Jurnal Penelitian Hasil Hutan
Forest Products Research Journal
Vol. 1, No. 3 (1984) 39 — 43

DICHLOFUANID AS PESTICIDE FOR THE PROTECTION OF RAMIN LUMBER AGAINST BLUE STAIN*)

Dichlofluanid sebagai pestisida untuk proteksi papan ramin terhadap jamur biru

by/*oleh*

Abdurahim Martawijaya & Dominicus Martono

Ringkasan

Pengujian efikasi dua macam formulasi Dichlofluanid (DCFN) komersial terhadap jamur biru pada papan ramin, masing-masing dengan kandungan bahan aktif 50 persen dan 80 persen (DCFN 50 dan DCFN 80), baik sebagai larutan tunggal maupun dikombinasikan dengan garam Diazeniumdioxy (DD), Borax (B) dan BHC, dibandingkan dengan campuran NaPCP + B + BHC, memberi hasil sebagai berikut :

1. *DCFN 50 dan DCFN 80 sebagai larutan tunggal menunjukkan efikasi yang nyata lebih baik daripada campuran NaPCP + B + BHC, baik dalam hal pewarnaan permukaan maupun pewarnaan intern.*
2. *DCFN 50 (tunggal) menunjukkan efikasi yang nyata lebih baik daripada DCFN 80 (tunggal) dan dalam hal ini larutan 1.5 % DCFN 50 memberi hasil yang efektif dengan nilai rata-rata pewarnaan permukaan dan pewarnaan intern kurang dari satu persen.*
3. *Borax sebagai larutan tunggal maupun dicampur dengan BHC tidak dapat mencegah serangan jamur biru pada papan ramin, tetapi efikasi DCFN meningkat secara nyata jika dikombinasikan dengan campuran B + BHC, terutama pada DCFN 50. Pada kombinasi 1,5 % DCFN 50 + 1,5 % B + 1,0 % BHC diperoleh papan ramin yang praktis bebas dari pewarnaan permukaan dan pewarnaan intern dengan tingkat serangan kurang dari satu persen, jauh lebih baik dari campuran NaPCP + B + BHC.*
4. *Efikasi DCFN 80 juga dapat meningkat secara nyata jika dikombinasikan dengan campuran B + BHC dan memberi hasil yang nyata lebih baik daripada campuran NaPCP + B + BHC, tetapi masih menunjukkan tingkat pewarnaan yang nyata di atas satu persen.*
5. *Garam DD secara tunggal (0,1 — 1,5 %) memberi hasil yang nyata lebih baik dari campuran NaPCP + B + BHC, tetapi tidak sebaik DCFN 50 atau kombinasi DCFN 50 + B + BHC. Dalam hal ini penambahan campuran B + BHC tidak meningkatkan efikasi DD.*
6. *Untuk mencapai hasil efektif dengan tingkat pewarnaan di bawah satu persen, dapat digunakan konsentrasi DCFN 50 yang lebih rendah dari 1,5 % tetapi tidak kurang dari 1,2 %, jika dicampur dengan garam DD, dalam hal ini dengan kombinasi 1,2 % DCFN 50 + 0,4 % DD. Konsentrasi DCFN 50 dapat dikurangi lagi menjadi 0,8 % jika ditambah dengan campuran DD + B + BHC, dalam hal ini berupa kombinasi 0,8 % DCFN 50 + 0,2 % DD + 1,5 % B + 1,0 % BHC.*
7. *Dengan menaikkan lagi konsentrasi DCFN 50 dan DD pada kombinasi DCFN 50 + DD + B + BHC menjadi 1,2 % DCFN 50 + 0,4 % DD + 1,5 % B + 1,0 % BHC diperoleh papan ramin yang bebas sama sekali dari pewarnaan permukaan dan pewarnaan intern.*

I. INTRODUCTION

Since the prohibition of the use of Pentachlorophenol and its sodium salts by virtue of the Agriculture Minister's Decision No. 59/Kpts/Um/1/1980, a series of experiments have been made in search of substitutes for NaPCP, a preventive agent commonly applied to ward off blue stain attack on ramin wood.

An earlier investigation showed that the formulation containing the active ingredient Dichlofuanid (normally called DCFN) is one of the pesticides having good prospects in the protection against blue stain of ramin wood, both freshly cut logs and freshly sawn lumber (MARTAWIJAYA, ABDURROCHIM and MARTONO, 1980). In the experiment, the 1.0 % and 1.5 % DCFN 80 solutions (a formulation with 80 % DCFN as active ingredient) were effective concentrations that can prevent blue stain infestation on ramin boards for 2 and 4 weeks respectively.

A second investigation gave more encouraging results. It is known that NaPCP is commonly used in a mixture with Borax in a certain proportion. The result of the investigation indicated that replacement of NaPCP in the mixture of NaPCP/Borax/BHC by DCFN 80 produced higher efficacy (MARTAWIJAYA, 1981). In the test the mixture of 1.5 % DCFN 80 + 1.5 % Borax + 1 % BHC gave a better result than the mixture of 3 % NaPCP + 1 % Borax + 1 % BHC, which is in common use in ramin wood sawmills. In the test the NaPCP con-

*) Presented as a position paper at the Wood Preservation Seminar in Jakarta, October 12 — 13, 1983.

tained 89 % active ingredient, while the BHC contained 26 % active Gamma-BHC.

It was reported further (MARTAWIJAYA, 1982) that DCFN 50, another formulation containing 50 % DCFN as active ingredient with additives different from that in DCFN 80, appeared to have higher efficacy against blue stain than DCFN 80 despite its lower content of active ingredient. In this case the significant effect may have been brought about by the different additives because, dipped in the DCFN 50 solution, ramin wood apparently was not affected by any internal stain while surface stain was just very slight and negligible.

This paper discusses the results of further research on the efficacy of DCFN against blue stain on ramin wood based on experimental tests conducted at the sawmill of PT Daya Sakti Timber Corporation, Pulau Beruang, Banjarmasin, November 1981 — January 1982.

II. MATERIALS AND METHOD

The test specimens used were freshly sawn ramin boards, each 1.5 inches thick, 4.0 to 8.5 inches wide and 32 inches long in most cases. Because of material scarcity, a number of 24 to 32 inch long boards were also employed.

Experiences from past tests indicated that boards originating from sunken logs or logs submerged in water for a long time, have often shown signs of internal stain, although their surface are free from discolouration by blue stain. Hence, the test specimens must entirely be fresh and free from defects and come from fresh logs floating in the logpond.

The test included 2 kinds of commercial DCFN formulation containing 50 % and 80 % active ingredient, each with different additives. Furthermore, the effect of adding other active ingredients were also examined to see whether the addition has increased the efficacy of DCFN. For this purpose 2 kinds of additional active ingredients were tested, i.e., Borax and Diazenium dioxy salt. Insecticides are often needed to protect the ramin boards in the sawmill against insect attack so that the addition of BHC was also tested to see whether it has no negative effects on the efficacy of DCFN. Comparative tests were also made on untreated ramin boards (control) and the NaPCP/Borax/BHC mixture, a preservative widely used in ramin sawmills. A summary of the active ingredients and the formulation forms of the pesticides used in the test is given in Table 1.

Table 1. Active ingredients and formulation form of tested pesticides

Tabel 1. Bahan aktif dan bentuk formulasi yang diuji

Pesticide code *(Kode pestisida)*	Active ingredient *(Bahan aktif)*	Formulation form *(Bentuk formulasi)*
DCFN 50	50 % Dichlofluanid	Powder
DCFN 80	80 % Dichlofluanid	Powder
DD	80 % Diazenium-dioxy	Powder
B	Borax	Powder
BHC	26 % Gamma-BHC	Powder
NaPCP	89 % Na-pentachlorophenol	Granular

Preservative solutions were then made of the 6 pesticides in various combinations of compositions and concentrations resulting in 30 kinds of treatment as listed in Table 2 (including control).

The test specimens were dipped into the respective pesticide solutions mentioned above for a few seconds, taken out and left for a moment until the drippings ceased. With the help of 5 cm stickers all specimens were then piled up at random in several piles together with the control board in the lumber shed. In this case 10 test specimens were treated for each concentration treatment. The piles of specimens were then exposed to blue stain and mold attacks in a natural way.

By the end of the 2nd, 4th and 8th week, observations were made on the test specimens by measuring the proportion of the surfaces affected by blue stain and mold, expressed in percentage of the total surface of the test specimen. At the end of the experiment (8 weeks after dipping) all the test specimens were split in half lengthwise to detect any possible blue stain attack in the inside (internal stain). The affected portion was then measured and expressed in percentage of the cross-section of the test specimen. The concentration treatment is considered effective if the average value of the attack is less than 1 %, for surface as well as internal stain.

III. RESULTS AND DISCUSSION

The results of the observations, which are the mean values of 10 replications are given in Table 2. To establish the effect of every treatment on surface stain an analysis of variance was made on the basis of a randomized block design where the observation time was treated as block, while the effects on internal stain were drawn up on a complete random design. For the analysis of variance the surface and internal stain percentages were first transformed into arcsin $\sqrt{\%}$. The results are given in Table 3.

Table 2. Test results of various Dichlofluanid formulations against blue stain on ramin boards
Tabel 2. Hasil pengujian berbagai formulasi Dichlofluanid terhadap jamur biru

No.	Pesticide composition *(Komposisi pestisida)*	Surface stain *(Pewarnaan permukaan)* (%)				Internal stain *(Pewarnaan intern)* (%)
		2 weeks *(minggu)*	4 weeks *(minggu)*	8 weeks *(minggu)*	Average *(Rata-rata)*	
1.	Control	68.3	81.1	81.4	76.9	77.5
2.	1.0 % DCFN 50	7.2	22.0	19.5	16.2	2.6
3.	1.5 % DCFN 50	0	0.1	0.9	0.3	0
4.	1.0 % DCFN 80	7.9	12.2	13.6	11.2	6.9
5.	1.5 % DCFN 80	17.1	28.3	35.8	27.1	5.8
6.	0.5 % DD	74.8	97.7	87.4	86.6	33.8
7.	1.0 % DD	1.0	0.2	1.4	0.9	11.8
8.	1.5 % DD	1.6	10.4	11.4	7.8	4.4
9.	1.5 % B	98.9	100	99.6	99.5	87.9
10.	1.5 % B + 1.0 % BHC	73.0	81.5	83.4	79.3	58.6
11.	1.0 % DCFN 50 + 1.5 % B + 1.0 % BHC	0.1	0.1	0.1	0.1	3.2
12.	1.5 % DCFN 50 + 1.5 % B + 1.0 % BHC	0	0	0.2	0.1	0
13.	1.0 % DCFN 80 + 1.5 % B + 1.0 % BHC	0.7	10.5	11.5	7.6	7.6
14.	1.5 % DCFN 80 + 1.5 % B + 1.0 % BHC	4.7	7.7	9.1	7.2	4.5
15.	0.5 % DD + 1.5 % B + 1.0 % BHC	83.6	93.2	93.5	90.1	31.7
16.	1.0 % DD + 1.5 % B + 1.0 % BHC	2.5	10.5	11.2	8.1	0
17.	1.5 % DD + 1.5 % B + 1.0 % BHC	1.5	4.2	3.8	3.2	5.4
18.	0.2 % DCFN 50 + 0.8 % DD	0	35.4	15.2	16.9	4.9
19.	0.5 % DCFN 50 + 0.5 % DD	0	6.5	4.4	3.6	26.9
20.	0.8 % DCFN 50 + 0.2 % DD	0.3	1.4	1.6	1.1	1.3
21.	0.4 % DCFN 50 + 1.2 % DD	0.6	26.9	9.3	12.3	23.1
22.	0.8 % DCFN 50 + 0.8 % DD	0.7	1.8	1.8	1.4	8.7
23.	1.2 % DCFN 50 + 0.4 % DD	0.1	0.2	0.2	0.1	0
24.	0.2 % DCFN 50 + 0.8 % DD + 1.5 % B + 1.0 % BHC	0	32.2	8.9	13.6	7.0
25.	0.5 % DCFN 50 + 0.5 % DD + 1.5 % B + 1.0 % BHC	0	0.8	1.4	0.7	7.2
26.	0.8 % DCFN 50 + 0.2 % DD + 1.5 % B + 1.0 % BHC	0	0.2	0.1	0	0.1
27.	0.4 % DCFN 50 + 0.8 % DD + 1.5 % B + 1.0 % BHC	0	25.5	5.2	10.3	10.5
28.	0.8 % DCFN 50 + 0.4 % DD + 1.5 % B + 1.0 % BHC	0	0.7	0.5	0.4	13.9
29.	1.2 % DCFN 50 + 0.4 % DD + 1.5 % B + 1.0 % BHC	0	0	0	0	0
30.	3.0 % NaPCP + 1.5 % B + 1.0 % BHC	21.7	68.4	73.5	54.6	14.7
	F	—	—	—	84.25**	170.20**
	D	—	—	—	7.0	2.9

Keterangan *(Remarks)* :

** = Significant at 1% probability level *(Nyata pada taraf peluang 1%)*

D = Significant difference between two means *(Selisih nyata antara dua nilai rata-rata)*

Table 3. Analysis of variance
Tabel 3. Analisis keragaman

Source of variation *(Sumber variasi)*	Degrees of freedom *(Derajat bebas)*	Sum of squares *(Jumlah kuadrat)*	Mean square *(Kuadrat tengah)*	F
		Surface stain *(Pewarnaan permukaan)*		
Time *(Waktu)*	2	14,322.16	7,166.08	
Pesticide *(Pestisida)*	29	647,638.51	22,332.36	84.255**
Error *(Galat)*	868	230,070.01	265.06	
Total	899	892,040.68		
		Internal stain *(Pewarnaan intern)*		
Pesticide *(Pestisida)*	29	186,639.30	6,435.83	170.20**
Error *(Galat)*	270	10,209.60	37.81	
Total	299	196,848.90		

The results of the analysis indicate that the treatments (pesticide compositions) used in the test have highly significant effects on surface and internal stain, the F values of which being 84.255** and 170.20** respectively. Further calculations using the Tukey procedure indicate that a significant difference exists between each treatment of surface and internal stain, if the differences (D) are greater than 7.0 % and 2.9 % respectively.

DCFN 50 and DCFN 80 used as a single preservative seem to produce better results than the control boards and are also obviously better than the NaPCP + B + BHC mixture, which is much used in ramin sawmills, for surface as well as internal stain. Indeed, in this experiment the NaPCP + B + BHC mixture has not shown good results having an average value of 54.6 % for surface stain and 14.7 % for internal stain. In both cases of internal and surface stain DCFN 50 appears to produce significantly better results than DCFN 80, especially at the concentration of 1.5 %. Therefore, effective results with an average stain value of less than 1 % can obviously be obtained by using the 1.5 % DCFN 50.

Plain Borax appears to be an ineffective pesticide for blue stain prevention on ramin lumber. In the test ramin boards dipped in 1.5 % Borax solution are infested more seriously than the control board. Mixed with BHC, Borax gives significantly better results than plain Borax, but the level of attacks remains high. Nevertheless, the addition of B + BHC to DCFN has proven to significantly enhance the efficacy of the pesticide, especially to DCFN 50 at 1.5 % concentration which in a combination of 1.5 % DCFN + 1.5 % Borax + 1.0 % BHC may produce ramin boards that are practically free from surface and internal stain, where the level of attack is less than 1 %, far better than the NaPCP + B + BHC mixture. Increasing efficacy of DCFN 80 is markedly observable, when it is combined with a B + BHC mixture, giving significantly better results than the NaPCP + B + BHC mixture, although the level of staining is significantly more than 1 %.

Plain DD salt at 1.0 — 1.5 % concentrations gives significantly better results than the control, even better than the NaPCP + B + BHC mixture but not so good as DCFN 50 or the DCFN 50 + B + BHC combination as staining still exist. Obviously, an addition of B + BHC to the DD solution works no better than the solution of plain DD.

Various DCFN 50 + DD combinations also turn out better results than the control and, generally speaking, also better than the NaPCP + B + BHC combination, though not so good as DCFN 50 or the DCFN 50 + B + BHC combination. Only with a 0.8 % DCFN 50 + 0.2 % DD + 1.5 % B + 1.0 % BHC combination can effective results be achieved as the mean stain value is less than 1 %, and, above all, treatments with a 1.2 % DCFN 50 + 0.4 % DD + 1.5 % B + 1.0 % BHC combination have come out with ramin boards that are completely free from surface and internal stain.

As has been pointed out, effective results, i.e., staining levels of less than 1 %, require a DCFN 50 concentration of not less than 1.5 %. This applies to plain DCFN 50 or added with a B + BHC mixture. Nevertheless, the results of further observations indicate that the same outcome can be obtained by reducing the DCFN 50 concentration, which can be done by adding DD salt or a DD + B +BHC mixture. By adding 0.4 % DD to a 1.2 % DCFN 50 concentration effective results can be obtained. In fact, this DCFN 50 concentration may still be further lowered to 0.8 % with an additional mixture of 0.2 % DD + 1.5 % B + 1.0 % BHC. By increasing again the DCFN 50 concentration to 1.2 % as in the combination of 1.2 % DCFN 50 + 0.4 % DD + 1.5 % B + 1.0 % BHC, ramin boards that are totally free from blue stain and mold attacks, surface as well as internal stain, can be achieved.

IV. CONCLUSION

The comparative test on the efficacy against blue stain on ramin boards of 2 kinds of commercial

dichlofluanid (DCFN) formulations, respectively containing 50 % and 80 % active ingredients (DCFN 50 and DCFN 80) as single preservative solutions or in combination with Diazenium-dioxy (DD) salt, Borax (B) and BHC vis-a-vis the NaPCP + B + BHC mixture has produced the following results :

1. The efficacy of plain DCFN 50 and DCFN 80 solutions to prevent surface and internal stain is significantly higher than that of the NaPCP + B + BHC mixture.
2. The efficacy of plain DCFN 50 is significantly better than that of plain DCFN 80; in this regard a 1.5 % DCFN 50 solution is effective with an average value of surface and internal stain of less than 1 %.
3. The plain Borax solution, or in combination with BHC, fails to prevent stain from ramin boards, but DCFN, especially DCFN 50, markedly increases in efficacy if combined with a B + BHC mixture. A combination of 1.5 % DCFN 50 + 1.5 % B + 1.0 % BHC produces ramin boards that are practically free from surface and internal stain at a level of attack of less than 1 %, which is far better than the NaPCP + B + BHC mixture.
4. The efficacy of DCFN 80 also increases significantly if combined with a B + BHC mixture, this result being significantly better than the NaPCP + B + BHC mixture, although a visible staining level of higher than 1 % still exists.
5. DD salt alone (0.1 — 1.5%) gives a significantly better result than the NaPCP + B + BHC mixture, but not so effective as the DCFN 50 or the DCFN 50 + B + BHC combination. In this case the addition of a B + BHC mixture dose not increase the efficacy of DD.
6. Effective results with a staining level of less than 1 % are obtainable by using DCFN 50 concentrations of less than 1.5 % but not less than 1.2 %, mixed with DD salt, in this case a 1.2 % DCFN 50 + 0.4 %DD combination. The DCFN 50 concentration may still be reduced to 0.8 % by adding a DD + B + BHC mixture, in this case a combination of 0.8 % DCFN 50 + 0.2 % DD + 1.5 % B + 1.0 % BHC.
7. By increasing further the concentration of DCFN 50 and DD in the combination of DCFN 50 + DD + B + BHC to 1.2 % DCFN 50 + 0.4 % DD + 1.5 % B + 1.0 % BHC, ramin boards which are perfectly free from surface and internal stain are obtainable.

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