

AIR DRYING AND PRESERVATION OF DEGLUPTA
(EUCALYPTUS DEGLUPTA) POSTS

Preliminary report

FOREST PRODUCTS LABORATORY - CATIE

By

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ABSTRACT

The full cell pressure treatment with salts, was applied to E. deglupta posts. Evaluation was on basis of the extent of penetration and retention of preservative chemicals. Treating variables studied included moisture content determination, seasoning of the wood, pressure treatment, air drying, and final quality.

The results obtained with this species were very encouraging as air drying time, penetration and retention of preservative concern.

However, this preliminary study is not enough to determine the optimum combination of treating variables.

The authors.

PRODUCTION OF FENCE POSTS FROM DEGLUPTA
(EUCALYPTUS DEGLUPTA) FOREST PLANTATIONS
IN TURRIALBA

Air drying and preservation of Deglupta
(Eucalyptus deglupta) posts.

(Preliminary Report)

G. González*, M. Krones**

(Eucalyptus deglupta Bl.) is a hardwood species introduced in Costa Rica by private land owners some years ago. This wood has been recommended by such institutions as the Forestry Department of the Institute of Agricultural Sciences, Turrialba, and the Ministry of Agriculture (MAG) of Costa Rica for reforestation of some areas in Costa Rica because of the rapid growth and good form of the tree.

The physical and mechanical properties of the wood has been determined by van der Slooten and Llach (1) for 15 ½ years old trees grown in the region of San Carlos, Costa Rica at an altitude of about 650 meters (2,000 feet). In table 1 the physical properties of Eucalyptus deglupta grown in Turrialba are compared with the physical properties of Eucalyptus deglupta grown in San Carlos.

Table 1. Physical properties.

	S P E C I E S	
	<u>Eucalyptus deglupta</u> San Carlos approx. 15 ½ years old	<u>Eucalyptus deglupta</u> Turrialba approx. 2 ½ years old
Number of bolts	4	15
Initial moisture content, percent	133	158
Specific gravity range oven-dry weight, green vol.	0,39 (0,36 - 0,42)	0,397 (0,354 - 0,432)

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From the previous table it can be deduced that the physical properties of the woods, as far as specific gravity and moisture contents are concerned, are very similar in spite of the different ages. It is likely that the wood samples would have similar mechanical properties.

If the above is true, E. deglupta from Turrialba could have a similar modulus of rupture in static bending at 12 percent moisture content as calculated for E. deglupta from San Carlos, that is: 742 kg/cm² (10.600 lb/in²). This value is above the modulus of rupture reported by the Forest Products Laboratory, Madison, Wisconsin for Ponderosa Pine of the United States with 9.200 lb/in² at the same moisture content (12 %). With this preliminary data, it could be concluded that deglupta is a very promising wood species to be used in the production of fence posts and poles.

With that in mind, 15 posts in fresh condition were brought to the Forest Products Laboratory, CATIE by the Cantonal Agricultural Center of Turrialba to be tested on the preservation and air drying characteristics.

Preparation of the Material.

The posts were 2.6 meters in length, and diameters varied between 6.8 to 10.5 cm. The initial moisture content was calculated in 158 % (134-178 %).

Because the treatment cylinder of the Laboratory can hold posts with a maximum length of 1.50 m, they were cut at that length and the remainder of the posts of 60 cm in length were end sealed and also piled outdoors in a ventilated place and covered with tar paper.

From each post an inch thick cross section was cut to determine the initial moisture content and the specific gravity.

The posts were weighed every two weeks to record the loss of moisture from the wood. With the recorded data a graph was made (see fig. 1) to show the drying ratio. A total time drying of 144 days was needed to reach the equilibrium moisture content.

The fiber saturation point (approx. 30 %) was reached in just 80 days.

This value was obtained under the following climatic conditions of 82 %

relative humidity and an average temperature of 18.5 ° C corresponding to the San José weather conditions from October 1973 to February 1974. The air drying defects presented by the posts after this period were noted. It was notice that little surface checks called needle checks appeared during the drying period. Also some splits and checks were observed.

Treating.

To get an idea of the absorption capacity of the posts, these were treated by pressure in a 80 cm diameter an 1.5 m. in length pressure cylinder. A full-cell treatment using a CCA type C preservative consisting of a 2.25 % solution of a dry mixture of the following three chemical components: sodium dichromate 42.6 %, copper-sulfate 25.5 %, arsenic pentoxide 26.9 %, inert ingredients 5.0 %.

The posts were treated as follows.

<u>Treating condition</u>	<u>Treating time</u>
Vacuum up to 0.65 kg/cm ² (19 Hg in)	30 minutes
Hydraulic pressure of 12.7 kg/cm ² (180 psi)	180 minutes
Emptying cylinder	<u>5 minutes</u>
Total treating time	215 minutes (3 hours, 35 minutes).

Preservative temperature 21 ° C (69.8 ° F)

Before treatment the posts were weighed, the large and small diameters (average of two measurements for each diameter for each post) and the total length were measured. With the average of the small and large diameters and the length, the volume of each post was computed using the cone-frustrum formula.

After treatment the posts were left to drain and the "after treatment weight" was recorded.

With this data the absorption of each post was calculated in kilograms of solution per cubic meter of wood.

As table 2 shows the average retention in the large size (1.50 m) 59-inch posts group was 516.6 kg/m^3 (32.3 lb/ft^3) and in the small size (60 cm) 23.6-inch group of end coated posts showed an average retention of 565.2 kg/m^3 (35.3 lb/ft^3) which makes deglupta an easy species to treat under the above mentioned conditions.

Air-drying of posts after treatment.

After treatment the posts were air-dried again under the same specifications as before treatment and the drying time (see figure 1) was recorded. Very soon it was noticed that the drying rate of the treated poles was faster than the rate of the non-treated posts. The recorded tested time reach the same moisture content (approx. 30 %) was 68 days. This means an increase of 15 percent in the drying time.

After this period air-dry defects were again checked out. It was noticed that defects were increased to some extent.

The defects observed after this period were as follows: end checks were from 3 to 5 mm in width with a length of 10 to 20 cm on the surface between 4 to 10 cracks per post were observed. These cracks were 1 to 2 cm deep and 15 to 30 cm in length in the 1.50 m long posts. In the smaller end coated posts defects were as follows. End checks between 4 and 6 mm in wide with a length of 10 to 15 cm. Surfaces checks per post; these cracks were 1 to 2 cm deep and 5 to 10 cm long.

Results of treatment.

After the second drying period, increment bores of 0.5 cm (0.2 inch) in diameter were taken from the middle part of the 1.5 m posts and a 3 cm thick disc (approx. 1 inch) was cut from the middle part of the 60 cm posts to determine retention and penetration according to AWP Standard methods.

Penetration of increment bores was between 1.8 cm (0.71 in) for the larger post with a diameter of 17 cm (6.7 in) and 3.2 cm (1.3 in) for the smaller post with a diameter of 7.5 cm (3.0 in).

These measurements represent the average depth of penetration of the preservative.

Some increment bores showed that other areas had been penetrated but these were not taken into account in these measurements. Figure 2 illustrates the distribution of the preservative. Penetration in the discs was determined taking an average measurement of the penetrated area. The smallest post with 4.0 cm (1.6 in) was totally penetrated and the biggest post with an average diameter of 17.5 cm (6.9 in) showed a penetration of 22 cm (0.8 in) but also showed a penetration in the center of 9 cm (3.5 in) in diameter (see figure 2).

Determination of the retention of the increment bores corresponding to the seven largest posts were carried out by the Koppers Co. using the X-Ray Analysis Method AWPFA Standard A9-70.

These results are summarized in table 3.

Comparing retention results values with those specific requirements of the AWPFA Standard C-5 Fence Posts it can be concluded that Eucalyptus deglupta easily surpasses the minimum retention amount of preservative. For fence posts AWPFA has established a minimum preservative retention of 0.40 lb/ft³ in the 1 inch outer zone. This wood shows a retention in that zone of 0.63 lb/ft³.

These posts show an average absorption of 0.37 lb/ft³ in the 2 inches outer zone.

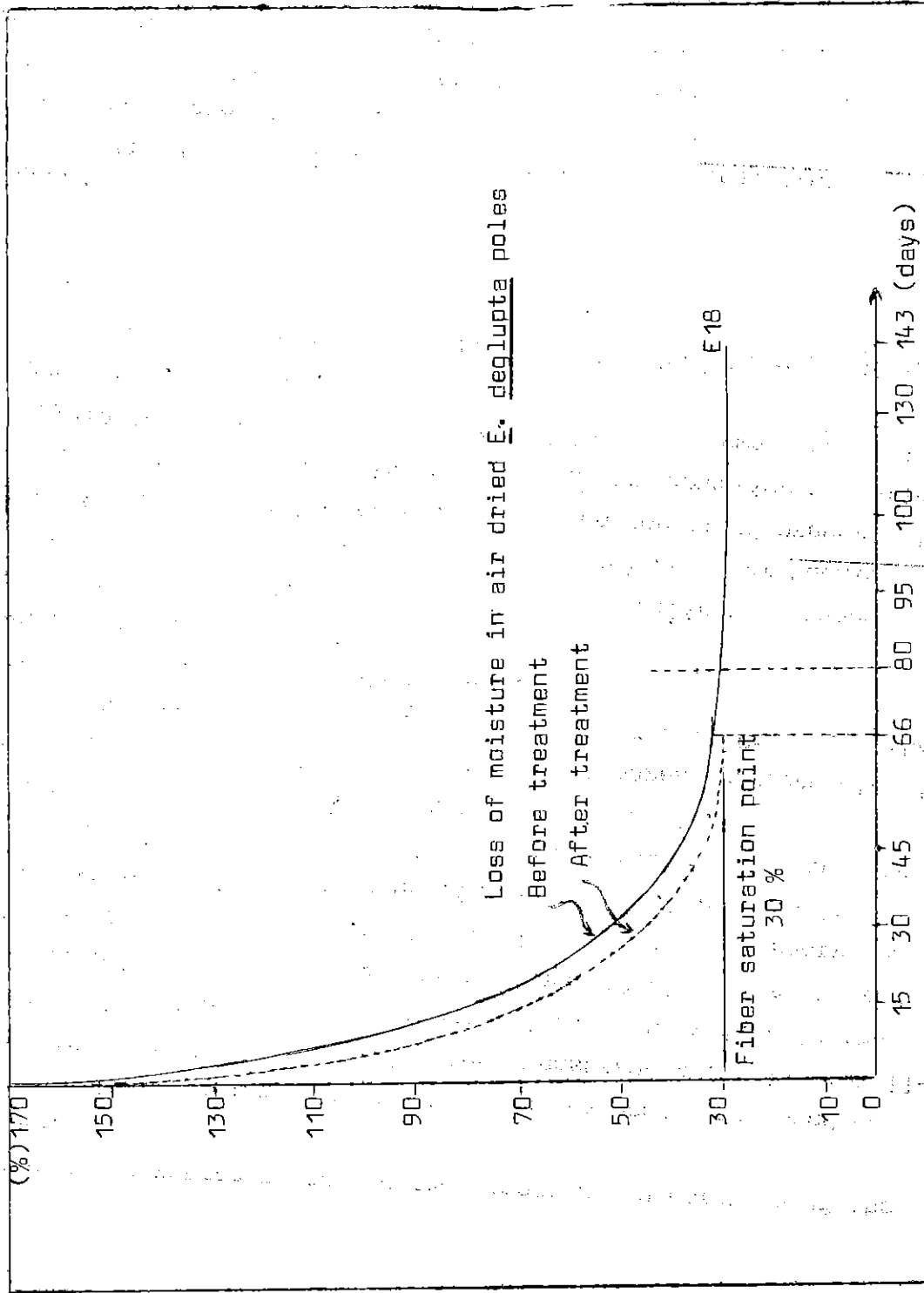
Conclusions.

From the results obtained it can be concluded that Eucalyptus deglupta is a fairly easy wood to treat.

This species according to the fairly high retention and uniform penetration found is a suitable species to use for banana props, fence posts, and mine timber; piles and poles.

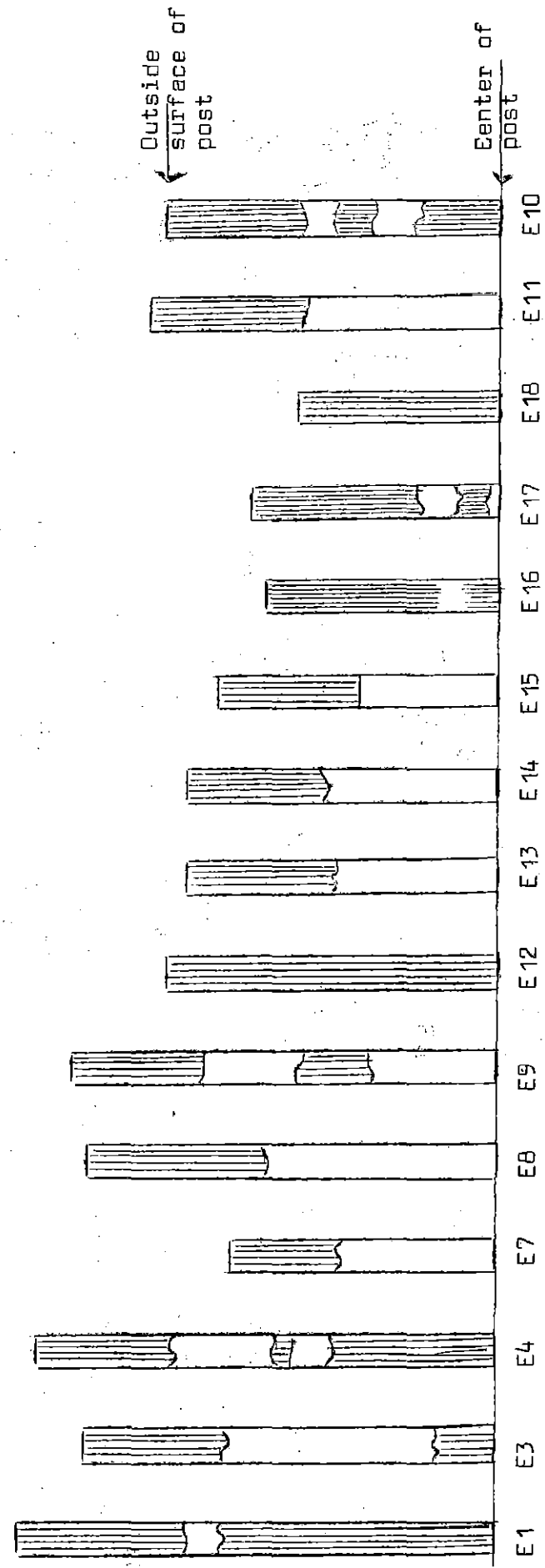
As far as the quality of the posts is concerned, the end splitting and surface checks which appeared during the air drying does not seem to affect seriously the strength properties of the wood in the dimensions studied. In spite of its high initial moisture content (158 % M.C.) this species showed a fairly fast drying rate without serious degradation of the wood.

Fig. 1. Relative humidity in San Jose 82.8 %
Temperature 18.5 ° C



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Fig. 2 BORER SAMPLES AFTER BEING EXTRACTED.



▨ Treated.

The samples have half length of the average diameter of the respective post.

Fig. 3 Cross sections from small post samples showing penetrated areas.

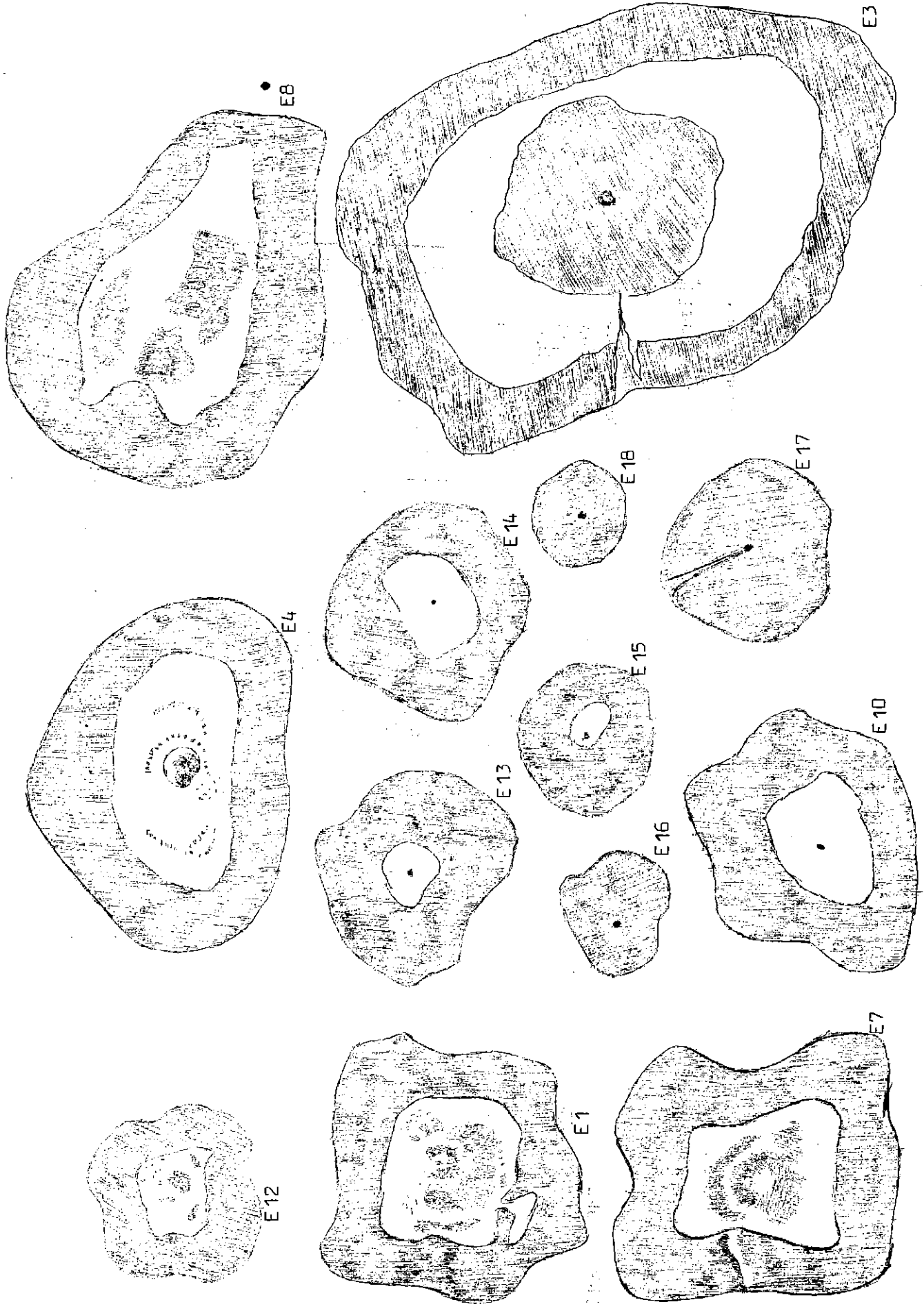


Table 2.

Sample No	Initial moisture content (percent)	Specific Gravity	Ovendry weight	green volume	DIAMETER		Length (cm)	Moisture content at test (percent)	Retention kg/m ³	Penetration percent cross section (mm)
					Large (cm)	Small (cm)				
<u>Large samples</u>										
E-9	175.4	0.408			13.0	12.0	150.0	23.4	539	21
E-12	149.7	0.397			10.5	10.0	150.0	22.6	517	27
E-11	171.9	0.371			11.0	11.0	150.0	26.2	486	22
E-10	151.8	0.387			11.5	10.0	150.0	25.9	506	23
E-15	158.7	0.401			9.0	8.5	149.5	22.5	493	23
E-14	166.0	0.392			10.0	9.8	149.5	22.9	536	22
E-13	145.5	0.421			10.0	9.5	150.0	19.4	497	20
E-16	178.3	0.384			8.0	6.5	149.5	27.0	467	25
E-17	167.7	0.381			8.5	7.0	150.0	26.0	466	26
E-18	173.1	0.395			7.5	5.0	150.0	30.0	478	32
E-3	158.2	0.388			13.5	12.5	150.0	-	470	25
E-7	155.0	0.354			17.0	17.0	149.0	-	617	18
E-1	158.6	0.432			16.0	14.5	149.0	-	558	26
E-4	154.3	0.405			15.0	14.0	149.5	-	556	22
E-8	134.3	0.436			13.0	12.5	150.5	31.0	563	27
<u>Small samples</u>										
E-16	151.0				6.5	6.0	60.0	17.9	457	Total
E-18	154.0				4.5	4.0	54.5	13.6	495	Total
E-17	149.0				6.5	5.5	56.0	20.1	480	Total
E-15	151.0				8.0	7.5	61.5	16.6	503	30
E-13	148.0				9.0	8.5	60.0	19.8	524	25
E-14	153.0				8.5	7.5	59.0	14.9	513	22
E-11	149.0				10.5	10.5	60.0	19.5	550	20
E-10	147.0				11.0	10.5	60.5	21.7	590	20
E-12	142.0				11.5	10.5	60.5	24.8	590	22
E-8	140.0				14.0	13.5	59.5	26.7	566	20
E-9										
E-4	133.0				17.5	14.5	49.0	31.2	710	24
E-3	125.0				18.0	17.0	48.0	35.9	698	22
E-7	139.0				14.5	13.5	47.5	27.1	544	25
E-1	133.0				16.5	14.0	47.5	30.0	693	23

Table 3. X-RAY ANALYSIS OF CCA-C TREATED BORINGS REMOVED FROM EUCALYPTUS DEGLUPTA FROM COSTA RICA.

Zone (in.)	Chemical	Oxide (x 1.69)= (pcf)	Product (pcf)	% of total
0-0.5	CrO ₃	0.36	0.60	49.3
	CuO	0.14	0.24	19.2
	As ₂ O ₅	<u>0.23</u> 0.73	<u>0.38</u> 1.22	31.5
0.5-1.0	CrO ₃	0.25	0.42	41.8
	CuO	0.10	0.17	19.2
	As ₂ O ₅	<u>0.17</u> 0.52	<u>0.28</u> 0.87	32.7
1.0-1.5	CrO ₃	0.06	0.10	50.0
	CuO	0.02	0.03	16.7
	As ₂ O ₅	<u>0.04</u> 0.12	<u>0.07</u> 0.20	33.3
1.5-2.0	CrO ₃	0.06	0.10	50.0
	CuO	0.02	0.03	16.7
	As ₂ O ₅	<u>0.04</u> 0.12	<u>0.07</u> 0.20	33.3
2.0-2.5	CrO ₃	0.07	0.12	46.7
	CuO	0.03	0.05	20.0
	As ₂ O ₅	<u>0.05</u> 0.15	<u>0.08</u> 0.25	33.3
2.5---	CrO ₃	0.04	0.07	44.4
	CuO	0.02	0.03	22.2
	As ₂ O ₅	<u>0.03</u> 0.09	<u>0.05</u> 0.15	33.3

NOTE: The South American plants base their analysis on the product basis, thus the extra column.

LITERATURE CITED

- 1.- Slooten , H.J. van der, L. Llach, Physical and mechanical properties of Eucalyptus declupta Blume grown in Costa Rica. Turrialba, Costa Rica. Wood Technology Laboratory-CATIE, 284-290, 1969.
- 2.- Hunt and Garratt, Wood preservation. Wood preserving processes. Madison, Wisconsin. Dec. 1937.