AGE OF TREE AND ROOT DEVELOPMENT BY AIR-LAYERS IN LOBLOLLY PINE

by

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Activity in forest tree genetics and improvement has increased considerably during the past decade in the Southeast. Methods of vegetatively propagating tree species are deemed of prime importance as "tools" for needed studies. Among the pines, grafting techniques are sufficiently well developed to allow rather easy vegetative propagation of clonal stock from trees of all ages. This method is now being used extensively for the establishment of seed orchards.

Other forms of vegetative propagation, namely the rooting of cuttings and the air-layering of branches, are often more useful than grafting since both root system and top of the new "progeny" are genetically identical to the "parent" tree rather than the top alone as is generally true of grafted trees. Both cuttings and air-layers, however, suffer an important limitation not common to grafting. That is, as the age of the parent tree increases, the ability to develop roots on cuttings and branches decreases sharply.

Many instances of this phenomenon are found in the literature. Delisle (2), for example, found in working with white pine that rooting ability falls off in direct proportion with increasing age of the tree. He found that auxin treatment definitely increases the percentage and quality of rooting, but does not eliminate the effect of age of the tree on the rooting of cuttings taken from it. Cech (1), in working with loblolly pine cuttings, found that rooting falls off sharply after the trees reach five years of age. Zak (4), concluded that with shortleaf pine the age of the parent tree determines how easily material taken from it will strike roots. Shoots from trees beyond 10 years of age are rooted only with difficulty.

Although much work has been done in the rooting of pine cuttings, little has been done, to establish the direct relationship between rooting ability and the age of the tree, through a series of age classes, from seedling to maturity. The present study was initiated to investigate the factor of age and specifically its relation to the successful rooting of loblolly pine. Because of the generally better results obtained by air-layering, this method rather than rooting, was decided upon to study this relationship,

Methods

During the summer of 1956, individual loblolly pines were selected in

plantations of known age located on land of the School of Forestry, University of Georgia, and on property belonging to Bannon Jones at High Shoals, Georgia. From these plantings, 12 trees were chosen from each of 9 age classes: 2, 3, 5, 6, 7, 8, 10, 17 and 24 years. In each case, age refers to the total age from seed.

There is considerable variation in intensity of sunlight falling on different portions of the crown. For example, the south side of the tree is expected to receive more intense sunlight than the north side. To overcome this, the crown was arbitrarily divided into four quadrants corresponding to the cardinal directions, North, East, South and West. One air-layer was made in each of these quadrants. Dominant trees were selected to reduce the shading effect from surrounding trees and to assure as much as possible trees of equal vigor. In all a total of 432 air-layers were made.

Trees of the 2 year age class were not branched sufficiently to allow more than one layer per tree; therefore, the main stems of 48 putted seedlings in the nursery were treated. In all the other age classes only the branches were treated.

The air layer was prepared as outlined by Mergen and Rossoll (3), in Station Paper No. 46, S. E. Forest Experiment Station entitled "How to Root and Graft Slash Pine." The procedure was modified to include the use of a bamboo splint along the stem to prevent breakage by wind. Also, the air-layer was covered with aluminum foil to reflect the rays of the sun thereby reducing the build up of heat within. Indolebutyric acid in talc, at a concentration 8,000 p.p.m., was applied to the upper portion of the girdle. All layers were made on the current years growth, each was tagged, and the date, age and location of tree and position of crown noted.

The installation of air layers was a tedious and time consuming procedure especially on the larger trees. There was necessarily a time difference in layering of the first and last tree in the experiment. The treatments began on July 17, and the final layer was made on August 15. To overcome this difference as much as possible, treatments were scattered randomly throughout the age classes during the installation period.

A treatment time of 70 days was chosen and each layer was removed at the expiration of its time limit. Upon opening the following data was taken: number of roots, total and average length of roots, condition of callus, diameter above and below girdle in:millimeters, and percent of bad gin by callus tissue. All roots were removed and oven-dry weights obtained.

Results

During the first few weeks of the air-layering period several of the trees in the 2 year age class died. This was presumably caused by girdling of the main stem during a period when food reserves in the roots were low. When the air layers were opened and examined most of the root stocks of this age class were dead, but in many cases the stem above the girdle had formed roots and was in good condition. Upon examination, it was found that death due to causes not directly related to rooting ability, was fairly uniform

Table 1: The Relation of Root Formation by Air Layering to the age of Tree in Loblolly Pine.

Age Class	Air-layers			
	Living 1/	Successfully rooted 2/		Average oven-dry weight of roots
	(number)	(Number)	(percent)	(grams)
2	39	39	100	0.540
3	40	36	90	0.170
5	42	15	36	0.016
6	40	7	18	0.004
7	40	8	20	0.004
8	40	2	5	0.002
10	46	3	7	0.002
17	44	0	0	0.000
24	43	0	0	0.000

1/ A total of 48 air layers were made per age class. The indicated discrepancies represent losses of various kinds.

2/ Based upon living air layers.

throughout the age classes and these were deleted from future calculations.

Rooting in each age class was calculated as a percentage of the total [1] 48 layers made less those which died, broke off, lost their foil covering
or were whipped severely by adjacent branches. The percentage of rooted air-layers was highest in the youngest age class and decreased sharply with increasing age. In the 2-year age class 100 percent rooted while none rooted on trees 17 years of age and older. A similar pattern was found in the data on the oven-dry weight of the roots.

In the 2-year age class a considerable variation in size of the root systems was noted. The air layers on seedlings, whose root stocks had died after beginning of root formation, produced such dense root systems that difficulty was experienced in extracting them from the moss. Those, in which the root stock remained alive, produced less well developed root systems and those, in which the girdle had been largely bridged over, de- veloped a few small roots. In practically all cases where the root stock remained alive there was some degree of bridging of the girdle by callus tissue.

No differences could be found in rooting initiated in those air- layers located in the four quadrants of the crown. In the younger age classes, in which rooting was best, the crowns were so small that the amount of sunlight falling on each layer was fairly uniform, In the older age classes rooting was insufficient to allow any conclusions to be drawn.

An attempt was made to correlate the ratio of diameter of stem above girdle over diameter below girdle with the number of rooted air-layers in each age class. It was thought that this ratio might give some measure of food accumulation in the top. However, no correlation was found to exist.

Some evidence is present to indicate that there is a variation in rootability between individual trees. In the 3-year old age class the air layers not rooted were found to be

SUMMARY

The effect of age of tree upon root formation by air layering in loblolly pines was tested. A total of 432 air layers were applied on planted trees, employing age classes from 2 to 24 years. Rooting was best in the

youngest age classes and decreased sharply with increasing age of trees. All of the living air layers in the 2-year age class rooted while none rooted in trees 17 years of age or older.

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