PRESERVATIVE TREATMENT OF STEM WOOD OF WILT-DISEASED COCONUT PALMS*

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GNANAHARAN, R. & DHAMODARAN, T.K. 1989. Preservative treatment of stem wood of wilt-diseased coconut palms. Sawn wood from wilt-diseased coconut palms were treated with copper-chrome-arsenate preservative under pressure and boron chemicals under diffusion process. The dry salt retention (DSR) of preservative chemicals decreased with the increase in age of the palm and density of wood. The strong negative relationship between density and DSR obtained in this study indicates that preservative solution strength can be varied, if necessary, to get the required retention of chemicals. This study shows that the stem wood of wilt-diseased coconut palms can be treated to adequate retention of chemicals, and depending on end-use, the type of preservative and treatment can be chosen.

Key words: Coconut palms - wilt-disease - preservative treatment

Introduction

Traditionally, coconut palm (*Cocos nucifera* Linn.) stem wood has been used in Kerala for beams and rafters. However, only the bottom half of senile palms which is durable indoors is used for such purposes. A Mycoplasma-Like-Organism (MLO)-related root wilt disease is now affecting the coconut palms (West Coast tall variety) in Kerala. As a phytosanitary precaution, diseased palms are being cut down. As the disease occurs in palms of all ages, it is desirable to use effectively the stem from palms of all ages. The study on the strength properties of wilt-diseased palms of different age groups showed that the butt logs from lower age palms can also be used for structural purposes (Gnanaharan & Dhamodaran in preparation). But since coconut wood is not durable in general (Jensen 1979, Dahlan & Tam 1985), preservative treatment of stem wood is essential to increase its service life.

Preservative treatment of coconut stem wood in sawn sizes was tried by different workers (McQuire 1976, Siriban & Tamolang 1976, Martin 1978, Mosteiro & Siriban 1979, Palomar 1979 *etc.*). These studies showed that coconut wood can be treated to adequate retention of chemicals. As one aspect of ascertaining the usage potential of wilt-diseased palms, preservative treatment of stem wood was carried out. Pressure treatment with copper-chrome-arsenate (CCA) preservative for outdoor use and non-pressure treatment (diffusion) with boron chemicals for indoor use were tried.

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Materials and methods

Pressure treatment

The wilt-diseased palms were grouped into the following age classes: 55 - 65 *y* (over-mature); 35 - 45 *y* (mature) and 15 - 25 *y* (young). Ten palms were felled under each age group. A billet each of 50 *cm* length was removed from the basal and 50% height level (middle) of over-mature and mature palms, and from only basal level of young palms. As only the denser (outer) portion of the palms is used in construction, the outer portion of the billets was converted into 2.5 x 2.5 *cm* sticks. They were air-dried under shade to a moisture content level of about 15%. About ten samples were selected for each age group and each height level of the palm.

A 2.0% solution (weight/weight) of CCA preservative was used in the experiment. A pilot-type treatment plant (30 x 200 *cm*) with the following treatment schedule was used: vacuum of about 85 *kPa* for 15 *min*, pressure of about 1000 *kPa* for 30 *min* and a final vacuum of 85 *kPa* for 10 *min*. Dry salt retention (DSR) was determined from the preservative solution uptake data and solution strength. The extent of preservative penetration was noticed by the colour reaction of Chrome-Azurol S reagent on the dry surface of treated wood.

Diffusion treatment

As wilt-diseased mature and young palms were not readily available during this study, the study was confined to samples from one over-mature wilt-diseased palm. So the emphasis was to see the effect of density (indirect effect of age and height level of the palm) on the treatability of wilt-diseased palm with boron chemicals by diffusion process. The palm was felled, the bottom two-thirds was converted into four logs. These logs were rip-sawn to give 2.5 *cm* thick boards of maximum width. The sides of the boards were dressed. There were four boards from each log.

A 16% boric acid equivalent (BAE) solution was used in the experiment. This concentration was attainable at ambient temperature (35°*C*) itself. The boards in green condition were kept immersed in the treatment solution for 30 *min*. After draining the solution, the boards were close-stacked and stored for diffusion under cover for four weeks. After the diffusion storage, the boards were dried and average chemical retention of each board was determined analytically (Wilson 1959) by taking specimens across the cross-section of the board.

Results

Pressure treatment

Dry salt retention of CCA in the treated samples (Table 1) ranged from 5.9

kg m^{-3} in the base sample of over-mature palm to 8.9 *kg m*$^{-3}$ in the base sample of young palm. DSR decreased with the increase in age and density of the wilt-diseased palm. The samples from middle position of the palms which had lower density than that of samples from the base had higher retention of chemicals.

Table 1. Average dry salt retention (DSR) and density of samples from basal and middle position of over mature, mature and young palms treated with CCA preservative (cv values are given within parentheses; the figures are average of ten samples)

Age class	Base		Middle	
	DSR *kg m*$^{-3}$	Density *kg m*$^{-3}$	DSR *kg m*$^{-3}$	Density *kg m*$^{-3}$
Over-mature	5.93 (13.6)	899 (11.7)	7.88 (11.7)	715 (13.0)
Mature	6.71 (12.4)	784 (7.8)	8.06 (3.9)	724 (16.8)
Young	8.85 (13.6)	625 (23.4)	-	-

As density increases with the increase in age of the palm and decreases with the height level, as expected, a highly negative relationship ($r = -0.816$) was obtained between density and dry salt retention (Table 2). This shows that 66.6% ($r^2 = 0.666$) of the variation in dry salt retention can be explained by density of the treated samples alone.

Table 2. Relationship between density (x) and dry salt retention (y) of CCA salts and boric acid

Chemical	Equation	r	r^2
CCA	$y = 13.5707 - 0.0082x$	-0.816	0.666
Boric acid	$y = 2.3923 - 0.0026x$	-0.830	0.688

Penetration of chemicals was 3 to 6 *mm* in the samples. The low density samples had a better distribution of the preservative compared to high density samples.

Diffusion treatment

The average retention of boric acid was low in the samples from the bottom log and high in that of logs from the higher height level of the palm

(Table 3). As in the case of CCA preservative, a highly negative relationship (r = -0.83) was obtained between density and retention of boron chemicals (Table 2).

Table 3. Average retention of boron chemicals (in % BAE) in wilt-diseased palm and average density of samples (Log numbers are from bottom up; the figures are average of four samples)

Log Number	BAE (%)	cv (%)	Density ($kg\ m^{3}$)	cv (%)
1	0.77	15.6	606	16.8
2	0.83	10.3	513	20.4
3	1.43	18.6	406	19.4
4	1.61	4.9	336	11.0

Discussion

A dry salt retention (CCA) of 6.5 $kg\ m^{3}$ is recommended by the Indian Standards (ISI 1982) for all interior structural and joinery timbers. In this study, excepting the base samples from over-mature palms, all the samples had met this standard. Even if higher retention is required, the solution strength can be suitably increased from 2.0%. It is interesting that low density samples, which are perishable, can be easily treated with CCA preservative to a high retention. As there is a strong relationship between density and dry salt retention of chemicals, solution strength can be varied, if necessary, to get the required retention.

Palomar (1979), using a 2.0% CCA solution, obtained an average DSR of 8.4 and 13.0 $kg\ m^{3}$ in high density and low density coconut wood at 18.7 and 17.6% moisture content, respectively. These results reflect the trend observed in the present study with wilt-diseased palm also. The higher values obtained by Palomar (1979) in wood (of healthy palm) was probably due to the higher pressure (1400 *KPa*) applied for longer period (50 *min*).

The British Wood Preserving Association requires an average net dry salt retention of 0.4% BAE (BCL 1972). In this study, the average retention was two to four times this requirement (Table 3). This shows that wilt-diseased coconut wood is permeable to diffusion treatment. Even high density material can be easily treated with boron chemicals. McQuire (1976) and Palomar (1986) also obtained fairly high values of retention of boric acid in coconut wood.

Conclusion

This study shows that sawn sizes from wilt-diseased palms, irrespective of age and height level, can be easily treated either with CCA preservative or with boron chemicals to the required retention. Depending on the end-use, the type of preservative and treatment can be adopted.

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