Woody Cuttings," by Thimann and Behnke-Rogers[2/], our solution concentrations were too low for best results. Further testing is indicated.

Conclusion

So far all of our work with the propagation of Delta hardwoods by rooting has been directed toward finding a simple, practical, and economical means of using dormant unrooted cuttings for field planting. In this we have already been partially successful with the species we have tried. Cottonwood and black willow have reproduced satisfactorily both in the nursery and in plantations. Sycamore and green ash have done very well in nursery tests, and pilot plantings of these two species are now being made. The oaks will require more intensive testing but there appears to be hope of finding a means to induce rooting. Sweetgum is the only species tested that has failed to produce some rooting.

As our program for the improvement of planting stock by selection progresses, we shall undoubtedly investigate the use of softwood cuttings, 1 root cuttings, and grafting as means of obtaining vegetative propagation of the species whose dormant cuttings do not root readily.

[2/] Thimann, Kenneth V., and Behnke-Rogers, Jane. The use of auxins in the rooting of woody cuttings. Maria Moors Cabot Foundation, Pub. No. 1, 344 pp. Harvard Forest, Petersham, Massachusetts. 1950.