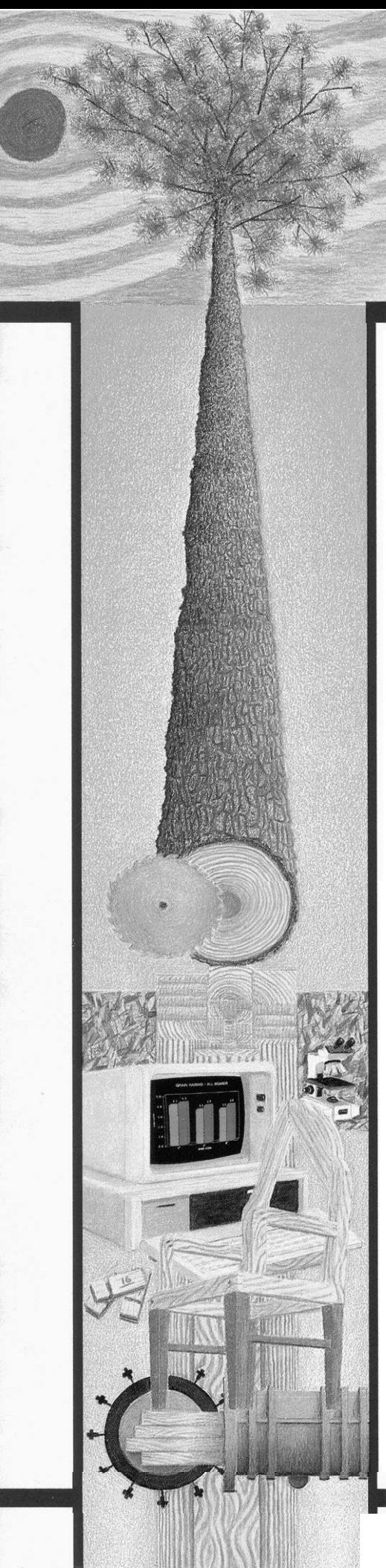
Forest and Wildlife Research Center
Mississippi Forest Products Laboratory
Research Advances
Volume 4, Number 1 • April 1995



Novel Methods for Controlling Gray Stain in Logs and Lumber

Abstract

The sapwood in hardwoods such as oak, hackberry and so on are subject to discoloration by both mold/stain fungi and enzymatic reactions. These discolorations substantially reduce the value of the lumber produced. Dr. Terry Amburgey of the Mississippi Forest Products Laboratory has as one of his principal research areas the prevention and control of stains in lumber. He has carried out tests in cooperation with Dr. Elmer Schmidt of the University of Minnesota which showed that enzymatic sapstains of some woods can be prevented by fumigating logs with methyl bromide. A joint application for a patent on this process has been filed and the team of researchers is carrying out further tests now to confirm the results and possibly discover even wider use of the method.

Recently, there has been additional research into a mechanical compression method for controlling enzymatic sapstain in lumber. The mechanical method has shown considerable promise as a new way to prevent the non-microbial discoloration from sapstain. Its advantage is that it can be more easily integrated into a mill's operations than the present chemical methods. Development of methods that can control gray stain will save millions of dollars each year, and make the lumber a more attractive export material. It has been estimated that controlling these sapstains can increase the value of Mississippi hardwoods by about $19 million per year.

Non-microbial stains-those not caused by fungi--can be guarded against by chemical means. Methyl bromide, a widely used fumigant that can be used to treat logs, is one such chemical. Another material which can be used to treat lumber is sodium bisulfite. However, these treatments do not fit well into many sawmill operations. Mississippi Forest Products Laboratory (MFPL) researchers now have shown that mechanical methods of treating freshly sawn lumber will prevent non-microbial sapstains without the use of chemical treatment.

Hardwood sawmill operators need

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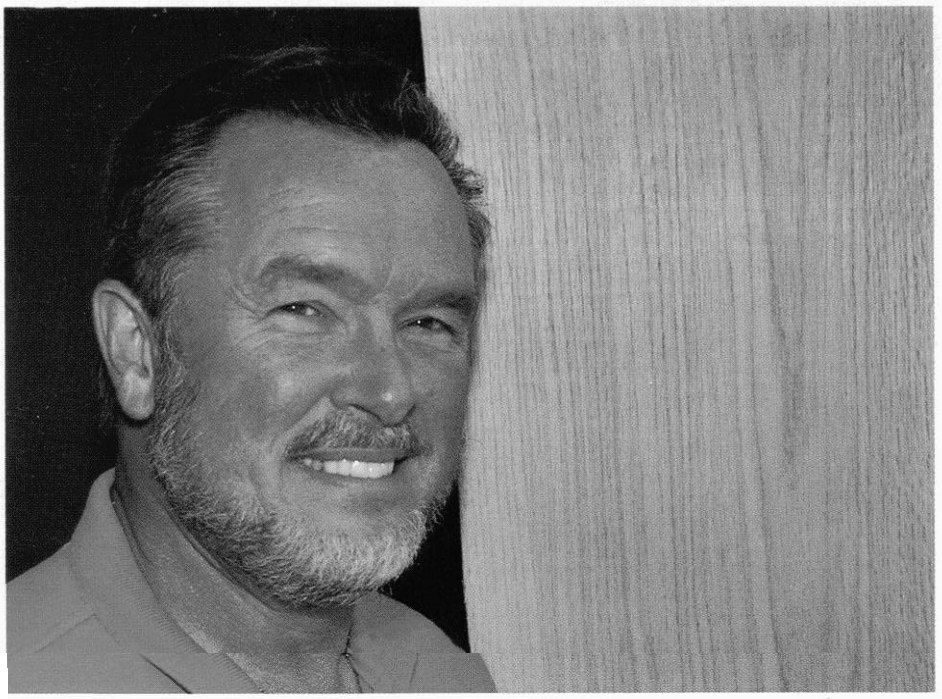


Dr. Terry Amburgey shows the kind of stain-free lumber his new compression machine is intended to produce. The machine can be integrated into mill operations more readily than use of chemicals, the current workable but awkward method.

"It's not that chemical treatment of logs or lumber ... doesn't work."

something other than the fungicide dips that they have for treating sapstains in wood that will be used for furniture and other products. Researchers at the MFPL think they may have come up with a way of treating lumber that would be much easier to integrate into mill operations than chemical baths or fumigation.

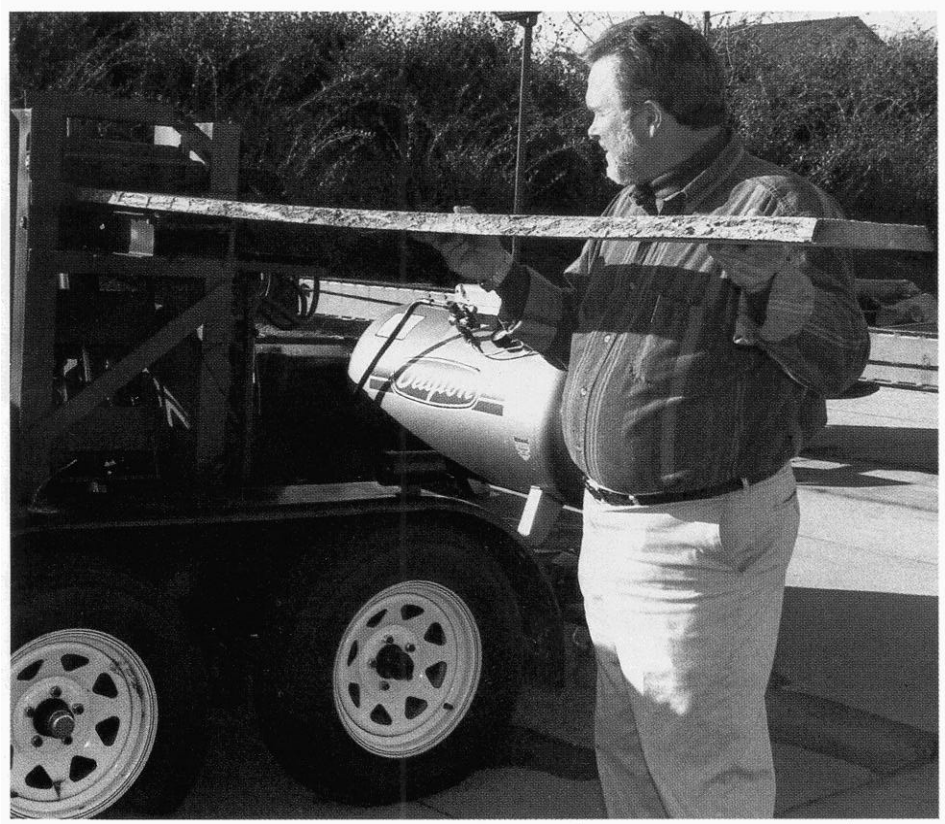
They're attacking non-microbial stains by mechanical means. (Non-microbial stains are those not caused by fungi as most stains 316. When boards are planed for use, the sapstains become apparent.) Since, up to now, chemical control was the only way to prevent these sapstains, it is appropriate to review these methods first.

It's not that chemical treatment logs to lumber to prevent non-microbial discolorations of hardwood lumber doesn't work. It does. Dr. Terry Amburgey, of the MFPL at Mississippi State University, working with Dr. Elmer Schmidt of the University of Minnesota, treated freshly cut 4-, 8- and 16-foot logs of red oak, ash, and sugar hackberry with methyl bromide, a well-known fumigant with many uses. The fumigated and some non-fumigated logs were then stored under a water spray for 16 weeks before being sawn into lumber.

The lumber was then bulk-stacked in warm, humid conditions to promote the development of stains in the sapwood.

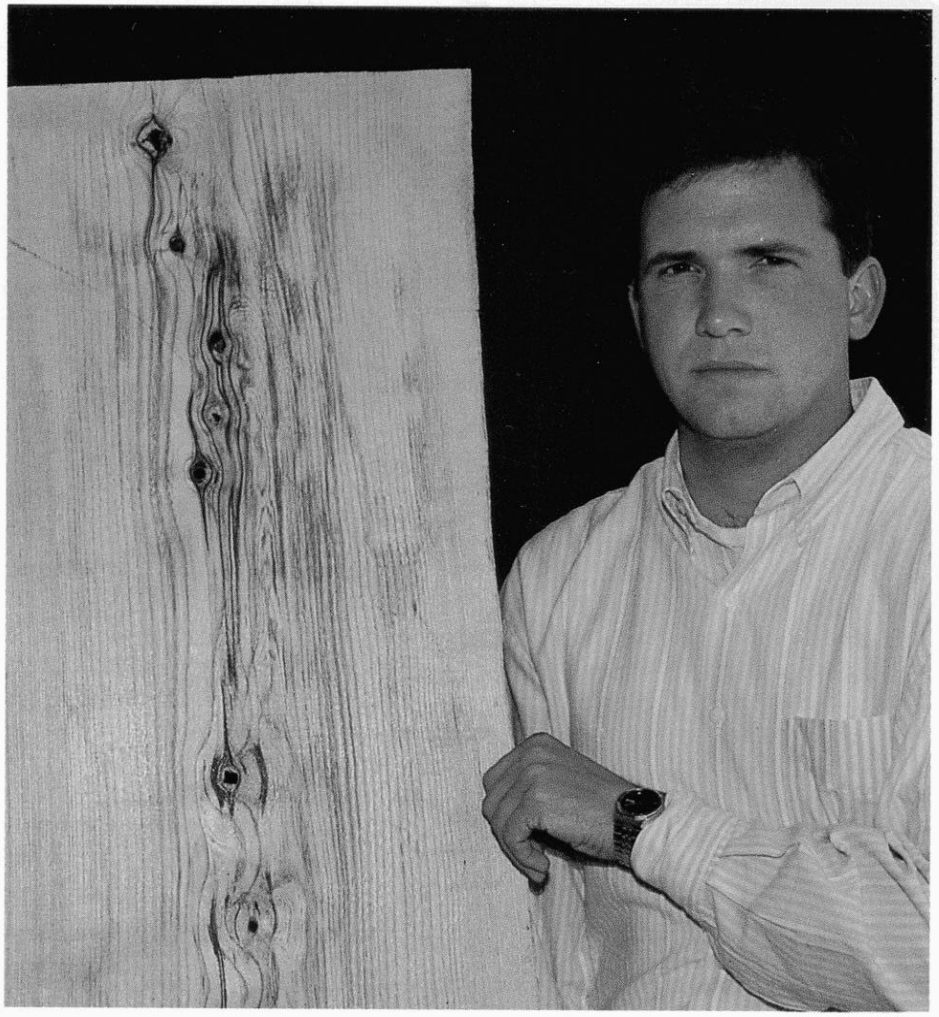
Lumber from the logs that had been fumigated with methyl bromide was free of discolorations, whereas that from non-fumigated logs had a great deal of non-microbial sapstain.

Amburgey and Schmidt are investigating this novel approach for prevention of non-fungal stains in hardwoods with other fumigants. These experiments showed that logs



Just completed, the machine stands on two pairs of tandem wheels. But it can be readily adapted to mesh with the flow of materials in a lumber mill. Amburgey demonstrates how a piece of lumber can be fed through the machine.

Graduate Student Shane Kitchens holds a piece of lumber that graphically shows how bad staining can become if neither the machine nor chemicals are used to prevent it. Kitchens helped build the machine and is testing it as part of his MS thesis project.



arriving at a mill can be fumigated and then stored under water sprays for later use without developing non-microbial sapwood discolorations,

The exact cause of gray stain is not known, but Amburgey believes that enzymes cause reactions within the parenchymna cells (essential or basic cells) of such woods as red oak, sugar hackberry, ash, yellow-poplar and other species, and that these reactions result in the formation of pigmented starch-like byproducts. Such stains are thus believed to have a chemical and not a fungal cause. That is why they are called non-microbial stains.

Research showed that either oven drying or steam heating lumber at 212 F for 30 minutes before air drying-a method which won't prevent fungal stains-did prevent gray stain.

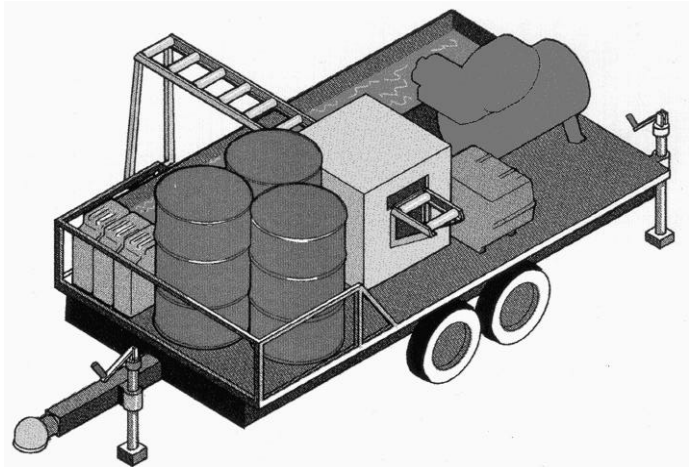
Amburgey and Paul Forsyth, once a graduate student at the FPL, who has now received a PhD from Oregon State University, used sodium bisulfite to prevent or greatly reduce such non-microbial oxidative sapstains in freshly sawn red oak and sugar hackberry lumber.

But ash sticker stain-that found under stickers in ash stacked to air dry-was prevented in only a few boards, although discoloration in all of the lumber was lighter.

The most effective chemical treatment of red oak, of several methods tested, was a five minute dip in a five-percent solution of sodium bisulfite plus a compatible biocide. By adding an iron sequestrant, discolorations from iron-tannate formation also were prevented.

Lumber so treated needs diffusion stacking (bulk stacking under a tarp) to allow the chemical to reach and inactivate the oxidative enzymes in the center of the board. Amburgey and Forsyth found that at least fourteen days of diffusion storage were needed.

"... a prototype machine has been built to Amburgey's specifications by Paul Gordon, MFPL machinist, and Shane Kitchens, graduate student, to process lumber mechanically as the lumber moves through the mill."



An artists concept of how the machine would look.

Lumber sawn from water-stored logs (stored under a water spray) develops non-microbial sapstains earlier and more quickly than lumber from freshly cut logs. Ten percent sodium hisulfite is needed to treat water-stored logs. Sodium bisulfite is not effective in completely preventing sapstain in lumber if logs are stored for more than three or four weeks.

Sodium bisulfite, properly used, will prevent gray stain in sapwood of most hardwood species. Then why not use this method?

The answer is that some lumber mills do use such chemical methods, but the treatment and diffusion storage of the lumber (instead of the logs) is time-consuming, costly, and interferes with the orderly movement of lumber through a mill., obviouly adding expense in handling.

More recent experiments indicate that non-microbial sapwood discolorations can he prevented without the use of chemicals. This novel process is based on mechanical compression of freshly sawn lumber which is covered by a recent patent application. The validity of this concept was verified by processing freshly sawn lumber through a prototype machine developed by Paul Gordon, MFPL machinest, and Shane Kitchens, graduate student. This study also provided valuable information of equipment design parameters for future commercial applications

It now appears that a relatively simple, inexpensive method for controlling gray stain in freshly sawn lumber is available for the Mississippi Forest Products Industry. Mills that take advantage of this development will reap the benefits of increased lumber value and better opportunity for participating in export markets.

Other non-chemical control procedures also are now being tested; these may provide additional methods for preventing gray stain.

Mechanical processes will permit the mill manager to produce stain-free lumber from freshly cut logs. At the same time, the fumigation technique discussed above will make it possible for the manager to safely water-store logs for several weeks and still get lumber free of non-microbial sapstains.

Typical lumber-drying facilities where gray stain might be a problem are these near Weir, Mississippi.