U. S. DEPARTMENT OF AGRICULTURE FOREST SERVICE
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
R. W. COWLIN, DIRECTOR

Research Note

Number 132 Portland, Oregon July 1956

PRUNING AND OCCURRENCE OF HEART ROT IN YOUNG DOUGLAS-FIR

By

Thomas W. Childs and Ernest Wright,
Division of Forest Disease Research

EDITOR'S FILE COPY

Heart rot is sometimes common in pole-size Douglas-firs that had been heavily live-pruned for trail clearance when they were long-crowned saplings. This observation suggested that benefits from pruning for quality increment might be reduced appreciably by heart rot infections occurring through pruning wounds. The study described in this paper was therefore undertaken to determine the relationship between pruning and incidence of heart rot in young Douglas-fir.

METHODS

Seven plots were established on the Willamette, Siuslaw, and Gifford Pinchot National Forests and the Pack Forest of the University of Washington College of Forestry. On these plots, 365 trees were tagged and left unpruned as checks, and 1261 similar trees were pruned as follows:

a. Dead branches sawed or clubbed off (305 trees on 7 plots).

b. Dead branches and 1 or 2 whorls of live branches sawed off (305 trees on 7 plots).

c. Dead branches and 4 or 5 whorls of live branches sawed off (305 trees on 7 plots).

d. All branches to 18 feet sawed off (120 trees on 3 plots). More of the green crown was removed by this method than by any other.

x. Dead branches and 4 or 5 whorls of live branches sawed or chopped off, with the cut deep enough to remove all of the trunk swelling at the base of the branch (41 trees on 1 plot).

y. Dead branches sawed off, and 4 or 5 whorls of live branches sawed or clipped off 4 inches from the trunk (185 trees on 4 plots).

Half of the trees were pruned in the spring and half in the fall. At the time of pruning, ranges of plot averages were as follows: d.b.h., from 3.6 to 8.8 inches; height, from about 35 to a little less than 50 feet; and age, from 19 to 28 years. Plot averages for height of bottoms of live crowns ranged from 6 to 10 feet.

Stands varied from moderately dense to dense. All of the plots were on site III or IV; two were in planted and five in natural stands; and one was thinned at time of pruning. None of these differences between plots perceptibly affected the results, except that infections through pruning wounds were least common in the youngest and densest stands.

RESULTS

Pruned and check trees were examined from time to time over a period of 14 years. Stereum sanguinolentum sporophores were fairly common for a few years on unhealed pruning wounds on one plot and were occasional on some of the others. Decay caused by this fungus was later found in the heartwood of only 5 of the 7 sporophore-bearing trees dissected, and was only slightly more extensive in these than in infected trees that had borne no sporophores. Several sporophores of Fomes pini appeared on one tree less than five years after it was pruned, but this infection probably occurred before pruning. No other sporophores of heart-rotting fungi were found associated with pruning on any of the plots.

Beginning four years after pruning, and at various intervals thereafter, some of the trees were felled, bucked, split, and examined for decay, for rate of healing, and for miscellaneous defects resulting from pruning.

Pruning wounds healed slightly faster on fast-growing trees than on slow-growing ones, even though branch stubs were usually larger on the former. They also healed somewhat faster just below the live crowns than on the lower parts of the trunks. Wounds of trees pruned by method x healed about as soon as any of the others, notwithstanding the much larger size of the wounds. This suggests that healing might be hastened by slightly injuring the cambium at branch bases during the pruning operation.

No difference in rate of healing was observed between clubbed and sawed branches. Clubbing sometimes left small splinters projecting for a few millimeters, but the best of the clubbing was better than the sawing, since sawing left a stub about as long as the bark was thick.

In 10 of the 253 pruned trees that were dissected, discoloration or decay had entered through broken or dead tops, or through dead branches prior to pruning. In 3 of the 50 unpruned check trees that were dissected, discoloration or decay was found associated with dead branches. These infections are ignored in the following discussion, which is concerned exclusively with infections that occurred through pruning wounds.

Decay found during the dissections is summarized below. Trees listed here as "decayed" are those in which decay was definitely recognized, or which yielded heart-rotting fungi in cultures from discolored heartwood. Trees listed as "discolored" are those in which decay could not be diagnosed with certainty in the field, and which yielded no heart-rotters in culture. A few of these latter may have been entirely sound, but most of them probably contained traces of incipient decay.

Pruning method	Number of trees			
	Dissected	Extensively decayed	Slightly decayed	Discolored only
a	54	0	3	4
b	53	0	2	3
c	53	0	1	10
d	49	3	2	6
x	14	0	4	5
y	30	0	0	2

Of the total of 45 trees containing definite or suspected infections, 31 were spring-pruned and 14 fall-pruned. Although many more dead branches than live ones were cut, infection was found to have entered through live-pruning wounds in 18 trees and through dead-pruning wounds in only 14 trees. (Infections in the remaining 13 trees were associated either with bases of both live- and dead-pruned branches, or with bases of branches whose condition at the time of pruning could not be determined.) Rate of healing of pruning wounds had little if any effect on the number of infections that occurred.

Methods x and y, neither of which is practicable for other than experimental use, obviously differ from the rest of the methods in proportions of trees infected. Differences between the other 4 methods are not statistically significant, but if a and b are grouped and compared with c and d as a group, the difference is almost significant at the 5 percent level. This suggests that heart rot risk is somewhat increased by pruning high-vigor live branches. Stronger evidence to the same effect

is afforded by the Fomes subroseus infections found in dissected trees. All 3 of these infections occurred through the bases of branches live-pruned by method d, and 2 of them occurred through the bases of the uppermost branches pruned. Decay in these trees extended for several feet from the point of entry, involved practically all of the heartwood cross section, and included a considerable proportion of the typical stage.

Although definite or suspected infections were fairly common in the dissected trees, their average extent was slight. Even where decay was far enough advanced to be easily recognized as such, it usually consisted merely of one or a few streaks of discoloration, with perhaps an occasional small spot of early typical decay. In most of the infected trees, decay was so limited in extent and development that culturing was necessary for positive diagnosis. The only outstanding exceptions to this general condition were the three trees infected by Fomes subroseus.

Culture studies indicate that many heart rot infections in young pruned trees die soon after closure of the pruning wounds through which they entered. On one plot, 5 years after pruning, cultures were made from suspected decay in 5 trees, and Stereum was obtained from every tree. On the same plot, 10 years after pruning, similar cultures from 7 trees failed to yield any wood-decaying fungus. Fomes subroseus cultures were easily obtained in 1938 but could not be obtained in 1955, although several attempts were made, from a group of trail-pruned trees in which extensive decay had been caused by this fungus.

It therefore appears that heart rot damage ordinarily will not be seriously increased as a result of pruning Douglas-fir, except perhaps where pruning extends well up into the live crown. This conclusion has been corroborated by observations in other young stands 10 years or more after pruning for quality increment.

SUMMARY AND RECOMMENDATIONS

Infections by heart-rotting fungi occur fairly commonly through pruning wounds. They are more common in spring-pruned trees than in fall-pruned, and where live branches have been cut than where only dead branches have been cut. However, most of these infections remain small and incipient, and die soon after the pruning wounds close.

Although the risk of serious damage by heart rots in pruned trees is not great, the following practices are recommended to reduce even the slight damage that may otherwise occur:

1. Prune in the fall, and prune dead branches and low-vigor live branches only. To minimize the number of loose knots, pruning can be done in two or more stages, as the bottoms of the crowns die.

2. Keep the stand fairly dense until about the time of pruning, to keep knots small by hastening death of lower branches. Then thin cautiously to stimulate growth and thereby hasten healing of pruning wounds. (Drastic thinning is likely to result in sunscald and consequent increase in heart rots.)

3. Cut branches as close to the trunk as possible, so that stubs will not delay healing. Slight injuries to the trunk cambium at the branch base will probably hasten healing.

4. Avoid extensive injuries to the trunk cambium.