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RALPH LINDGREN AND THE SEARCH FOR THE CONTROL OF THE BLUE-STAIN FUNGUS INFECTING NON-DRIED LUMBER

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Cover photo:
Typical of most early 20th century sawmills, lumber was stacked across large areas of the sawmill grounds to air dry prior to being planed for sale. Wooden decking was established to provide access to the stacks using small gasoline powered vehicles. (Photo from Southern Forest Heritage Museum collections)

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Abstract:
A major problem facing the lumber industry in the South during the early 20th century was that of blue stain discoloration of lumber. Few sawmills had the capacity to kiln dry their lumber—it was stacked on the mill site to air dry. Such storage was typical for most sawmills and environmental conditions in the summer favored spread of the blue stain fungus on the lumber. The resulting discoloration reduced its market value even though the structure of the wood was not affected. A challenge to the newly created Southern Forest Experiment Station of the U.S. Forest Service was to develop technology to overcome this problem. A recent graduate from the University of Minnesota, Ralph Lindgren, with a master's degree in plant pathology was assigned this problem and he began evaluating the effectiveness of hundreds of potential chemicals. In 1929, he found 6 chemicals that had some promise and convinced lumbermen in 5 states to evaluate these chemicals on railroad car lots of treated lumber during the hot summer months when the fungus is aggressive. He found the fungicide Lignasan effective in protecting the lumber and within 2 years over 100 companies were using the chemical to treat their lumber—within 4 years it was used throughout the world where there was a blue stain problem. To apply the chemical, vats holding the chemical solution were installed in the green-chain were lumber leaves the mill to be sorted by size and length. Lumber was dipped in the solution contained in this vat. Such a vat was installed in the Crowell and Spencer Lumber Company mill and the history of this process can now be viewed at the Southern Forest Heritage Museum at Long Leaf, LA.

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RALPH LINDGREN AND THE SEARCH FOR THE CONTROL OF THE BLUE-STAIN FUNGUS INFECTING NON-DRIED LUMBER

James P. Barnett

THE PROBLEM

A serious problem in early sawmill operations was the discoloration of the freshly cut lumber by a blue-stain fungus. This dark-colored microscopic fungus causes a bluish or grayish discoloration in the sapwood. Spores of the common blue-stain fungus, *Ceratocystis pilifera*, can attain 80 percent germination after 24 hours when temperatures are warm (Miller 1980). The fungus cannot grow in wood which has a moisture content of less than 20 percent nor in wood in which the cell cavities are full of water. Hence, the stain can be prevented either by rapidly drying freshly exposed surfaces or by keeping the timber saturated in water. One of the advantages of dumping logs into sawmill ponds in the South was the prevention of blue-stain development until the sawing of the logs into boards.

The fungi are disseminated either by spores, which are produced in great number, and are carried by wind and insects. Blue stain is often found in standing trees killed by the southern pine beetle (*Dendroctonus frontalis*) inoculated from spores carried by the insect. Lumber from beetle killed trees is discolored and therefore of lower value.

Cross section of southern pine beetle killed southern pine showing the development of blue stain in the sapwood (left, photo from Richard F. Billings, Texas A&M Forest Service) and, right, lumber infested with the blue-stain fungus.

Blue stain is not a mold and has no effect on the performance and strength of lumber. Although the wood can be used for any practical purpose, the discoloration does cause a degrade in the lumber. Blue stain, then, became a major economic problem for southern lumbermen (Lindgren 1929, Wakeley 1978). Lumber coming from mill production was typically stacked for air drying—the quantity produced greatly exceeded to capability to kiln dry large amounts of lumber. Hence, there was a great need for a means to control and reduce the effects of blue stain discoloration.

THE ASSIGNMENT OF RALPH LINDGREN

The Southern Forest Experiment Station of the U.S. Forest Service was established in 1921 in New Orleans to conduct research on problems facing the development of forestry in the South. To address the blue stain issue, the Southern Station recruited Ralph M. Lindgren to work on the problem. Ironically, Lindgren could not be hired directly the by Station—he was a plant pathologist who had been hired by the Bureau of Plant Industry. But, in 1928, he was reassigned to the Southern Station and was given the task of coming up with techniques to control the blue-stain fungus commonly infesting green (freshly sawed) lumber (Wakeley and Barnett 2011).

Ralph Lindgren who was noted for developing the control of blue stain in mill operations across the South. (Photo from Forest Service files)

Lindgren had graduated from the University of Minnesota with a master's degree in plant pathology. He evaluated about 250 potential chemicals on billets of sap pine. He placed treated and untreated samples in the best "blue-stain environment" he could find, underneath stacks of green lumber in the yards of a number of sawmills. Several chemicals showed promise and he used these results to convince companies in Florida, Alabama, Mississippi, and Louisiana to try his six most promising chemicals on railroad car lots of green lumber (Barnett 2011).

After a long drought period where no stain developed, a rainy period produced a heavy amount of blue stain. One of the chemicals resulted in complete control of the stain.

THE CONTROL AND ITS APPLICATION

The chemical, a fungicide (methyl 2-benzimidazolecarbamate phosphate), marketed under the trade name of Lignasan, quickly was accepted as a preventive treatment in sawmills. Unheated vats were installed in the green-chain (where lumber leaves the mill) of mills to dip lumber into the chemical solution (Lindgren and Verrall 1950). One year after two brief reports of its effectiveness in the *Southern Lumberman* journal and his personal contacts, Lignasan was being used in a hundred mills in the United States and abroad. Four years from the start of the effort it was in world-wide use. Chapman Chemical Company grew out of the findings.

Fortunately, blue stain poses no health risk, and treated blue-stained lumber is safe to handle. The Lignasan treatment resulted in tremendous recognition and support for Lindgren and the Southern Forest Experiment Station. Lindgren continued to have an illustrious career in Forest Service Research.

When touring the Southern Forest Heritage Museum, such a vat can be viewed, and its impressive history can be revisited. This treatment is seldom used today because most sawmills

have kiln capacity to dry their lumber before environmental conditions favor blue stain development.

This vat to contain the chemical solution is in the Crowell and Spencer Lumber Company sawmill where lumber left the mill and moved to the green-chain for sorting. The Lignasan solution was mixed in the tank at the top of the photo and then pumped to maintain the needed level in the vat. This treatment of lumber continued until the mill closed in 1969.

Development of the Lignasan treatment provides an example of the creativity that shaped the lumbering industry during the early 20th century and resulted in mills profitable to the owners and towns that brought sawmill families into the mainstream of an industrial nation.

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