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TECHNICAL NOTE NUMBER 225

FOREST PRODUCTS LABORATORY - U. S. FOREST SERVICE - MADISON, WISCONSIN

CAUSE AND PREVENTION OF BLUE STAIN IN WOOD

Blue stain is caused by minute fungi which grow within the cells of sapwood. The objectionable bluish appearance is a combination of the light color of the wood and the dark color of the fungus threads in the wood. Blue stain, of itself, should not be considered a stage of decay, although the conditions that favor blue staining also very often lead to infection with decay-producing fungi.

To prevent blue stain it is first necessary to know the conditions favorable and unfavorable to the development of blue stain fungi, and then to eliminate the favorable and to produce the unfavorable conditions as far as possible. The organisms are disseminated by spores that are always present in the air, or by spreading from wood already infected. Their growth is dependent upon food, moisture, air, and favorable temperatures. If any one of these factors can be controlled, sapwood will not stain.

The contents of the sapwood cells furnish the necessary food. If the food supply can be made unavailable by the use of chemicals, this factor can be controlled. The moisture content of the wood must exceed 20 per cent to sustain growth, but on the other hand the fungi can not grow if the cell cavities are absolutely full of water. Hence the spread of stain may be prevented either by rapidly drying freshly exposed surfaces to a moisture content below 20 per cent or by keeping the stock thoroughly wet. Some air is required to sustain growth, and stain can be prevented if the air can be excluded. The fungi grow most rapidly when the temperature is from 75° to 95° F. At 40° to 45° F. and at 100° F. and above, growth practically stops. A temperature of 130° F., if maintained long enough, will kill the organisms.

CONTROLLING STAIN IN LOGS

Logs are often badly infected before they are sawed into lumber. Where immediate conversion into lumber is impossible, it may be practicable to prevent fungus growth by using chemicals, or by excluding the air or by retarding evaporation from the green logs. The choice of a method will depend upon conditions.

CHEMICAL TREATMENTS: Spraying the sides and ends of logs with an antiseptic mixture of 1 part cresylic acid to 10 parts of crude oil or kerosene will retard the spread of stain in the sapwood of red gum for several weeks of hot summer weather, and two or three months of fall weather. The method is recommended for trial with other hardwoods and softwoods. The antiseptic may be applied with an ordinary garden spray.

EXCLUDING AIR AND RETARDING EVAPORATION: Air may be excluded by sinking the logs in a log pond, or by storing them in piles under a water spray which will keep them thoroughly wet at all times. Painting the ends of logs with an antiseptic mixture which excludes the air and retards drying will be more effective in reducing end checking and will control stain somewhat better than will oil and cresylic acid combination. A coating of this character can be prepared by mixing the following materials in the proportions indicated:

	Parts by weight
Hardened gloss oil	100
Barytes	25
Asbestine	25
Cresylic acid	10

CONTROLLING STAIN IN LUMBER

The most effective method of preventing stain in lumber is to kiln dry the stock green from the saw. By this method both temperature and moisture conditions are made unfavorable for the growth of fungi. Where

stock is to be seasoned in a storage yard, one of the following preliminary treatments may be used: The surfaces of the lumber may be treated with chemicals that top the development of the organisms, or the surface moisture content may be lowered below 20 per cent, or the stock may be subjected to a high-temperature treatment that will kill all infection in the pieces.

CHEMICAL TREATMENT of lumber to prevent stain is usually accomplished by dipping. Bichloride of mercury, although effective, is not extensively used in the United States because of its corrosive and poisonous qualities. The substances most commonly employed are sodium carbonate (soda ash) and sodium bicarbonate (baking soda). In rainy weather sodium carbonate should be used in the proportion of 66 pounds to 100 gallons of water (8 per cent), but in dry weather 33 pounds to 100 gallons (4 per cent) should suffice. The proportions of sodium bicarbonate recommended for rainy and dry weather, respectively, are 90 pounds to 100 gallons (11 per cent) and 45 pounds to 100 gallons (5.5 per cent).

Sodium fluoride, sodium silicate and sodium bisulphite, either alone or in combination with each other or with the carbonate or bicarbonate, seem effective when properly handled. They are therefore recommended for trial.

In prolonged periods of wet weather chemical dipping may not prevent stain. Surface treatment of boards from infected logs will not stop the development of fungi already present. The following points should be kept in mind: (1) Success depends on knowledge of blue stain and its control, on careful allowance for weather conditions, and on adequate supervision of both the treating process and the subsequent handling of the lumber. (2) The solutions should be prepared carefully and the concentrations kept as nearly uniform as possible with a hydrometer. (3) Hot solutions are better than cold solutions. (4) The solutions should be kept as clean as practicable. (5) The stock should

be dipped as soon possible after it comes from the saw. (6) After dipping it should be piled so that it will dry as rapidly as possible without undue warping or checking.

REDUCING SURFACE MOISTURE CONTENT: End-racking lumber (leaning pieces crosswise on edge against a horizontal support) for 3 to 7 days usually reduces the surface moisture content below the point where stain will develop. The stock should be watched carefully so that it may be taken from the rack and yard-piled before warping begins. End-racking is not completely effective against stain if the stock is cut from infected logs.

TEMPERATURE TREATMENT: Steaming for four hours or more at 180° F., which is common practice at many plants, will kill the staining fungi present in the stock. Steaming itself does not dry the lumber, but upon removal from the steaming chamber the hot wood surfaces will dry rapidly, provided the load is exposed to free air circulation and is protected from rain. If the steaming chamber is provided with heating coils, so that the stock can be subjected to a period of 12 hours or more of low humidity after steaming, surface drying will be assured. Such treatment, applied to non-refractory species, would be an improvement upon ordinary steaming practice.

GENERAL RECOMMENDATIONS FOR YARD PRACTICE: If kiln dried, end-racked, or steamed stock is subsequently allowed to become wet, more or less staining is likely to result. Stock going to the yard from the racks or kilns should not be allowed to stand close-piled on buggies over night. Yard piles should be as narrow as practical, properly elevated, well spaced, and adequately roofed. The use of stock boards as stickers, especially where over 4 inches wide, induces crosser stain. Narrow, dry stickers are greatly to be preferred. Chemically treated stickers last longer than untreated stickers and are less likely to carry infection to the lumber.

(This note supersedes Technical Note 151)