USDA FOREST SERVICE RESEARCH NOTE NE-125

1971

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DECAY NOT SERIOUS IN NORTHERN RED OAK

Abstract. — A study of 114 northern red oak, *Quercus rubra,* indicated that decay is not serious during the time necessary to produce high-quality saw logs and veneer logs. Two heart-rot fungi, *Poria oleraceae* and *P. cocos,* accounted for almost 25 percent of the total decay volume in the study trees. Basal fire wounds, dead branch stubs, and open branch-stub scars were the most important means of entry for decay fungi.

Northern red oak is one of our most valuable hardwood species. Its wood is highly prized because of its strength and beauty and the many uses for which it is suited. More intensive management of northern red oak has pointed up the need for information on decay in this species. Therefore, we made a study to determine the heart rot fungi associated with decay in northern red oak and the relationship of decay losses to tree age and diameter.

Study Areas and Methods

The northern red oaks (*Quercus rubra* L.) sampled in this study were scattered from Virginia to Missouri. Altogether, 114 northern red oak trees 5.6 inches diameter breast height and over were felled and bucked into either bolts or logs. The nature, extent, and location of all defect indicators were recorded. The 41 trees from Virginia had been selected previously for a log- and tree-grade study on the George Washington National Forest. These trees were bucked into logs and the extent of decay was determined when the logs were milled. The remaining 73 trees were randomly selected from national and State forests in Ohio, Kentucky, Indiana, Illinois, and Missouri. They were cut into 4-foot bolts up to a 4-inch-top diameter inside bark, and critically examined

for decay in the field. Where decay appeared, its extent and dimensions were determined by splitting the bolts longitudinally.

Gross volume and decay volume were calculated in cubic feet. No reduction in gross volume was made for trim, taper, long butting, or breakage.

Cultures were prepared from samples of decayed wood to determine the fungi responsible for decay. Sample blocks were taken to the laboratory and split to expose a fresh face of infected wood. Small cores of infected wood were removed with a sterilized increment hammer and placed in test tubes containing 2.5 percent Fleischmann's diamalt[1] with 2 percent agar. If no growth was observed after 2 weeks, reisolations were attempted.

[1]Mention of a particular product should not be taken as endorsement by the Forest Service or the U.S. Department of Agriculture.

Table 1. — *Fungi causing decay in living northern red oak trees and their relation to the portion of the tree bole affected*

Fungus (species)	Number of infections			Decay volume		
	In butt[1]	In trunk	Total	In butt[1]	In trunk	Total
	No.	*No.*	*No.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
Poria oleraceae Davidson & Lombard	1	2	3	8.38	0.67	9.05
Poria cocos (Schw.) Wolf	2	—	2	8.69	—	8.69
Polyporus compactus Overh.	—	8	8	—	2.85	2.85
Polyporus sulphureus Bull. ex. Fr.	1	2	3	.82	.89	1.71
Unknown H[2]	—	3	3	—	.92	.92
Stereum frustulatum (Pers. ex. Fr.) Fckl.	—	4	4	—	.81	.81
Stereum gausapatum (Fr.) Fr.	—	3	3	—	.62	.62
Polyporus versicolor L. ex. Fr.	—	1	1	—	.38	.38
Poria andersonii (Ell. & Ev.) Neuman	—	2	2	—	.20	.20
Irpex mollis Berk. & Curt.	—	1	1	—	.15	.15
Polyporus spraguei Berk. & Curt.	1	—	1	.14	—	.14
Unknown[3]						
White rots	8	34	42	5.83	19.05	24.88
Brown rots	4	4	8	16.90	.49	17.39
Undetermined rots	17	30	47	3.48	3.97	7.45
Total	34	94	128	44.24	31.00	75.24

[1]Decay originating at stump height or below was considered as butt rot.

[2]Misidentified as *Corticium lividum* Pers. ex. Fr. in U.S. Dep. Agr. Tech. Bull. 785, FUNGI CAUSING DECAY OF LIVING OAKS IN THE EASTERN UNITED STATES AND THEIR CULTURAL IDENTIFICATION, by Ross W. Davidson, W. A. Campbell, and Dorothy B. Vaughn. 1942.

[3]Decay columns from which we were unable to isolate any heart rot fungi.

The Fungi that Caused Decay

Most of the 11 species of fungi recovered (table 1) are well established as organisms causing decay in other oak species (*1,2,3*). The two species of *Poria* — *P. oleraceae* Davidson & Lombard, and *P. cocos* (Schw.) Wolf — accounted for about one-fourth of the total decay volume (table 1). However, because of the small number of identified infections, we did not attempt to draw any conclusions on the relative importance of the various fungus species in causing decay in northern red oak. Many of the decay columns were inactive at the time the trees were dissected and we were unable to isolate a decay fungus from them. Some of these columns yielded bacteria and nondecay fungi while others were sterile. The close association of bacteria, nondecay fungi, and decay fungi in living trees suggests that all are important in the decay process (*4*).

As in other tree species, decays can be divided into butt rots and trunk rots, based on their position in the tree. Although trunk infections were almost triple the number of butt infections, the latter infections accounted for considerably more volume loss (table 1). All decay caused by *P. cocos* and most of that caused by *P. oleraceae* was found in the butt log.

How Fungi Gained Entry

Decay-causing fungi are unable to penetrate the protective bark on living trees except through wounds or dead branch stubs. Basal fire wounds were the most important means of entry for decay fungi

Table 2. — *Relationship between infection courts and decay in living northern red oak trees*

Infection court	Infections	Volume of decay	
	No.	*Cu. ft.*	*Pct.*
Closed fire scars	14	22.40	29.77
Open fire scars	3	17.26	22.94
Dead branch stubs	19	8.07	10.73
Open branch stub scars	5	8.06	10.71
Branch bumps	21	4.50	5.98
Insect wounds	15	3.52	4.68
Mechanical injuries	11	2.63	3.50
Parent stump	6	1.73	2.30
Woodpecker injuries	3	1.49	1.98
Unknown	31	5.58	7.41
Total	128	75.24	100.00

(table 2). Over 50 percent of the decay volume was associated with fire-scarred trees. And this decay was in the most valuable part of the tree — the butt log. Better fire protection and fewer fires should result in less decay from basal wounds in the future. Other important entry courts, based on decay volume, were dead branch stubs and open branch stub scars.

Decay vs. Tree Age and Diameter

Age-decay relationships demonstrate that relatively small decay volumes can be expected in northern red oak (table 3). Sixty-one of the 114 trees contained measurable amounts of decay. Decay losses were slightly over 1 percent of the gross volume for trees up to 90 years of age. Although decay volume increased in trees over 90 years old, the decay percent of

Table 3. — *Relationship between age and decay in living northern red oak trees*

Age class (years)	Trees	Trees with decay	Gross volume	Decay
	No.	*No.*	*Cu. ft.*	*Pct.*
30 to 70	64	22	1,921.92	1.13
71 to 90	32	26	1,564.23	1.02
91 to 130	18	13	1,125.15	3.32
Total	114	61	4,611.30	—
Average (all classes)	—	—	—	1.63

Table 4. — *Relationship between diameter and decay in living northern red oak trees*

Diameter class (inches)	Trees	Trees with decay	Gross volume	Decay
	No.	*No.*	*Cu. ft.*	*Pct.*
5.6 to 11.5	30	12	342.14	1.61
11.6 to 17.5	53	27	1,785.69	1.21
17.6 to 25.5	31	22	2,483.47	1.94
Total	114	61	4,611.30	—
Average (all classes)	—	—	—	1.63

3.32 was still quite nominal. And 4 of the 13 trees with decay in this age class contained 90 percent of the decay volume.

The relationship between decay and tree diameter was analyzed (table 4). There was relatively litlle decay loss even in the largest diameter class, which indicates that decay will not be serious during the time necessary to produce high-quality northern red oak saw logs and veneer logs.

Conclusion

From the decay standpoint, northern red oak should be an excellent tree to manage for lumber and veneer production. Its durable heartwood is affected by relatively few fungi that cause decay. Northern red oak grows rapidly, so these fungi do not have time to cause excessive cull before the trees reach merchantable size.

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MANUSCRIPT RECEIVED FOR PUBLICATION 8 MAY 1970.

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