

EVALUATION OF SOME CHEMICALS FOR THE CONTROL OF BLUE STAIN FUNGUS AND PINHOLE BORER ON FRESHLY-SAWN COCONUT TIMBER ¹

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ABSTRACT

An investigation was made to determine the relative performance of some chemicals against growth of blue stain fungus and attack of pinhole borer on freshly-sawn coconut timber during the drying process. The fungicides used were Farmay Plus, Azaconazole and the standard chemical combination of Sodium Pentachlorophenate, BHC and Borax Pentahydrate. Cislin, an insecticide, was mixed with either Farmay Plus or Azaconazole solution.

Results after 12 weeks of air drying showed that all fungicides failed to give the desired protection against blue staining. Performance ratings of planed wood samples were within the range of heavy to severe stain infection. Although none of the fungicides was able to effectively control the blue stain fungus, their respective performance have been to some extent ascertained. On the other hand, Cislin showed an acceptable level of protection from pinhole borer infestation on coconut lumber.

INTRODUCTION

Green coconut lumber is susceptible to attack by blue stain fungus and pinhole borer during air drying. Kiln drying of lumber immediately after sawing will certainly solve this problem but at the moment the process is apparently too expensive to adopt. As a result, immediately dipping of freshly-sawn timber into chemical solution against attack of blue stain fungus and borer is usually resorted to prior to air drying.

Stain and pinholes may not be harmful to coconut timber but under certain conditions where general appearance of finished products is concerned, the wood materials with these defects caused by blue stain fungus and borer become serious problem. For instance, most people who choose wood for decorative purposes prefer unstained products as well as free from pinholes. On the other hand, products with aforementioned defects lose their innate beauty and are sold at lower price. Stain and pinholes are generally confined to low and medium density coconut timber. The former is caused by deeply penetrating fungus which caused discoloration through their dark-coloured hyphae or occasionally through staining of the cell walls of wood. The discoloration is most commonly greyish blue but it occurs also in black, pink or brown. The stained areas of the wood tend to follow porous routes, spreading along the grain and radially to form wedge-shaped patches when viewed in cross section. In addition, stain is almost invariably associated with superficial discoloration caused by mold fungus forming greenish-brown or black powdery growths which are easily brushed or planed away.

On the other hand, the latter defect is caused by pinhole borer which is known as ambrosia beetle. The ambrosia beetle is so named because it cultivates and feeds upon stain fungus which it introduces into its gallery. Hence, it derives little or no nourishment from the wood itself. Damage to coconut timber is done by adult beetle which bores into freshly-sawn timber. The hole is usually excavated across the grain of the wood and is kept clean of boring dust. The walls of the gallery, However, become stained from the inplanted fungus and this results to deep penetration of stain into the wood structure.

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This study was made possible through the close collaboration of The Wellcome Foundation Ltd. to compare/evaluate the performance of their chemicals (Farmay Plus and Azaconazole, both fungicides, and Cislin, an insecticide) and the standard chemical mixture of Sodium Pentachlorophenate, BHC and Borax Penahydrate for protection against attack of blue stain fungus and pinhole borer on freshly-sawn coconut timber. This study was conducted at the Timber Utilization Division, PCA, Zamboanga Research Centre from January to September, 1985.

MATERIALS AND METHODS

Newly-felled coconut logs were used in this study. The logs were converted into lumber using a circular sawmill. The round method of sawing was adopted to segregate the low, medium and high density timber. Only the low and medium density materials were selected as test samples.

Two treatment trials were made based on the prevailing weather conditions. The first trial was done during the dry season (January to April) while the other trial was conducted during the wet season (June to September). The treatments/treatment combinations were prescribed by The Wellcome Foundation Ltd. The first test consisted of eight treatment combinations or chemical mixtures with fifty samples per treatment (Table 1). Four hundred freshly-cut samples measuring 5 cm thick by 10 cm wide by 240 cm long were used.

Table 1: Treatment combinations and solution concentrations of test chemicals used during the dry season.

| TREATMENT COMBINATIONS | SOLUTION CONCENTRATION (%) |
|--|----------------------------|
| T ₁ - Sodium Pentachlorophenate (NaPCP) | 2.5 |
| BHC | 0.715 |
| Borax | 2.0 |
| T ₂ - NaPCP | 0.5 |
| BHC | 0.715 |
| Borax | 2.0 |
| T ₃ - Farmay Plus | 0.5 |
| Cislin 2.5% EC | 0.1 |
| T ₄ - Farmay Plus | 1.0 |
| Cislin 2.5% Ec | 0.1 |
| T ₅ - Azaconazole | 0.025 |
| Cislin 2.5% Ec | 0.1 |
| T ₆ - Azaconazole | 0.05 |
| Cislin 2.5% EC | 0.1 |
| T ₇ - Azaconazole | 0.075 |
| Cislin 2.5% EC | 0.2 |
| T ₈ - Control | Untreated |

In the second test, Azaconazole was excluded. It comprised of five treatments/treatment combinations with fifty samples each (Table 2). Two hundred fifty samples with dimensions of 5 cm by 10 cm by 275 cm were utilized.

Immediately after sawing, the sample boards were clearly labelled and dipped in the appropriate chemical for 30 seconds. Each treatment group was stacked under shed using one inch spacer for a period of three months.

Table 2: Treatment combinations and solution concentrations of test chemicals used during the wet season.

| TREATMENT COMBINATIONS | SOLUTION CONCENTRATION (%) |
|-------------------------------|-----------------------------------|
| T ₁ - NaPCP | 0.5 |
| BHC | 0.715 |
| Borax | 2.0 |
| T ₂ - Farmay Plus | 0.5 |
| Cislin 2.5% EC | 0.1 |
| T ₃ - NaPCP | 2.5 |
| BHC | 0.715 |
| Borax | 2.0 |
| T ₄ - Farmay Plus | 1.0 |
| Cislin 2.5% Ec | 0.1 |
| T ₅ - Control | Untreated |

Each sample board was examined 1 week, 2 weeks, 1 month, 2 months and 3 months after treatment by breaking down the stacks. They were evaluated visually for stain fungus and pinhole borer infestations. The visual stain infection rating presented below was used for assessment of each top and bottom surface of the samples:

| Particulars | Rating |
|----------------------------------|---------------|
| Clean - no infection | 1 |
| Trace - 1-5% of area infected | 2 |
| Slight - 6-10% of area infected | 3 |
| Light - 11-25% of area infected | 4 |
| Medium - 26-50% of area infected | 5 |
| Heavy - 51-75% of area infected | 6 |

On the other hand, borer's attack was assessed based on the number of holes on each top and bottom surface of the sample boards. The rating used was as follows:

| Particular | Rating |
|----------------------------|---------------|
| No attack of pinhole borer | 1 |
| 1 - 5 pinholes | 2 |
| 6 -10 pinholes | 3 |
| 11-20 pinholes | 4 |
| 21 or more | 5 |

After the final inspection (3 months storage), each board was planed to a depth of 3 mm from both faces and reassessed the extent of damage done by stain fungus and pinhole borer.

Reassessment was made after planing because the major problems with these defects were the discoloration and presence of pinholes of dressed timber.

RESULTS AND DISCUSSION

One of the recognized problems confronting the use of coconut wood is the presence of discoloration and pinholes caused by blue stain fungus and pinhole borer, respectively. This objectionable appearance in wood is frequently rejected by wood users and in most cases the stained and pinholed wood materials are accepted only at a reduced price.

The low and medium density sawn coconut timber were observed to be susceptible to attack by blue stain and pinhole borer during air seasoning. Thus, this experiment was conducted to evaluate the efficacy of the different chemicals as control measures against stain and pinhole borer on 2-inch low to medium density coconut boards.

Performance of anti-stain Chemicals

The effects of different chemical treatment in the control of blue stain infestation on freshly-sawn coconut timber are presented in Tables 3 and 4.

Table 3: Effect of Different Chemical Treatments in the Control of Blue Stain Infestation on Freshly-sawn Coconut Timber During the Dry Season.¹

| TREATMENT COMBINATIONS | R A T I N G ² | | | | | |
|---|---------------------------|--------------------|--------------------|---------------------|--------------------|---------------------|
| | Assessment Period (Weeks) | | | | | After Panning |
| | 1 | 2 | 4 | 8 | 12 | |
| T ₁ – 2.5% NaPCP+0.715% BHC+2% Borax | 1.00 ^e | 1.00 ^f | 1.000 ^f | 2.24 ^f | 2.05 ^d | 4.36 ^e |
| T ₂ – 0.5% NAPCP+0.715% BHC+2% Borax | 1.00 ^e | 1.15 ^f | 3.20 ^d | 6.76 ^a | 4.55 | 5.64 ^{cd} |
| T ₃ – 0.5% Farmay Plus+0.1% Cislin | 2.07 ^c | 2.94 ^d | 4.32 ^c | 5.13 ^e | 3.27 ^c | 5.57 ^d |
| T ₄ – 1.0% Farmy Plus+0.1% Cislin | 1.17 ^e | 1.69 ^e | 2.40 ^e | 5.79 ^d | 3.20 ^c | 4.68 ^e |
| T ₅ – 0.025% Azaconazole+0.1% Cislin | 2.37 ^b | 5.07 ^{ab} | 5.37 ^b | 6.26 ^{bcd} | 4.82 ^{ab} | 5.81 ^{bcd} |
| T ₆ – 0.05% Azaconazole+0.1% Cislin | 2.52 ^b | 5.45 ^a | 6.24 ^a | 6.55 ^{ab} | 5.28 ^a | 6.18 ^{ab} |
| T ₇ – 0.075% Azaconazole+0.2% Cislin | 1.73 ^d | 4.26 ^c | 5.56 ^b | 6.47 ^{abc} | 3.38 ^c | 6.11 ^{abc} |
| T ₈ - Control | 3.39 ^a | 4.83 ^b | 5.24 ^b | 6.04 ^{cd} | 4.96 ^{ab} | 6.59 ^a |
| CV % | 40.16 | 38.64 | 35.32 | 20.16 | 38.19 | 22.02 |

1. Mean of 50 samples. Means having the same letters are not significantly different at 5% level.

2. Clean or no infection - 1, Trace - 2, Slight - 3, Light - 4, Medium -5, Heavy - 6 and Severe - 7.

Results of tests during the dry season (Table 3) indicated that samples treated with 2.5% NaPCP (T₁) and 0.5% NaPCP (T₂) apparently gave complete protection from blue stain infestations on the surfaces of the boards within 4 weeks and 1 week, respectively. On the other hand, after 1 week 15% of the specimens treated with 1.0% Farmay Plus (T₄) showed trace to light infestations while the ones receiving 0.5% Farmay Plus (T₃) were 69% infected including 5% of the samples having heavily attacked by the fungus. Similarly, treatment with 0.075%, 0.05% and 0.025% Azaconazole (T₇, T₆ and T₅) indicated that 58% to 72% of the treated specimens were infected as against 93% of the untreated samples after a period of one week.

Attack of blue stain fungus associated with molds was observed to increase up to 8 weeks but after this period infestation was apparently slowed down due to decreased of moisture content of the wood (fiber saturation point and below). On the 12 weeks of assessment when equilibrium moisture content was attained, the performance rating of the samples were decreased by 21%, 40%, 30% and 18% for Sodium Pentachlorophenate, Farmay Plus, Azaconazole and control, respectively. This phenomenon indicated that the fungus ceased to grow at equilibrium moisture content leaving only discoloration.

Table 4: Effect of Different Chemical Treatments in the Control of Blue Stain Infestation on Freshly-sawn Coconut Timber During the Wet Season.

| TREATMENT COMBINATIONS | R A T I N G ² | | | | | |
|---|---------------------------|-------------------|-------------------|------|------|---------------|
| | Assessment Period (Weeks) | | | | | After Panning |
| | 1 | 2 | 4 | 8 | 12 | |
| T ₁ – 0.5% NaPCP+0.715% BHC+2% Borax | 2.16 ^b | 5.79 ^b | 6.64 ^a | 6.60 | 6.18 | 6.79 |
| T ₂ – 0.5% Farmay Plus 0.1% Cislin | 2.92 ^b | 6.07 ^b | 6.69 ^a | 6.90 | 6.84 | 6.64 |
| T ₃ – 2.5% NaPCP+0.715% BHC+2% Borax | 1.00 ^c | 1.06 ^d | 2.09 ^c | 6.10 | 6.09 | 6.40 |
| T ₄ – 1.0% Farmay Plus+0.1% Cislin | 1.50 ^c | 3.92 ^c | 5.90 ^b | 6.50 | 6.30 | 6.64 |
| T ₅ – Control | 5.18 ^a | 6.91 ^a | 6.02 ^a | 6.90 | 6.46 | 6.43 |
| CV % | 35.20 | 43.66 | 14.94 | NS | NS | NS |

¹Mean of 50 samples. Means having the same letters are not significantly different at 5% level.

²clean or no infection - 1, Trace-2, Slight-3, Light-4, medium-5 Heavy-6 and severe - 7.

The results during the wet season (Table 4) showed that the specimens treated with 2.5% NaPCP (T₃) were noted of having no, infection while 50% of the samples receiving 1.0% Farmay Plus (T₄) were infected by blue stain after one week. The treatments with lower solution concentrations showed inferior protection than the higher ones during the first week of drying. Samples treated with 0.5% Farmay Plus 0.5% NaPCP (T₁) were 71% infected while the specimens receiving 0.5% Farmay Plus (T₂) showed infestation of 86%. Ninety eight percent of the untreated specimen indicated medium to heavy attack of blue stain during the same period.

Infestations on the untreated specimens were severe on the second week while the treated samples were slightly to heavily infected except the materials treated with 2.5% NaPCP (T₃) which were 95 free of infection. On the fourth week of assessment, the only treatment having an acceptable level of infection was T₃ with a rating of 2.09 (Table. 4). However, on the eight week T₃ was rated of having heavy to severe infection together with T₁, T₂, T₄ and T₅. Likewise, results of assessment on the twelve week indicated heavy to severe infection in all treatments indicating that the test samples still contained high amount of moisture necessary for the growth and survival of stain and mold fungi.

The extent of damage by blue stain fungus was determined by dressing the specimens at a depth of 3 mm after the twelve week of assessment. The effect of the different treatments after planing as control measure against blue stain on coconut timber is presented in Table 3. Comparison among treatment means showed that T₁ (2.5% NaPCP + 0.715% BHC + 2% Borax) and T₄ (1.0% Farmay Plus + 0.1% Cislin) showed no significant difference and these treatments were markedly

better than the rest of the treatments. T₁ and T₄ indicated light to medium staining while T₂, T₃, T₅, T₆ and T₇ including the control were heavily to severely stained.

The test conducted during the wet season showed that the treatment means of the treated and untreated samples were not significantly different. After planing, the specimens were severely stained (Table 4).

The rate of attack of blue stain fungus on freshly-sawn low to medium density coconut timber was observed to be high during the wet than the dry season. This is an indication that extra protection should be made on sawn coconut timber during the rainy season when stain fungus is prevalent and infection takes place rapidly.

Control of Pinhole Borer

The effects of different chemical treatments in the control of pinhole borer on freshly-sawn coconut timber are- presented in Tables 5 and 6. Results showed that during the dry season the samples were almost free from pinholes after one week except T₁, T₅, T₆ and T₈ which had infestation of 7%, 3%, 4% and 5%, respectively. The test during the wet season revealed that 5% of the untreated specimens were infested but the treated samples were completely free from pinholes in one week exposure.

The weekly rate of increase of pinholes ranged from 2% to 8% although T₃ (2.5% NaPCP + 0.715% BHC + 2% Borax) and T₄ (1.0% Farmay Plus + 0.1% Cislin) were not attacked by pinhole borer for the first two weeks (Table 6).

Comparison among treatment means indicated no significant difference after one week (Tables 5 and 6). However, starting from the second week the untreated specimens markedly showed greater pinholes than the treated samples. The test conducted during the dry season showed that after planing the treated materials were not significantly different while the ones done during the wet season indicated that T₃ and T₄ were markedly better than T₁ and T₂.

Based on the final assessment after planing, all the treated samples provided acceptable level of pinholes with mean performance ratings ranging from 1.41 to 1.63 during the dry season and 1.17 to 1.52 during the wet season. The untreated specimens showed performance ratings of 2.0 to 2.40.

CONCLUSION AND RECOMENDATION

Based on the results of this study, Sodium Pentachlorophenate, Farmay Plus and Azaconale used as anti-stain chemicals with solution concentrations of 0.5%-2.5%, 0.50%-1.0% and 0.025%-0.075%, respectively, appeared unsatisfactory in the control of molds as well as blue stain fungus on freshly-sawn low to medium density coconut timber. However, Cislin, an insecticide, provided acceptable level of protection against attack of pinhole borer on coconut lumber.

It is recommended that further trials should be done on these chemicals to determine the optimum solution concentration for complete protection from growth of molds and blue stain on newly-sawn coconut timber during the drying process.

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