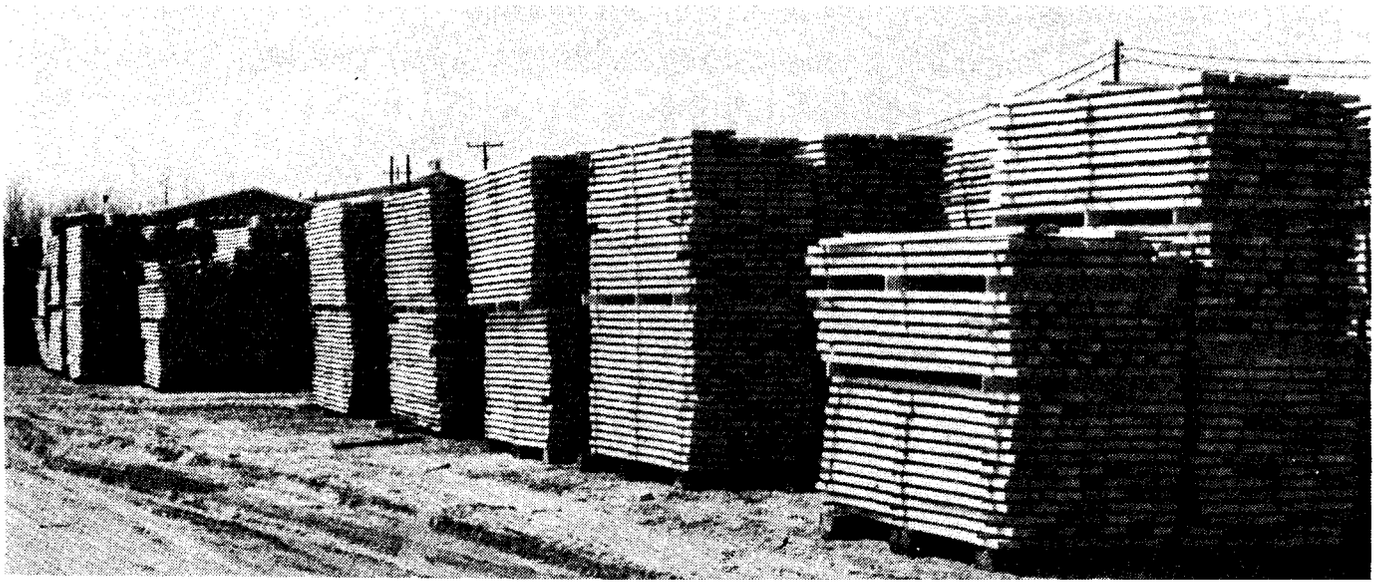

Does Sapstain Rob Summertime Profits?

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"Yellow poplar lumber can stain up in three days" were the comments of one Central Indiana grade sawmill operator when asked about sapstain. To prevent sapstain and associated value loss of high grade lumber this operator insisted that his lumber be dipped treated during the spring and summer months with the antistain chemical sodium pentachlorophenate (Na-PCP). We were not so sure that Central States hardwood lumber would undergo serious degrade from sapstain in three days (we subsequently found out that it can) but we did know that concern was being expressed by the Environmental Protection Agency over the toxicity of sodium pentachlorophenate. As a result the Department of Forestry at Purdue University and the U.S. Forest Products Laboratory initiated a cooperative project to identify chemical treatments with relatively low toxicity but yet effective in preventing sapstain and mold on lumber.

This article reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses here have been registered. All uses of pesticides must be registered by appropriate state and/or Federal agencies before they can be recommended. Use of trade names does not constitute an endorsement.

Fungal Stain and Decay

First let's discuss the cause of such discolorations in wood. Fungi are minute, thread-like organisms which utilize wood, or carbohydrates stored in wood cells, for food. Besides food, fungi require the presence of air (oxygen), water, and warm temperatures to survive and grow. Three general groups of fungi, all of which cause varying amounts of degrade in wood during air drying, are recognized. These are: stain, mold and decay fungi.

The stain fungi commonly affect only the sapwood, hence the resulting discoloration is commonly termed "sapstain." Blue stain is probably the most common of the sapstains and is readily recognized by its dark gray to blue color. The discolorations are deep-seated and considered a defect in most of the upper grades of all hardwood species. Also, where heavy sapstain is present, the toughness of the affected wood, or its ability to withstand shock, may be significantly reduced.

Discolorations caused by mold fungi are generally restricted to the surface of the wood, hence they usually do not result in a lowering in wood grade. Molding may be so heavy on wood, however, that it may cause respiratory problems with wood handlers. In addition, the presence of molds on wood indicate that conditions are conducive to sapstain and decay development.

The decay fungi usually take longer to develop noticeably and are the cause of

more serious degrade than that encountered with stain and mold fungi. Decay fungi may attack the heartwood as well as the sapwood and cause serious strength losses and discoloration throughout.

Oxidation Stain

Stains caused by fungi should not be confused with a gray to brown chemical or oxidation stain which develops during prolonged warm, wet seasons, especially in the southern United States. It is most common in stickered lumber but it can also develop in logs. Sometimes it appears like a sapstain on the surface of lumber. However, it usually develops just beneath the wood surface where adequate drying has not occurred.

Chemical stains are thought to be the result of oxidation and enzymatic action on certain materials stored in the wood cells. These stains are especially troublesome since they may not show up until the lumber is surfaced, and they may occur even when chemicals are used to prevent the fungus type sapstains. Chemical stain can be differentiated from the fungus type. Concentrated oxalic acid will bleach out the chemical stain but not those caused by fungi.

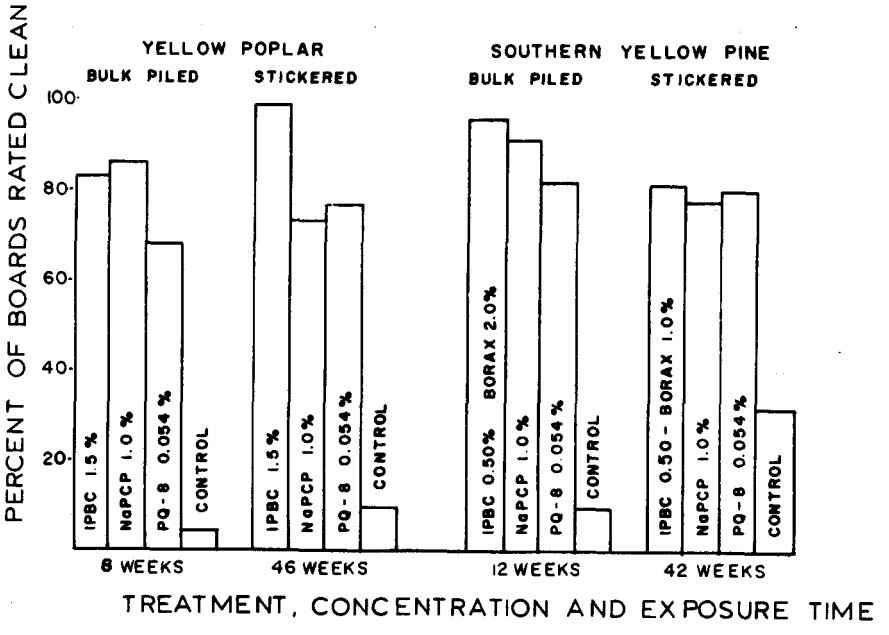
Bulk piled yellow poplar lumber with the bottom half dip treated for 15 seconds with a 60% solution of 3-iodo-2-propynyl butyl carbamate in early August and exposed for 8 weeks.

Chemical Dips to Prevent Sapstain

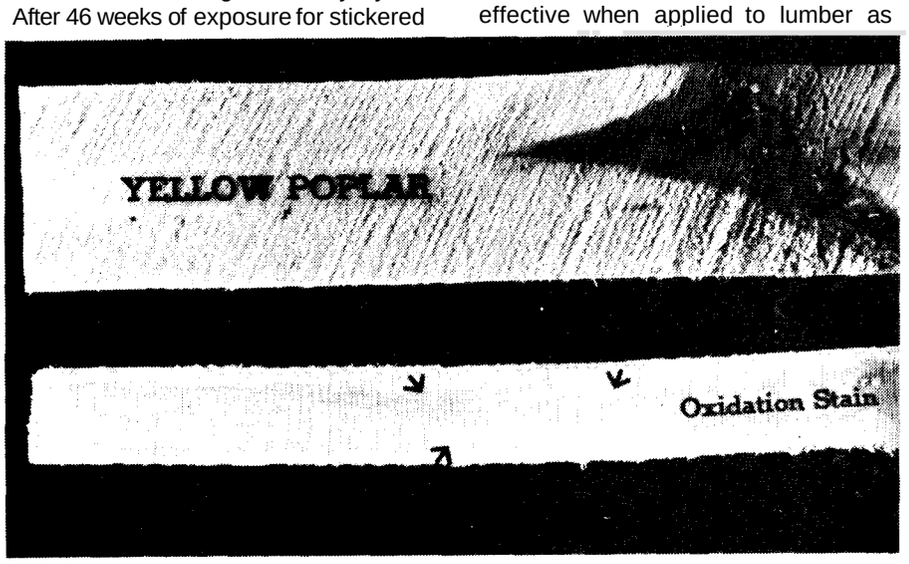
After laboratory testing[1,2] of numerous fungicides submitted by several companies on both yellow poplar and southern yellow pine lumber we were able to find one chemical 3-iodo-2-propynyl butyl carbamate (IPBC) produced by Troy Chemical Company of Newark, New Jersey which appeared to be about as effective as Na-PCP. Furthermore, the manufacturer was interested in developing it for the sawmill industry and has subsequently been able to register it for use in preventing sapstain on lumber. Therefore, field tests using IPBC as well as Na-PCP and Copper-8-quinolinolate (PQ-8) for comparative purposes were initiated on both yellow poplar and southern yellow pine lumber.[3]

Freshly cut lumber 1 by 6 feet long containing both sapwood and heartwood were obtained from west central Indiana. The bottom half of each board was dipped in the appropriate chemical solution for 15 seconds and allowed to drain in an upright position for another 15 seconds. After treatment, the lumber was piled into two stacks for each treatment and species. One stack was constructed using sticks for air drying while the second stack was bulk piled. The piles were erected between May 29 and August 14, 1983, near the Purdue University Campus in West Lafayette, Indiana. At four week intervals, the boards were scored on both the treated and untreated (control) ends. The table shows the percent of bulk piled and stickered boards for both yellow poplar and southern yellow pine lumber with five percent or less of the surface area (considered "clean") discolored by stain or mold for the best treatment involving IPBC, Na-PCP, PQ-8, and the controls. The results presented were selected to show treatments judged "effective" for the longest exposure periods. Additional exposure simply reduced the effectiveness of all. treatments.

Regardless of the chemical treatment used, the condition of the lumber in both



bulk and stickered piles is drastically improved over that of the controls. Lumber treated with any of the three chemicals tested and placed on stickers can be held with little damage for nearly a year. After 46 weeks of exposure for stickered yellow poplar the IPBC treatment was nearly a 100 percent effective in preventing discoloration but only 14 percent of the controls were rated clean. After 42 weeks of exposure for stickered yellow pine the chemical treatments were about 80 percent effective in preventing discoloration while only 32 percent of the controls were rated clean.



Gritty to brown chemical or oxidation stain on yellow poplar.

Even on bulk piled lumber, the chemical treatments on yellow poplar were fairly effective in preventing stain after eight weeks of exposure while treated southern yellow pine was in somewhat better condition even after 12 weeks of exposure.

For both the bulk piled and stickered lumber lower concentrations of IPBC were nearly as effective in preventing discoloration particularly with shorter exposure periods.

From these results, it is obvious that discoloration of lumber from sapstain and mold is a serious problem during warm weather even in the central United States. It is not a problem confined to the southern United States where nearly all lumber is dip treated to prevent discoloration. Weather conditions (warm temperatures) favoring stain and mold development simply occur more frequently each year in the South than in the North. Chemical treatments can substantially reduce discoloration of bulk piled lumber for at least two months exposure time. Even on stickered lumber, substantial discoloration can result if a chemical treatment is not used. Chemical treatments of lumber are most effective when applied to lumber as soon as it is cut. Lumber cut from logs pre-infected with stain fungi will not respond well to treatment.

Prevention of Stain in Logs

Logs, like lumber, can stain during spring and summer months. Unfortunately, most lumbermen have no idea how much economic loss they may suffer from sapstain in logs. Portions of boards with stain are simply "cut back" or the grade is lowered. Then too, stain may be extensive one time and not present a serious problem at another time.

Because the extensiveness of stain varies with conditions, it is difficult to accurately assess the amount of damage which may occur. An Indiana study on yellow poplar has shown that 25 to 39 percent of the sapwood area of 4/4 lumber cut from logs stored for 10 weeks during the summer is stained. In a Wisconsin and Michigan study of maple and birch veneer bolts, average sapstain penetration ranged from 21 to 42 inches from each end for winter-cut material held until October.[4] A Mississippi study on hackberry showed that nearly all lumber cut from untreated logs had stain penetration of 15.5 inches on each end. The logs were held for 4 weeks during the summer.[5] Another Mississippi study showed that the value of lumber cut from unprotected hackberry logs was reduced from $255.82 to $112.13 per thousand board feet due to stain.[6]

Many mill operators in the central, northern, and eastern United States reduce log stain and deterioration problems through inventory control or rapid turnover of logs. The first logs decked should be the first milled. Logs can be decked from one side of an alley and removed from the back side. This prevents some logs from remaining in the yard longer than necessary. Limiting inventory will help prevent stain of untreated logs during the summer months and also cut inventory costs. It is also

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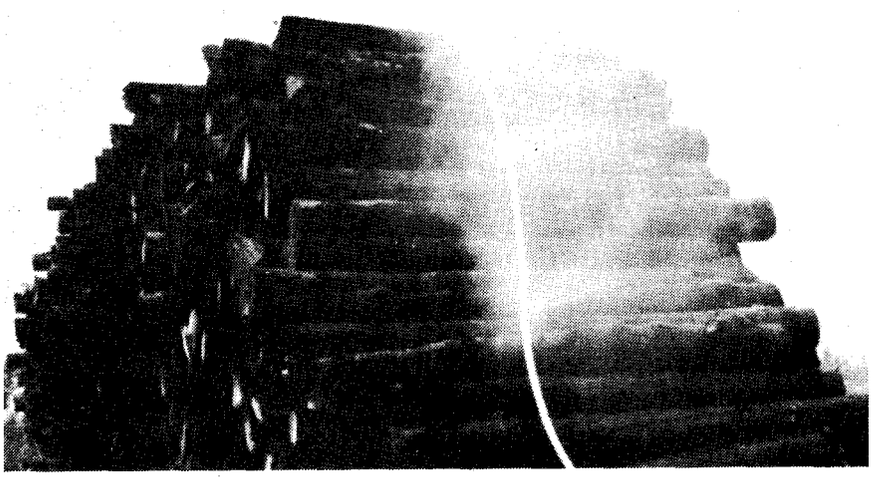

Example of water spray system designed to prevent log stain.

common practice to cut those species with wide sapwood first. They include yellow poplar, hard maple, soft maple, gum, sycamore, and hackberry.

Stain can also be avoided by preventing contact of air with the logs. When ponding logs was common practice, stain seldom developed in those log parts which were consistently submerged. Air was excluded.

Today, the most common method of preventing log stain is by using water spray systems. Southern yard managers have indicated that logs can be stored under water for six months to 1.5 years without appreciable damage. Experience at a commercial mill in Indiana on fresh cut yellow poplar logs has shown that the percent of sapwood area stained can be reduced from 39 percent to four percent when the logs are held for 10 weeks during the summer. At a second location, the amount of stain was reduced from 25 to one percent. The logs were cut into 4/4 quarter lumber and the surface areas measured to determine percent.

Any type of sprinkler system, such as common agricultural irrigation equipment may be used as long as the logs are kept consistently wet. Strong winds, which blow the spray to one side, and hot, dry days must be considered in designing the system. Makeshift operations using fire hose perforated with a leather punch and draped long-ways across log decks have been incorporated by others and have given excellent results.

The use of water spray systems in log yards may cause excessive accumulation of moisture in the yard, and some of it will "run off," especially during periods of heavy natural precipitation. Certain state and/or federal requirements must be met if waste water is discharged from a mill yard or even if the water is retained in a holding pond. Before installing a water spray system be sure to check with local and state officials to determine exactly what is required.

Where water supplies are limited or where environmental considerations limit the use of water storage, logs may be protected by fungicidal sprays.[7] Where insects are a problem, insecticides need to be combined with the fungicide. High value hardwood logs, not subjected to insect damage, may be protected by application of a preservative to the log ends followed by an asphaltic material.[8] Chemical treatment of logs does not work on tree species, such as beech and black oak, however, whose bark is not fungus resistant.[7]

Summary

Stain, or the objectionable discoloration of wood, is generally caused by decay fungi and occurs during the late spring and summer months in northern and eastern states. It can affect both logs and lumber. If the proper conditions develop, stain will be a costly problem in terms of a devalued product. Fortunately, it can be controlled in logs by rapid processing, chemical sprays, or by water storage systems. It can also be controlled in freshly-cut lumber by chemical treatment. However, lumber treatment will not be effective if the logs being processed are already seriously infected with stain fungi.

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