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The Use of Water Soluble Preservatives In Preventing Decay in Fence Posts and Similar Materials

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THE purpose of this circular is to bring to the attention of the people of Connecticut a new and easy method of treatment to prevent decay in posts, poles, stakes or other round wood material. The wood of most species of trees native to or planted in Connecticut is not durable in contact with the soil for more than three to five years unless given some form of preservative treatment.

Credit for the processes described, which are adaptations of the Boucherie Process patented nearly 100 years ago, should be given to the Forest Products Laboratory of the Forest Service and the Division of Forest Insect Investigations of the Bureau of Entomology and Plant Quarantine, both of which are divisions of the United States Department of Agriculture. The reader is referred to the two publications listed at the bottom of this page for additional information. These may be obtained without cost from the bureaus in which they originated.

The principle involved in the treatment consists in introducing a preservative salt, dissolved in water, into the wood through the same channels in which water is transported from the soil in the living tree. Evaporation of the water in the solution during seasoning leaves the salt deposited in the wood.

Wood must not be allowed to season before treatment. This is very important. The sooner the work is done after cutting, the better will be the results. If some delay is necessary between cutting and treatment, the posts should be immersed (not floating) in a pond or the cut ends should be sealed with tar, asphalt or other material. In the latter case a fresh cut should be made just before treating. Peeling prior to treatment is unnecessary.

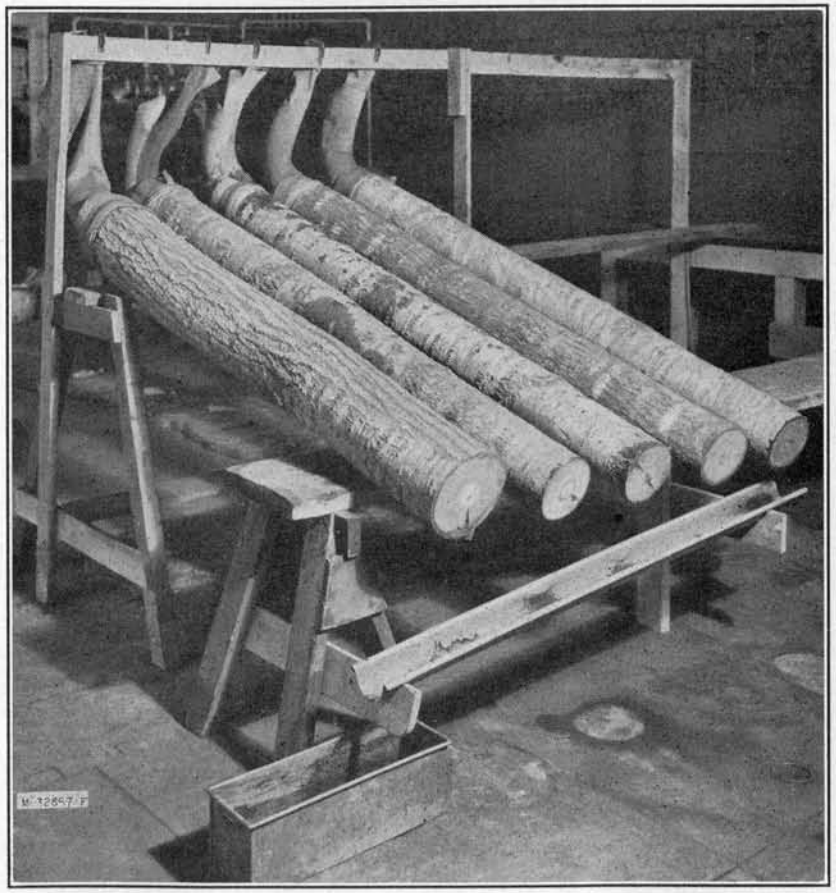
Tire Tube Method of Fence Post Treatment by George M. Hunt and R. M. Wirka, April, 1938. Forest Products Laboratory, Forest Service, U.S.D.A., Madison, Wis.

A Method for Preventing Insect Injury to Material Used for Posts, Poles and Rustic Construction by F. C. Craighead, R. A. St. George and B. H. Wilford, June, 1937. Division of Forest Insect Investigations, Bureau of Entomology and Plant Quarantine, U.S.D.A., Washington, D. C.

Application of Preservative

The preservative may be applied by several methods, two of which are described briefly below.

1. The tire tube method is recommended for posts and poles 4 to 8 inches in diameter. The apparatus needed is shown in the figure below which is largely self-explanatory. The section of old tire tube, 2 to 3 feet long, is drawn over the butt end of the post and fastened securely to form a tight seal between the tube and the post. Usually some draw-shaving is necessary to provide a reasonably smooth surface free of abrupt depressions. Fastening the tube to the post may be done with rubber bands, cord or wire. One very effective method is to wrap one turn of



Courtesy of U. S. Forest Service

number 12 wire around the tube and post and draw up the ends with pliers. Two rubber bands cut from an old tire tube make a good cushion between wire and tube and also prevent injury to the latter. Tapping the wire with a hammer after it has been drawn taut will usually stop any

small leaks that may occur. After the tube has been attached to the post, the latter is placed on the rack, as shown, and the preservative solution poured into the tube, the open end of which is fastened to the rail above. The rack should be so constructed that the lower end of the post is at least 18 inches below the end to which the tube is attached.

Treatment is completed when all the liquid has been drained from the tube by gravity. The water normally found in green wood is forced out at the lower end of the post together with a small amount of the preservative solution. This drip should be collected, strained and used in mixing the next lot of solution.

The tire tube method may be used at any time of year when the temperature is above the freezing point. However, the preservative will be absorbed much more quickly in warm weather. The time needed will vary with the species, season, length of stick, etc., but for material of fence post size, treatment will usually be completed in 4 to 24 hours. The technique involved is quite simple and can be carried out very easily after a little practice.

Posts may be set immediately after treatment but seasoning for a few weeks is recommended. Peeling is unnecessary unless the post is to be painted, in which case only the part above ground need be peeled. If it is possible to do so, cut to length before treating, but if it is necessary to cut to length after setting, the cut end should be painted over with creosote or with a strong solution of zinc chloride.

2. The stepping method is recommended for bean poles, stakes and similar small round material. When the trees are cut, *all or a considerable portion of the green crown* is left intact. The cut ends are immersed in a barrel containing the preservative solution which, through the action of the leaves, is drawn up through the sapwood in the same way that water is drawn from the soil and distributed in the living trees. The rapidity with which this takes place will depend on the activity of the foliage in transpiring moisture. The method may be used for evergreens (pine, spruce, etc.) throughout the year when temperatures are above freezing. Absorption will be most rapid during the summer and may cease altogether at low temperatures. Broad-leaved trees must be treated when in leaf.

The Preservative

Various preservatives that are soluble in water may be applied by the methods described above. However, because of its low cost, availability and effectiveness, zinc chloride seems to be the most promising material at present. Granular zinc chloride of 95 to 98 percent purity is probably the best form of the salt to use. This material is deliquescent (i.e. it absorbs moisture readily from the air) and should be kept in an airtight container. It may be kept in any open container as a 50 percent solution which can be made from the granular salt by mixing equal weights of salt and water. Solutions of lesser strength may be made from this by adding water. Zinc chloride is colorless and tests to indicate its presence within the wood must be made chemically.

Current prices for granular zinc chloride in 500 to 700 pound drums vary from 5.75 to 9 cents per pound; in 100 to 150 pound lots from 7 to

16 cents per pound. The above prices are F. O. B. New Haven, Connecticut. The volume of the average farm fence post will usually be about three-fourths of a cubic foot. At the above prices, the cost of preservative would be between 4 and 12 cents per post. If properly carried out, treatments as recommended should prolong the serviceable life of posts, stakes, etc., to 10 years or more.

Species to Treat and Dosage

Because only sapwood is susceptible to treatment by the methods described, species should be selected in which the sapwood is one inch or more in thickness. Some native species with thick sapwood are maple, elm, aspen, birch, whitewood, pine and spruce. The objectives in treatment are: first, to introduce the preservative salt into the wood at the rate of about one pound per cubic foot; and second, to distribute it as evenly as possible.

Mixing Solutions

Solutions of any desired strength in units of 100 pounds may be made from granulated zinc chloride as follows: Weigh out an amount of salt equal in pounds to the percent solution required and add to this water to make up 100 pounds. For instance, 5 pounds of salt plus 95 pounds of water makes 100 pounds of 5 percent solution; 7.5 pounds of salt plus 92.5 pounds of water makes 100 pounds of 7.5 percent solution; etc. It is usually customary to increase slightly the amount of salt over the theoretical figures to compensate for impurities.

If the salt is stored as a 50 percent concentrated solution, as suggested above, solutions of any desired strength (under 50 percent) in units of 100 pounds may be made from it as follows: Weigh out an amount of 50 percent solution equal in pounds to double the percent solution required and add to this water to make up 100 pounds. For instance, 20 pounds of 50 percent solution plus 80 pounds of water makes 100 pounds of 10 percent solution; 15 pounds of 50 percent solution plus 85 pounds of water makes 100 pounds of 7.5 percent solution; etc. As in the case of the dry salt, compensation should be made for impurities.

To compute the amount of solution needed to impregnate any stick at the rate of one pound of salt per cubic foot, multiply the volume of the stick in cubic feet by 100 and divide by the percentage strength of the solution to be used. For example, if the volume of the stick equals 0.7 cubic feet and the strength of the solution equals 7.5 percent, then $0.7 \times 100/7.5 = 9.35$ pounds of 7.5 percent solution needed, in which there is 0.7 pound of salt.

Table 1 gives the amount of solution required to impregnate at the rate of one pound per cubic foot for four different strengths of solution and for volumes of wood ranging from 0.1 to 8.0 cubic feet.

Extreme accuracy in mixing solutions or in computing the amounts of solution needed is unnecessary.

Computation of Volumes

The volume in cubic feet for posts or similar material may be computed by the formula, $V = .005454 \times D^2 \times L$, where V equals the volume in cubic feet, D the average diameter in inches and L the length in feet.

In Table 2 the volume in cubic feet is shown for round sticks ranging in average diameter from 0.5 to 10.0 inches and in length from 5 to 10 feet.

The Connecticut Agricultural Experiment Station is carrying out a comprehensive series of tests with both methods on native woods. Most of the work to date has been with the tire tube method. The preliminary results indicate that the use of 13 to 15 pounds of 7.5 percent solution per cubic foot of wood will give a good initial distribution of salt. While only a very limited amount of work has been done with the stepping method, the indications are that 13 to 15 pounds of 7.5 percent solution per cubic foot of stem wood, excluding branches, will result in a good distribution of salt by this method also.

Of some 20 local species treated at the Station using the tire tube method, the best results were obtained on maple, elm, aspen, whitewood, spruce and pine. Service tests to determine the durability of treated material in actual service are being made and further information will be published from time to time.

The Station will be glad to render assistance to anyone wishing to treat wood by these methods.

TABLE 1. NUMBER OF POUNDS OF 10 PERCENT, 7.5 PERCENT, 5 PERCENT AND 2.5 PERCENT SOLUTION NEEDED TO IMPREGNATE AT THE RATE OF ONE POUND OF SALT PER CUBIC FOOT OF WOOD.

Volume of Wood Cubic Feet	Strength of Solution			
	10.0%	7.5%	5.0%	2.5%
	Number of Pounds Needed			
0.1	1.0	1.3	2.0	4.0
.2	2.0	2.7	4.0	8.0
.3	3.0	4.0	6.0	12.0
.4	4.0	5.3	8.0	16.0
.5	5.0	6.7	10.0	20.0
.6	6.0	8.0	12.0	24.0
.7	7.0	9.3	14.0	28.0
.8	8.0	10.7	16.0	32.0
.9	9.0	12.0	18.0	36.0
1.0	10.0	13.3	20.0	40.0
1.1	11.0	14.7	22.0	44.0
1.2	12.0	16.0	24.0	48.0
1.3	13.0	17.3	26.0	52.0
1.4	14.0	18.7	28.0	56.0
1.5	15.0	20.0	30.0	60.0
1.6	16.0	21.3	32.0	64.0
1.7	17.0	22.7	34.0	68.0
1.8	18.0	24.0	36.0	72.0
1.9	19.0	25.3	38.0	76.0
2.0	20.0	26.7	40.0	80.0
2.1	21.0	28.0	42.0	84.0
2.2	22.0	29.3	44.0	88.0
2.3	23.0	30.7	46.0	92.0
2.4	24.0	32.0	48.0	96.0
2.5	25.0	33.3	50.0	100.0
2.6	26.0	34.7	52.0	104.0
2.7	27.0	36.0	54.0	108.0
2.8	28.0	37.3	56.0	112.0
2.9	29.0	38.7	58.0	116.0
3.0	30.0	40.0	60.0	120.0
3.1	31.0	41.3	62.0	124.0
3.2	32.0	42.7	64.0	128.0
3.3	33.0	44.0	66.0	132.0
3.4	34.0	45.3	68.0	136.0
3.5	35.0	46.7	70.0	140.0
3.6	36.0	48.0	72.0	144.0
3.7	37.0	49.3	74.0	148.0
3.8	38.0	50.7	76.0	152.0
3.9	39.0	52.0	78.0	156.0
4.0	40.0	53.3	80.0	160.0
4.1	41.0	54.7	82.0	164.0
4.2	42.0	56.0	84.0	168.0
4.3	43.0	57.3	86.0	172.0
4.4	44.0	58.7	88.0	176.0
4.5	45.0	60.0	90.0	180.0
4.6	46.0	61.3	92.0	184.0
4.7	47.0	62.7	94.0	188.0
4.8	48.0	64.0	96.0	192.0
4.9	49.0	65.3	98.0	196.0
5.0	50.0	66.7	100.0	200.0

Volume of Wood Cubic Feet	Strength of Solution			
	10.0%	7.5%	5.0%	2.5%
	Number of Pounds Needed			
5.1	51.0	68.0	102.0	204.0
5.2	52.0	69.3	104.0	208.0
5.3	53.0	70.7	106.0	212.0
5.4	54.0	72.0	108.0	216.0
5.5	55.0	73.3	110.0	220.0
5.6	56.0	74.7	112.0	224.0
5.7	57.0	76.0	114.0	228.0
5.8	58.0	77.3	116.0	232.0
5.9	59.0	78.7	118.0	236.0
6.0	60.0	80.0	120.0	240.0
6.1	61.0	81.3	122.0	244.0
6.2	62.0	82.7	124.0	248.0
6.3	63.0	84.0	126.0	252.0
6.4	64.0	85.3	128.0	256.0
6.5	65.0	86.7	130.0	260.0
6.6	66.0	88.0	132.0	264.0
6.7	67.0	89.3	134.0	268.0
6.8	68.0	90.7	136.0	272.0
6.9	69.0	92.0	138.0	276.0
7.0	70.0	93.3	140.0	280.0
7.1	71.0	94.7	142.0	284.0
7.2	72.0	96.0	144.0	288.0
7.3	73.0	97.3	146.0	292.0
7.4	74.0	98.7	148.0	296.0
7.5	75.0	100.0	150.0	300.0
7.6	76.0	101.3	152.0	304.0
7.7	77.0	102.7	154.0	308.0
7.8	78.0	104.0	156.0	312.0
7.9	79.0	105.3	158.0	316.0
8.0	80.0	106.7	160.0	320.0

TABLE 2. VOLUMES OF ROUND POSTS, STAKES, ETC. IN CUBIC FEET.

Average Diameter (inside bark)	Volume per Linear Foot	Length in Feet					
		5	6	7	8	9	10
Inches	Cubic Feet	Volume in Cubic Feet					
0.5	.0014	.007	.008	.010	.011	.013	.014
1.0	.0060	.030	.036	.042	.048	.054	.060
1.5	.0120	.060	.072	.084	.096	.108	.120
2.0	.0220	.110	.132	.154	.176	.198	.220
2.5	.0340	.170	.204	.238	.272	.306	.340
3.0	.0490	.245	.295	.345	.390	.440	.490
3.5	.0670	.335	.400	.470	.535	.605	.670
4.0	.0870	.435	.520	.610	.695	.780	.870
4.5	.1100	.550	.660	.770	.880	.990	1.100
5.0	.1360	.680	.815	.955	1.090	1.225	1.360
5.5	.1650	.825	.990	1.155	1.320	1.485	1.650
6.0	.1960	.980	1.175	1.370	1.565	1.765	1.960
6.5	.2300	1.150	1.380	1.610	1.840	2.070	2.300
7.0	.2670	1.335	1.600	1.870	2.135	2.400	2.670
7.5	.3070	1.535	1.840	2.145	2.450	2.760	3.070
8.0	.3490	1.745	2.090	2.440	2.790	3.140	3.490
8.5	.3940	1.970	2.360	2.755	3.150	3.545	3.940
9.0	.4420	2.210	2.650	3.090	3.535	3.980	4.420
9.5	.4920	2.460	2.950	3.440	3.930	4.425	4.920
10.0	.5450	2.725	3.270	3.815	4.360	4.905	5.450