In Eastern White Pine

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Degrade caused by brown stain and blue stain in eastern white pine was virtually eliminated by the use of sap stain chemicals and sodium azide. Combinations of buffered sodium azide with both sodium pentachlorophenate plus borax and buffered ethyl mercury phosphate were effective.

THE BROWN STAIN FOUND IN eastern white pine *(Pinus strobus L.)* is essentially identical to that found in western white pine *(Pinus monticola)* in degree, rate of stain development, and general stain appearance. Stain development is dependent on the presence of oxygen, moisture, and is greatly accelerated by high summer temperatures and humidities. Unlike stain in sugar pine,[2] the appearance of this stain is not as dependent on the secondary oxidation step or the dry-kiln step in that it can be induced under air seasoning conditions. Prevalence of the stain is generally associated with an induction period during the hottest and most humid part of the summer, followed by normal kiln drying.

Since brown stain development in eastern white pine is most severe during July and August, the field test was installed at the Champlin Company in Rochester, New Hampshire during this season. Grading of the lumber was done under the supervision of Dr. Koch. Approximately 20 percent of the lumber taken from the sawmill green sorting chain was rejected because of the presence of log-borne blue stain. In spite of this selection, an added burden was placed on the blue stain control agents because the leading hyphae of the fungi are an undetermined distance ahead of pigment development. Therefore, the assumption follows that some blue stain would escape observation and appear in the anti-blue stain treated solid piled portion of the samples.

Methods and Materials

Six groups of 50 eastern white pine boards ranging in size from 1-inch-by-6-inch-by-8-foot to 1-inch-by-10-inch-by-8-foot, which were examined before treating to be certain none contained any blue or brown stain, were treated per 100 gallons of solution with 4 pounds of 12.50 percent sodium azide and a borate-carbonate buffer (Bazide); 10 pounds of 35.00 percent sodium pentachlorophenate in a borax buffer (Permatox 10–S); 10 pounds of 12.50 percent sodium azide and a borate-carbonate buffer plus 4 pounds of 35.00 percent sodium pentachlorophenate in a borax buffer (Permatox 10–S plus Bazide); 2 pounds of 6.25 percent ethyl mercury phosphate in a carbonate buffer (Timsan); 2 pounds of 6.25 percent ethyl mercury phosphate in a carbonate buffer plus 2 pounds of 12.50 percent solium azide and a borate-carbonate buffer (Timsan plus Bazide); and a control. The boards in this series were placed in the dry kiln immediately after treatment.

Twelve groups of approximately 50 eastern white pine boards ranging in size from 1-inch-by-6-inch-by-8-foot to 1-inch-by-10-inch-by-8-foot were solid piled one week before drying in the kiln. This series was treated per 100 gallons of solution with 2 pounds of Bazide; 4 pounds of Bazide; 8 pounds of Bazide; 10 pounds of Bazide; 10 pounds of Permatox 10–S; 10 pounds of Permatox 10–S plus 2 pounds of Bazide; 10 pounds of Permatox 10–S plus 4 pounds of Bazide; 10 pounds of Permatox 10–S plus 8 pounds of Bazide; 2 pounds of Timsan; 2 pounds of Timsan plus 1 pound of Bazide; 2 pounds of Timsan plus 2 pounds of Bazide; 2 pounds Timsan plus 4 pounds Bazide; and a control.

Both series of boards were completely sprinkled on both sides and ends to insure complete coverage. A garden sprinkling can was used, since a dip tank was not available. Experience has shown that results obtained by this procedure are identical to those from the usual dipping operation.

Each board was graded according to the mill's modification of the white pines grading standards for the paneling grades of stock produced. The dollar degrade values were calculated on the basis of accumulated experience of

Table 1 EASTERN WHITE PINE BROWN STAIN FIELD TEST NUMBER OF BOARDS DEGRADED*

	Untreated	4 lb. Bazide	P-10-S	P-10-S Plus 4 lb. Bazide	Timsan	Timsan Plus 2 lb. Bazide
Number of boards in sample	88	50	49	47	45	47
Brown stain present but no degrade	0	3	2	2	4	2
Blue stain present but no degrade	0	0	0	0	0	0
Downgraded 1 grade with brown stain	18	1	0	0	0	0
Downgraded 1 grade with blue stain	0	1	0	0	0	0
Downgraded 2 grades with brown stain	7	0	0	0	0	0
Downgraded 2 grades with blue stain	2	0	0	0	0	0
Boards containing brown stain	25	4	2	2	4	2
Number of unstained boards	11	45	47	45	41	45

*Stock treated and placed directly in the dry kiln.

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Table 2.—EASTERN WHITE PINE BROWN STAIN FIELD TEST*

	Untreated	2 lb. Bazide	4 lb. Bazide	8 lb. Bazide	P-10-S	P-10-S plus 2 lb. Bazide	P-10-S plus 4 lb. Bazide	P-10-S plus 8 lb. Bazide	Timsan	Timsan plus 1 lb. Bazide	Timsan plus 2 lb. Bazide	Timsan plus 4 lb. Bazide
No. of Boards in sample	50	49	49	49	49	50	50	50	49	50	50	50
No. of boards with brown stain but no degrade	1	4	1	1	7	1	2	1	14	7	1	2
% of boards with brown stain but no degrade	2	8.2	2.0	2.0	14.3	2	4	2	28.6	14	2	4
No. of boards with blue stain but no degrade	38	0	0	0	0	0	0	0	0	2	4	0
% of boards with blue stain but no degrade	76	0	0	0	0	0	0	0	0	4	8	0
No. of boards downgraded 1 grade with brown stain	14	6	2	0	27	0	2	1	10	5	3	0
% of boards downgraded 1 grade with brown stain	28	12.2	4.1	0	55	0	4	2	20.4	10	6	0
No. of boards downgraded 1 grade with blue stain	0	0	2	0	1	0	0	0	1	0	0	0
% of boards downgraded 1 grade with blue stain	0	0	4.1	0	2.0	0	0	0	2.0	0	0	0
No. of boards downgraded 2 grades with brown stain	35	0	0	0	12	0	0	0	0	0	0	0
% of boards down graded 2 grades with brown stain	70	0	0	0	24.5	0	0	0	0	0	0	0
No. of boards downgraded 2 grades with blue stain	0	0	0	0	0	0	0	0	0	0	0	0
% of boards downgraded 2 grades with blue stain	0	0	0	0	0	0	0	0	0	0	0	0
Total No. of boards containing brown stain	50	10	3	1	46	1	4	2	24	12	4	2
Total % of boards containing brown stain	100	20.4	6.1	2.0	93.6	2	8	4	49.0	24	8	4
Number of boards containing no stain	0	39	44	48	2	49	46	48	24	36	42	48

*Stock held in solid package one week before stickering and kiln dried.

Table 3.—EASTERN WHITE PINE BROWN STAIN FIELD TEST*

	Untreated	4 lb. Bazide	P-10-S	P-10-S plus 4 lb. Bazide	Timsan	Timsan plus 2 lb. Bazide
Downgraded 1 grade with Brown Stain	16.50	0.70	0	0	0	0
Downgraded 1 grade with Blue Stain	0	0.70	0	0	0	0
Downgraded 2 grades with Brown Stain	12.90	0	0	0	0	0
Downgraded 2 grades with Blue Stain	3.72	0	0	0	0	0
Total Dollar Loss per 1000 Board Feet	33.12	1.40	0	0	0	0

*Dollar degrade per 1,000 board feet (stock treated and placed directly in dry kiln.).

the mill. The data for the dollar degrade losses derived from brown stain were calculated on the basis of the $35 loss charged by the mill for each grade dropped in the paneling stock used in this test. Thus, if there was a 100 percent fall down of two grades from stain there would be a $70 mill loss.

Results

Table 1 shows the results for boards that went directly to the dry kiln after treatment. Eighteen of the 38 untreated controls were downgraded one grade as a result of brown stain, 7 (18.4 percent) were downgraded two grades with brown stain for a total of 65.7 percent downfall for brown stain, and 2 (5.3 percent) were downgraded two grades with blue stain. In contrast with the untreated control, the treatments (five different treatments) prevented degrade from both blue and brown stain with the exception of the 4-pound Bazide treatment in which one board (2 percent) was downgraded one grade because of brown stain, and one board (2 percent was degraded one grade with blue stain. Bazide alone exerts no blue stain control. Since this stock went directly to the dry kiln, the traces of blue stain are presumed to be log borne in origin except in the Bazide or untreated control portion, where blue and brown stain could have developed to this level during the normal manipulative period.

Table 2 shows there were 50 untreated controls. The boards in this test were solid piled one week before drying. Thirty-eight (76 percent) of the controls had blue stain but no degrade. The controls produced one board 2 percent with brown stain but no degrade. Fourteen boards (28 percent) of the controls were downgraded one grade with brown stain and 35 (70 percent) of the control boards were downgraded two grades with brown stain for a total of 100 percent development of brown stain. About 94 percent of the samples treated with Permatox 10–S alone developed brown stain, while only 49 percent of those treated with Timsan showed stain development. This ethyl mercury phosphate inhibition of stain formation is greater than that found with this system on sugar pine (1).

The increase of the Bazide level from two pounds to eight pounds per 100 gallons when Bazide alone was used caused a decrease in brown stain and thereby reduced the downgrade from 12 percent to 0 percent. There were no boards downgraded two grades with brown stain when treated with Bazide alone, while 70 percent of the untreated controls had fallen two grades.

When Permatox 10–S was used, there were 27 or 55 percent of the boards downgraded one grade with brown stain and 12 or 24.5 percent downgraded two grades with brown stain. The one board showing blue stain in both the Permatox 10–S and Timsan controls was probably from undetected log-borne stain. The brown stain dropped to the expected biological variation with the addition of Bazide to the Permatox 10–S. In fact, the Permatox solution containing two pounds of Bazide gave far better re-

Table 4.—EASTERN WHITE PINE BROWN STAIN FIELD TEST*

	Untreated	2 lb. Bazide	4 lb. Bazide	8 lb. Bazide	Permatox 10-S	P-10-S plus 1 lb. Bazide	P-10-S plus 4 lb. Bazide	P-10-S plus 8 lb. Bazide	Timsan	Timsan plus 1 lb. Bazide	Timsan plus 2 lb. Bazide	Timsan plus 4 lb. Bazide
Downgraded 1 grade with Brown stain	9.75	4.25	1.44	0	19.25	0	1.40	0.70	7.15	3.50	2.10	0
Downgraded 1 grade with Blue Stain	0	0	1.44	0	.70	0	0	0	1.40	0	0	0
Downgraded 2 grades with Brown stain	49.00	0	0	0	17.15	0	0	0	0	0	0	0
Total Dollar Loss per 1000 Board Feet	58.75	4.25	2.88	0	37.10	0	1.40	0.70	8.55	3.50	2.10	0

*Dollar degrade per 1,000 board feet (stock held in solid package one week before stickering and kiln drying).

sults than were anticipated on the basis of previous experience and must be attributed to biological factors. An 8 percent to 10 percent level of stain, insufficient to cause degrade, would have been normally expected. Since log freshness is a contributing factor, it can be argued that this was a factor in all sample groups. With the use of Timsan the number of boards downgraded one grade was 10 percent at the 1-pound of Bazide per 100-gallon level and again there were no boards downgraded two grades for brown stain. With the increase in concentration ratio of Bazide to Timsan, downgrade from brown stain was eliminated. Thus, in the Timsan portion of Table 2 the normal anticipated distribution pattern for brown stain control is followed.

Table 3 indicates that there is an appreciable dollar loss from brown stain even in stock that goes directly to the dry kiln, while Table 4 clearly indicates the amount and levels of dollar saving or increased profits that can be realized even when the stock is held in solid package for a week prior to kiln drying. In the sugar pine field test[2] these differences were even greater, although the patterns were similar.

Conclusion

This field test showed that brown stain can be eliminated with the addition of Bazide. Blue stain and brown stain can be controlled simultaneously with proper use of Permatox 10–S and Bazide or Timsan and Bazide with the resulting increase in grade recovery whether the stock goes directly to the dry kiln or whether there is a delay. Partial air seasoning with finishing in the kiln would follow this pattern. Completely air seasoned stock would be expected to show the same control pattern found previously in sugar pine except that a higher percentage of stain would be immediately apparent without an extended induction period of delayed development required by sugar pine.

Except for the untreated and Permatox 10–S controls there were no pieces dropping two grades, clearly demonstrating the effectiveness of the stain control system under these conditions. The important conclusion from Tables 3 and 4 is the increase in profit that can be realized by the use of Permatox 10–S plus 4 pounds per 100 gallons of Bazide or Timsan plus 2 pounds per 100 gallons of Bazide. As with the western pines, use of the dip system and control of solution concentration will allow sufficient time for accumulation of segregations and more nearly optimum use of the dry kiln even during the most severe portion of the stain season.

[2] Stutz, R. E. 1959. Control of brown stain in sugar pine with sodium azide. For. Prod. Jour. X(12) 459–463.

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