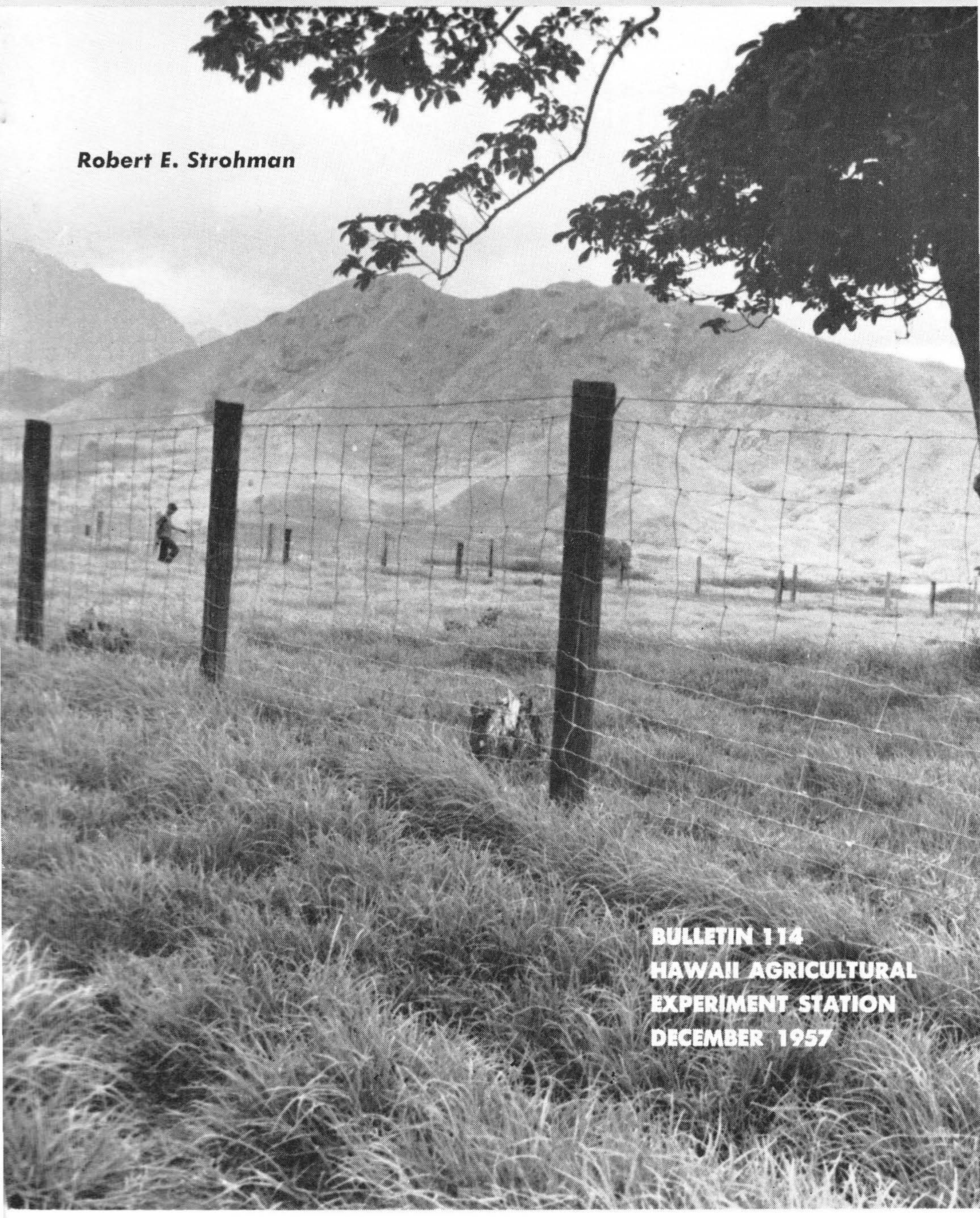
Preservative Treatments for Eucalyptus Fence Posts

Robert E. Strohman



BULLETIN 114
HAWAII AGRICULTURAL
EXPERIMENT STATION
DECEMBER 1957

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ACKNOWLEDGMENTS

The testing of preservatives and methods of treatment for fence posts has, due to the length of time required for making the tests, been the work of many individuals. René Guillou made the original survey and submitted an outline of the project on May 23, 1947. He also made the annual inspection in 1951.

John F. Cykler, who was project leader from September 24, 1947, to June 30, 1950, completed and studied the bibliography, drew the actual plans for the project, and supervised the treating and setting of the posts.

William T. Kirschbaum, Kazuo Murakami, Roy T. Tribble, and Lawrence W. Larson have all assisted in various ways, from treating and setting posts to making annual inspections and analyzing data.

A number of organizations have also cooperated in this project. The Territory of Hawaii Board of Agriculture and Forestry identified the species of wood and made available stumpage for cutting posts. The Agricultural Extension Service of the University of Hawaii gathered information on present fencing practices and made arrangements for setting posts. Ulupalakua Ranch provided locations for two of the test plots.

PRESERVATIVE TREATMENTS FOR EUCALYPTUS FENCE POSTS

Robert E. Strohman[1]

INTRODUCTION

Quite a number of years ago the rising cost of farm labor made it unprofitable to grow crops in areas where it was necessary to post a guard in order to keep livestock from damaging the crops. This situation led to the development of fences. To this day the construction and maintenance of adequate fences continues to be one of the major problems facing our farmers. While in some communities the practice of fencing livestock in, rather than fencing them out, has resulted in shifting the problem to the shoulders of the stockmen, the problem remains. The ideal fence should be attractive, should turn all types of livestock without injury, and should cost nothing to build or maintain. This ideal, of course, can never be reached. For a commercial livestock-raising enterprise the best fence is the fence with the lowest total yearly cost. This cost is difficult to obtain, and must be computed separately for each fence in question, since it includes not only such standard items as depreciation on first cost, interest on investment, labor and materials for routine inspection and repair, but also such things as damage caused by stock that may break out if the fence fails between inspections, injury or loss of the animals themselves, cost of labor required to round up the animals and make emergency repairs, value of land taken out of production by the fence, cost of clearing fence rows of noxious weeds, and time lost opening and closing gates.

In making an estimate of the probable yearly cost of a particular fence, one can always obtain local prices for all of the components of the fence and local wage rates for labor. Hours of labor required for each operation can be obtained from experience or observation. However, in figuring depreciation and probable repair costs, it would be very helpful if there were available tables showing expected life under various conditions of each of the principal components used in building fences. While a research project to compile all of these tables would be ideal, if finances, facilities, and personnel were available, this project has been limited by practical considerations to one phase of this work.

The project was narrowed down to a consideration of the life expectancy of eucalyptus posts when treated with various preservatives, using various methods of treatment, and when set in areas of varying rainfall. At the same time, it was expected that simple equipment and methods for treating posts could be developed. At the time this project was started, the need for more information in these areas seemed to be greater than in any of the other related fields.

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[1]Robert E. Strohman was Associate Agricultural Engineer at the Hawaii Agricultural Experiment Station and Associate Professor of Agriculture, University of Hawaii, 1951–57.

REVIEW OF LITERATURE

Indications as to the preservatives to be used, the condition of the posts at the time of applying the preservatives, and methods of application were obtained from a review of the literature on these subjects. The literature was also helpful in designing equipment for applying the preservatives and evaluating the results of the experimental work.

Some properties of a good wood preservative (*9*) are: (a) poisonous to wood-destroying fungi, (b) able to penetrate the wood deep enough to form a barrier, (c) safe to handle, (d) non-corrosive. Snyder and Zetick (*19*) also mention availability and price. Another property (*12*) is the stability and permanence of the material. Bateman (*1*) includes all of the above and adds solubility in a cheap vehicle.

Of the preservatives which meet the above criteria, coal tar creosote has been in common use for the longest time. Hunt (*15*) in 1928 described a hot and cold bath treatment similar to the one used in this project. MacLean (*18*) mentions the use of a 50:50 mixture of coal tar creosote and fuel oil for the treatment of Engelmann spruce, which like eucalyptus is very resistant to the penetration of preservatives. By 1946, pentachlorophenol was well enough established as a preservative to be given a description with recommendations for use by Blew (*2*). In 1947, Committee 7–9 of AWPA (*5*) reported the use of Osmosalts. In the tests reported, this preservative gave poor results. However, the same year Blew reported results of tests in Mississippi (*3*)in which Osmosalts gave good results.

As part of an international termite exposure test, Hunt and Snyder (*16*) reported that of the various preservatives tested on stakes in Honolulu, nickel arsenate gave the best results, followed closely by coal tar creosote.

Technical Note 135 from the Forest Products Laboratory (*11*), explains why round posts are preferred over split posts for preservative treatment. Hicock and Olson (*13*) explain this further and also give several rules for preparation of posts for treatment.

The most widely accepted and standardized method of applying preservative is the pressure process. This method is described briefly by Hunt (*15*), Hicock and Olson (*13*), and in more detail in Forest Service Report No. R154 (*8*). Special treating conditions which produced good results on wood which is resistant to penetration were described by MacLean (*18*). Another common method of treating posts is the hot and cold bath. This is described in considerable detail in (*15*), (*13*), and (*8*) of the above publications and also in Forest Service Report R1468 (*10*).

The cold-soaking method of treating posts with pentachlorophenol is described in Forest Service Reports R154 (*8*), R1468 (*10*), and R1445 (*4*). Further information on this treatment was obtained from Lorenz (*17*).

Hunt (*15*) describes equipment for the hot and cold methods ranging from converted oil drums for the individual farms to portable steam-heated tanks for custom work, and Hicock and Olson (*13*) describe other modifications of the equipment for this method.

In any work with preservatives, it is desirable to know how far the preservative has penetrated into the wood. Some suggestions for this determination using either ordinary bits or increment borers, and directions for prevention of re-infection, were obtained from Forest Products Laboratory Technical Note No. 163 (*7*).

It is interesting to note that of the above-mentioned publications only (*2*), (*3*), (*5*), (*16*), (*18*), and (*19*) report results of experimental work. The lack of publications based on research work may be due in part to the length of time required to obtain results in preservative tests. While this project has been in progress, a great deal more literature has been written on preservatives; but most of it again has been based on previous publications and observations of local customs rather than research projects. Three stations, however, have reported results of their research projects which may be of interest to some readers.

Dunkelberg (*6*) tested copper sulphate and zinc chloride. These were tested on shortleaf pine posts, starting in 1940 at Clemson, S. C. The untreated posts had a service life of 1.6 years while at the end of 12 years 29 percent of those treated with zinc chloride had failed and 56 percent of those treated with copper sulphate had failed.

Hicock and Olson (*14*) made a survey of posts used in highway guide rail fencing. Treatments used and percentage of posts (oak and maple) serviceable after 12 years were as follows:

(a) Pressure with creosote	92 percent
(b) Pressure with Wolman salts	98 percent
(c) Full-length hot and cold bath with creosote	95 percent
(d) Butts only, hot and cold bath with creosote	50 percent
(e) Hot dip with coke oven tar	8 percent
(f) Brushing with creosote	3 percent

White (*20*) used the hot and cold creosote treatment and plain and chromated zinc chloride applied in various methods. These were used on a great variety of woods. Although the data are not consolidated, it appears that creosote gave better results than zinc chloride.

EXPERIMENTAL PROCEDURE

It was decided to test two species of eucalyptus, *Eucalyptus globulus*, commonly called blue gum, and *Eucalyptus robusta*, commonly called swamp mahogany. Four preservatives were tested: (a) AWPA Grade 1 coal tar creosote oil; (b) Dowicide 7, which is a dry powder containing 95 percent chlorinated phenols, of which 83 percent is pentachlorophenol and the other 12 percent other chlorinated phenols; (c) Osmosalts; and (d) Permawood (both of the latter two are trade mark names for mixtures of salts of unknown chemical composition). Three methods of applying the preservative were used: cold soaking, hot and cold bath, and pressure. The cold soaking varied from a quick dip to 168 hours. Three areas were chosen in which to set the posts: (a) a dry area on the Ulupalakua Ranch near

Makena, with annual rainfall of about 30 inches; (b) an area of moderate rainfall, about 75 inches yearly, at the Haleakala branch station; and (c) a wet area in the Kipahulu section of the Ulupalakua Ranch, with more than 107 inches of rain a year.

The *E. globulus* posts were given the following treatments:

1. Check .... no treatment
2. Creosote .... hot and cold bath
3. Creosote and Diesel Oil .... 96-hour cold soak
4. Creosote and Diesel Oil .... 168-hour cold soak
5. Pentachlorophenol in Diesel Oil .... 96-hour cold soak
6. Pentachlorophenol in Diesel Oil .... 168-hour cold soak
7. Creosote .... pressure 1 hour 185° F., 100 psi
8. Creosote .... pressure 1 hour 185° F., 150 psi
9. Creosote .... pressure 1 hour 185° F., 200 psi
10. Creosote .... pressure 3 hours 185° F., 100 psi
11. Creosote .... pressure 3 hours 185° F., 150 psi
12. Creosote .... pressure 3 hours 185° F., 200 psi

Seventy-five posts were used for each non-pressure treatment, 1 through 6 above. Twenty-five of these were set in each of the three areas used for the tests, in July 1949. Ten posts were given each of the pressure treatments 7–12, and these plus 10 check posts were all set in the medium rainfall area at Haleakala in April 1951.

The *E. robusta* posts were given the following treatments:

1. Check .... no treatment
2. Osmosalts .... dip
3. Permawood .... dip
4. Creosote and Diesel Oil .... 168-hour cold soak
5. Pentachlorophenol in Diesel Oil .... 163-hour cold soak
6. Creosote .... pressure 1 hour 180° F., 100 psi
7. Creosote .... pressure 1 hour 180° F., 150 psi
8. Creosote .... pressure 1 hour 180° F., 200 psi

Twenty-five posts were given each of the non-pressure treatments 1–5 and eight posts were given each of the pressure treatments 6–8. All *E. robusta* posts were set in the medium rainfall area at Haleakala. Non-pressure in September 1949, and pressure in June 1950.

DESCRIPTION OF EQUIPMENT USED FOR TREATING POSTS

For cold soaking and for hot and cold bath treatments open iron tanks were used. The inside dimensions were 4 feet deep, 4 feet wide, and 7½ feet long. Metal tanks were used because no effective method has yet been devised to keep wooden tanks oiltight (see fig. 1).

Tanks were constructed for a full-length treatment. It has been found practical due to the relative ease in handling posts to have the posts in a horizontal position when treated. It is also easier to fully submerge horizontal posts by the addition of weights.

Immersion tank heaters were screwed into pipe couplings which in turn were welded on each side of the ends of the tank and located so as not to obstruct the interior of the tank but at the same time not to reduce the effectiveness of the heater. To locate the coupling a center 4 inches off the tank floor and 2¼ inches from the side was found sufficient. Protecting strap iron guards were welded on the inside of the tank to prevent the posts from striking the elements. This source of heat is considered more expensive but easier to handle and safer in regard to fire hazards. With 200 gallons of creosote at 75° F. and the tank insulated with 1-inch canec, a period of about 3 hours was required to raise the temperature to 210° F.

A thermostat was used to remove two of the four heaters from the circuit when the temperature reached 210° F. Baskets fabricated from airfield landing mat were used to hold the posts during treatment. These baskets were fitted with pad eyes for lifting and channel iron legs to clear the heaters and increase circulation of the hot creosote between the bottom of the tank and the bottom of the basket.

A small motor-driven gear pump was used to recirculate the preservative when necessary and as a means for emptying the tanks.

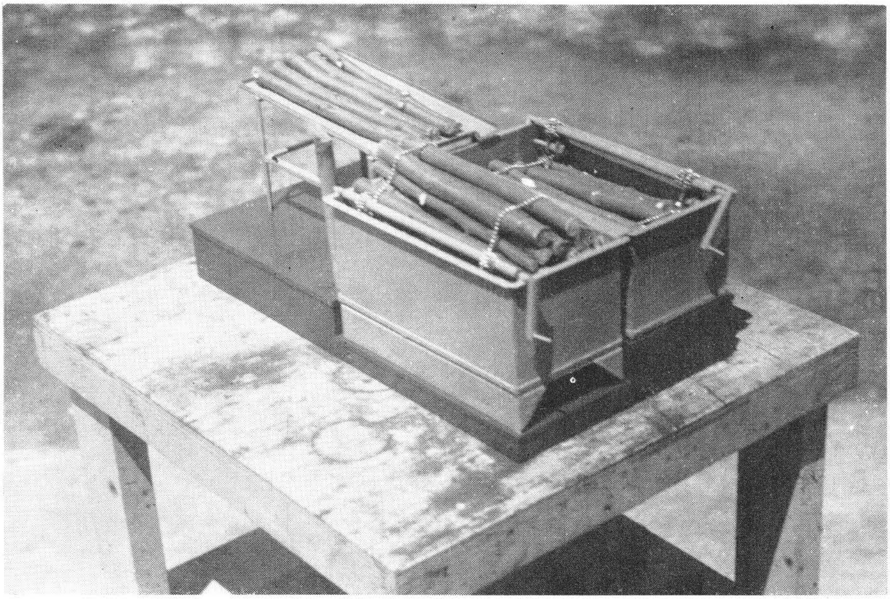


FIGURE 1. Scale model of portable tanks and drainboard designed to be used for hot and cold treatment of posts in areas where electricity is not available.

The tank used for pressure treatments was 93½ inches long and 11¾ inches in diameter, both inside dimensions. Pressure was supplied by a gear pump, 300-lb. capacity, driven by a 3 H.P. motor. Pressure was maintained at the desired value by a pressure switch (see fig. 2).

The creosote was heated by four immersion heaters, each 3 kw. and 110 volts. Two of these were located in the supply tank and two in wells attached to the pressure drum. Temperature was controlled by two thermostatic switches, one for the drum and one for the storage tank. There were also indicating pressure and temperature gauges.

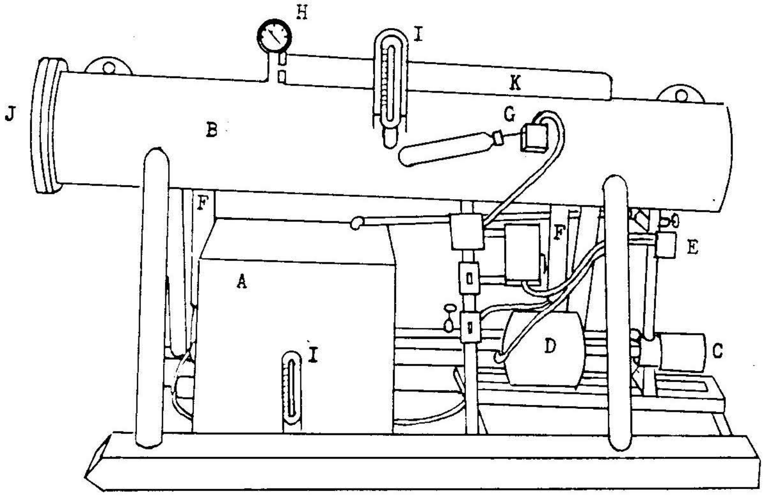
A door bolted to one end of the drum provided a means of placing posts in it. A small air receiver was provided on top of the drum to receive and compress the air when pumping preservatives into the drum. This air receiver also provided better control for the operation of the automatic pressure switches.

DESCRIPTION OF VARIOUS TREATMENTS

A. Hot and Cold Bath—Creosote

This treatment, of the non-pressure processes of timber preservation, has been found to produce the best absorption.

Each tank was filled with approximately 215 gallons of creosote. The cold tank was not heated except through the heat loss of the hot timber. The hot tank was brought up to temperature (210° F.) before the tank was charged with posts. The wood was submerged in the hot tank for 3 hours, then quickly transferred to the cold tank for 3 hours. The posts were then transferred to the hot bath for another 3-hour period and again quickly transferred to the cold bath and left in this tank until the next morning.



A. STORAGE TANK D. MOTOR G. THERMOSTATIC SWITCH J. DOOR
B. PRESSURE TANK E. PRESSURE SWITCH H. PRESSURE GAUGE K. AIR RECEIVER
C. GEAR PUMP F. HEATER WELLS I. THERMOMETER

FIGURE 2. Equipment built by the Agricultural Engineering Department for experimental pressure treatment of fence posts.

B. Cold Soaking

1. 50 percent creosote and 50 percent diesel oil (PS 200) by volume.

   One of the two tanks was filled with 300 gallons of creosote and 300 gallons of diesel oil and thoroughly mixed. Two durations of cold soaking were employed, 96 hours and 168 hours.

2. 5 percent pentachlorophenol in diesel oil (PS 200)

   A solution was made by combining 5 percent (by weight) of Dowicide 7 with 95 percent of diesel oil. A 50-gallon drum open at one end was filled with diesel oil and charged with about 20 pounds of dry powder. The temperature was raised to 160° F. with a submersible electric heater and the solution agitated with a two-bladed propeller welded on a ½-inch shaft and chucked in a ½-inch electric hand drill. Six batches were necessary to dissolve 125 pounds of Dowicide 7. The bulk of the diesel oil was poured into the tank and as each concentrated batch was prepared it was added to this tank. No pentachlorophenol was observed to precipitate out of solution. The posts were submerged in this preservative in a similar manner as in the creosote and diesel oil treatment above.

   Both creosote and pentachlorophenol are irritating to the respiratory system and skin. Respirators, goggles, and gloves may be necessary depending upon the conditions for handling the preservatives. Posts will partially dry after removal from the tanks. The length of time varies with the preservative used, method of treatment, and climatic conditions. All posts could be handled within two weeks. Posts should be turned once or twice to drain excess preservative from the checks.

3. Permawood

   Following the instruction of the manufacturer, Permawood solution was poured in a galvanized iron trough which was large enough to hold one post. The posts were dipped in this solution, removed, drained, and piled in order to dry before further handling.

4. Osmosalts

   These posts were treated as per instructions contained in the descriptive literature published by the company. The posts were treated 12 hours after peeling. A 1:3 mixture by weight of powder to water was used. The posts were immersed in this solution which was kept agitated. After treatment the posts were piled and sealed in building paper. Posts were dipped and sealed on March 15, 1949, and removed on April 20, 1949. The posts were moldy and mildewed upon removal.

C. Pressure Treatment

The posts for the pressure treatments were cut, peeled, and seasoned in similar fashion to those used in the other treatments.

When starting the treating plant with cold creosote, it was necessary to turn on the heaters in the storage tank about 3 hours before putting in the first batch of posts. From 3 to 6 posts could be treated at one time, depending on the size. After the posts were placed in the pressure tank, the door was bolted on tight and the pump was started to force the hot creosote into the pressure tank. When the pressure gauge indicated that the pressure was up to the desired value and the pressure tank was filled with creosote, the heaters in the pressure tank were turned on and the thermostats were set to maintain the desired temperature. The heaters in the storage tank were then turned off. When the posts had been held under the required pressure and temperature for the allotted time, the heaters in the storage tank were turned on, heaters in the pressure tank turned off, pump shut off and the valve opened to drain the creosote into the storage tank. With the pressure thus released the door could be opened and the posts removed, and placed on a drain rack. The plant was then ready to start another cycle.

In each of the above cases, the posts were piled and allowed to dry prior to further handling. After all final physical measurements were obtained, the posts were crated and shipped to Maui for setting.

SETTING OF POSTS

The *E. globulus* posts set in the dry area near Makena and the medium rainfall area at Haleakala were cut to a length of 3 feet and 6 inches. They were set 18 inches deep in plots five rows wide with 30 posts in each row (see fig. 3). Those at Haleakala were set July 9, 1949, and those at Makena, July 14, 1949. The *E. globulus* posts in the wet area at Kipahulu were cut to a length of 7 feet and set 30 inches deep in a fence line between July 22 and July 26, 1949.

The pressure-treated *E. robusta* posts were cut to a length of 6 feet and were set 2 feet deep in a straight line beside the original plot at Haleakala on June 28, 1950 (see fig. 3).

FIGURE 3. Posts in plot at Haleakala Branch Station as they appeared on May 18, 1954.

The *E. robusta* posts treated with cold solutions were cut to a length of 7 feet and set in fence lines at Haleakala on September 12, 1949.

The pressure-treated *E. globulus* posts were cut to a length of 6½ feet and were set in fence lines at Haleakala on April 23 to 25, 1951 (see fig. 4).

TABLE 1. Condition of *Eucalyptus globulus* posts, non-pressure treatments, May 30–31, 1956

(These posts were set in July 1949, and had been in the ground about 6 years and 10 months at the date of this inspection.)

TREATMENTS*	LOCATION		
	Makena (1)	Haleakala (2)	Kipahulu (3)
A	0†	0	0
B	30.8	31.2	30.4
C	12.4	3.6	2.0
D	22.4	11.6	3.2
E	10.4	0.8	0.4
F	16	5.6	0

Ratings:

Sound	50	Decay over ¼″	20
Surface soft	40	Severe decay	10
Decay less than ¼″	30	Failure	0

*A–Untreated
B–Hot and cold creosote
C–96 hrs. diesel and creosote
D–168 hrs. diesel and creosote
E– 96 hrs. diesel and pentachlorophenol
F–168 hrs. diesel and pentachlorophenol

†Figures are the mean condition of 25 posts

FIGURE 4. Pressure-treated *E. globulus* posts in fence line at Haleakala Branch Station, May 18, 1954.

ANNUAL FIELD INSPECTIONS

At each inspection, posts have been tested for failure by a firm jolt by hand on top of the post. Those posts which did not fail were given a visual inspection to note the extent of decay. Special attention was paid to the area at or near the ground surface. The depth of decay was determined by probing with a blunt pointed instrument similar to an ice pick with a dull point.

At each inspection, posts were rated as follows:

A. Sound, no evidence of decay....................50 pts.
B. Surface soft, suspicion of decay....................40 pts.
C. Partial shallow decay....................30 pts.
D. Partial deep decay....................20 pts.
E. Severe decay....................10 pts.
F. Failure .... 0 pts.

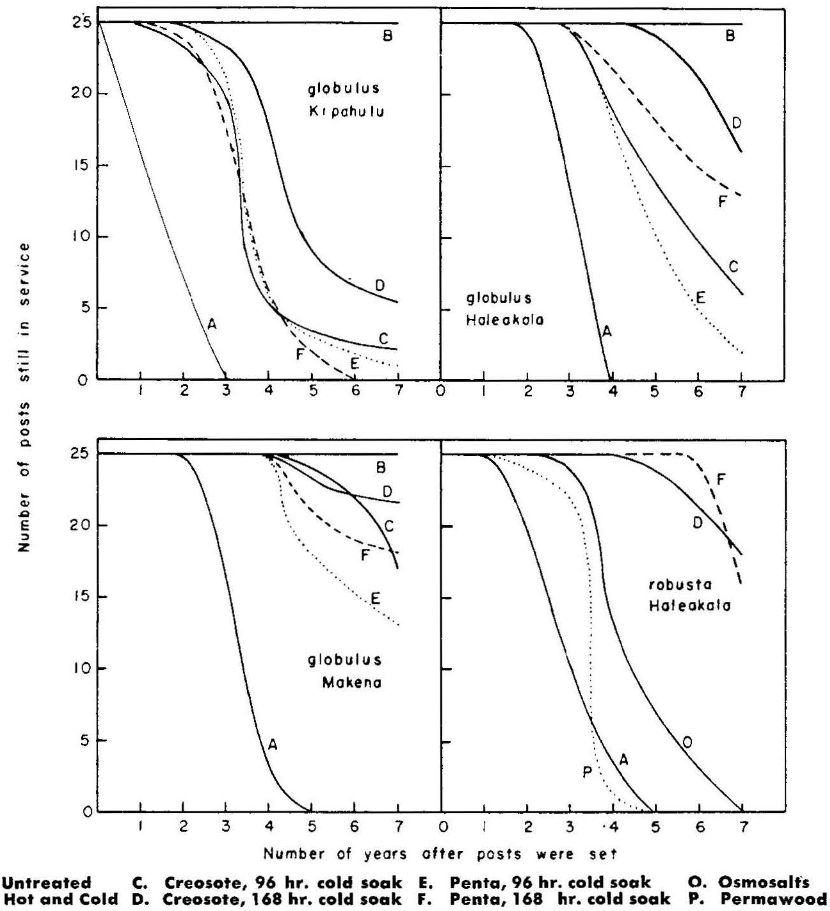


FIGURE 5. Curves showing number of posts surviving each year for various treatments and locations.

TABLE 2. Condition of posts at Haleakala given miscellaneous treatments, May 31, 1956

WOOD AND TREATMENT	MEAN CONDITION OF 25 POSTS
Miscellaneous treated *E. robusta*	
Osmosalts	0
Check	0
50% creosote, 50% diesel, 168 hrs	15.6
5% penta, 95% diesel, 168 hrs	14.8
Permawood	0
(These posts are *Eucalyptus robusta*, set September 12, 1949, and had been in the ground about 6 years, 9 months at the date of this inspection.)	
Pressure-treated *E. robusta*	
A–1 hr., 180° F., 100 psi	40
B–1 hr., 180° F., 150 psi	37.5
C–1 hr., 180° F., 200 psi	38.7
(These posts are *Eucalyptus robusta*, harvested from Aiea Heights, and were set on June 28, 1950. They had been in the ground about 5 years, 11 months at the date of this inspection.)	
Pressure-treated *E. globulus*	
A–1 hr., 185° F., 100 psi	39
B–1 hr., 185° F., 150 psi	36
C–1 hr., 185° F., 200 psi	39
D–3 hrs., 185° F., 100 psi	38
E–3 hrs., 185° F., 150 psi	39
F–3 hrs., 185° F., 200 psi	40
G–Untreated	1
(These posts are *Eucalyptus globulus*, set between April 23–25, 1951, and had been in the ground about 5 years and 1 month at the date of this inspection.)	

Ratings:

Sound	50	Decay over ¼″	20
Surface soft	40	Severe decay	10
Decay less than ¼″	30	Failure	0

These numerical ratings could then be averaged for each group of posts and some idea of the rate of decay could be obtained without waiting until all of the posts had failed. By subtracting each rating from 50 and multiplying by 2, the percentage of decay can be obtained. A summary in tables 3 and 4 shows the percentage of decay for each treatment and location for each year.

EXPERIMENTAL RESULTS

From table 5 it can be seen that the expected life of an untreated *E. globulus* post would be from 2 to 4 years depending on rainfall. The life

Table 3. Summary—Percentage of decay at various locations, *Eucalyptus globulus*

TREATMENT AND LOCATION	YEAR						
	1950	1951	1952	1953	1954	1955	1956
	%	%	%	%	%	%	%
A. Check—no treatment							
Makena	20	18	72	98	100	100	100
Haleakala	34	42	86	100	100	100	100
Kipahulu	76	100	100	100	100	100	100
B. Hot-and-cold							
Makena	0	0	12	2	8	23.2	38.4
Haleakala	0	0	8	0	4	21.6	37.6
Kipahulu	0	0	8	4	19.2	34.4	39.2
C. 96 hrs. diesel and creosote							
Makena	8	14	40	54	57.6	64.0	75.2
Haleakala	14	16	46	68	77.6	84.0	92.8
Kipahulu	40	40	70	92	93.6	94.4	96.0
D. 168 hrs. diesel and creosote							
Makena	14	10	42	40	49.6	51.2	55.2
Haleakala	8	6	28	40	56	64.0	76.8
Kipahulu	28	24	58	84	85.6	93.6	93.6
E. 96 hrs. diesel and pentachlorophenol							
Makena	14	8	44	60	64.8	71.2	79.6
Haleakala	8	14	38	72	88.8	95.2	98.4
Kipahulu	40	32	70	96	96.4	98.4	99.2
F. 168 hrs. diesel and pentachlorophenol							
Makena	8	8	42	56	58.4	60.8	68
Haleakala	8	16	34	56	68.0	81.6	88.8
Kipahulu	32	28	68	94	98.4	100.0	100

expectancy of untreated *E. robusta* appears to be about the same. *E. robusta* posts treated with Permawood have a life expectancy of less than 4 years in an area of medium rainfall. Those treated with Osmosalts could be expected to last 5 years under the same conditions.

In the wet area at Kipahulu life expectancy runs from 2 years for untreated posts to 6 years for posts soaked 168 hours in creosote. At Haleakala it runs from 4 years for untreated to 8 years for 168 hours in creosote. For all practical purposes, we can say that if a post is soaked for more than 96 hours in a cold solution of either creosote or penta, its life will be approximately doubled regardless of the area where it is set.

For those treatments and areas where the number of posts still standing is too large to make a reasonable estimate of post life in years the per-

TABLE 4. Summary—Percentage of decay of miscellaneous treatments at Haleakala

WOOD AND TREATMENT	YEAR					
	1951	1952	1953	1954	1955	1956
	%	%	%	%	%	%
E. robusta						
Osmosalts	18	48	80	86.4	88.8	100
Check	58	86	94	100	100	100
50% creosote, 50% diesel, 168 hrs.	10	32	22	41.6	49.6	68.8
5% penta, 95% diesel, 168 hrs.	2	12	18	32.0	43.2	70.4
Permawood	24	64	100	100	100	100
Pressure-treated *E. robusta*						
A–Treated 1 hr., 180° F., 100 psi	0	5	0	0	20	20
B–Treated 1 hr., 180° F., 150 psi	0	5	0	0	20	25
C–Treated 1 hr., 180° F., 200 psi	0	0	0	0	20	22.6
Pressure-treated *E. globulus*						
A–Treated 1 hr., 185° F., 100 psi		0	0	0	8	22
B–Treated 1 hr., 185° F., 150 psi		0	0	0	12	28
C–Treated 1 hr., 185° F., 200 psi		0	0	0	12	22
D–Treated 3 hrs., 185° F., 100 psi		0	0	0	14	24
E–Treated 3 hrs., 185° F., 150 psi		0	0	0	12	22
F–Treated 3 hrs., 185° F., 200 psi		0	0	0	8	20
G–Untreated		0	60	76	80	98

TABLE 5. Number of posts failed each year and probable life for various treatments and locations

TREATMENT, WOOD, AND LOCATION	YEARS AFTER POSTS WERE SET									Average Life in Years
	1	2	3	4	5	6	7	8*	9*	
	Number of Posts Failed									
Untreated *Eucalyptus globulus:*										
Makena			8	14	3					3.8
Haleakala			11	14						3.6
Kipahulu	9	9	7							1.9
Eucalyptus robusta at Haleakala:										
Untreated		7	6	8	4					3.4
Permawood		1	2	21	1					3.7
Osmosalts			1	13	4	1	6			4.9
Eucalyptus globulus at Kipahulu:										
Untreated	9	9	7							1.9
Creosote, 96 hrs., cold soaking		2	3	15	1	1	1	1*	1*	4.3*
Pentachlorophenol, 96 hrs., cold soaking			4	16	1	2	1	1*		4.3*
Creosote, 168 hrs., cold soaking			2	9	0	8	0	5*	1*	5.6*
Pentachlorophenol, 168 hrs., cold soaking		1	6	12	4	2				3.9
Eucalyptus globulus at Haleakala:										
Untreated			11	14						3.6
Creosote, 96 hrs., cold soaking				6	4	2	7	3*	3*	6.2*
Pentachlorophenol, 96 hrs., cold soaking				7	8	5	3	1*	1*	5.4*
Creosote, 168 hrs., cold soaking					1	3	4	5*	12*	7.6*
Pentachlorophenol, 168 hrs., cold soaking				4	2	4	2	6*	7*	7.0*

*Estimated

centage of decay as shown in tables 3 and 4 will give some indication as to relative merits of treatments. Note that it required 6 years for the hot and cold bath treatment to reach the same state of decay as was reached by the check posts in less than one year. This would indicate a post treated by the hot and cold method might last six times as long as an untreated post. These tables also indicate that the pressure treatment has no advantage over the hot and cold bath.

DISCUSSION

It is fairly easy to determine by research methods which combination of preservative and treatment method will give the longest post life for a given type of wood and location. In practical applications, other factors such as local availability of equipment and supplies, skill of available labor, or personal preference of a farmer for a particular preservative due to appearance or ease of handling may enter into the determination of which preservative to use.

However, it does seem unlikely that a situation will be encountered in which it would be more economical to set untreated posts than treated. In most cases where the treating is done on the farm, the hot and cold bath treatment will probably be the most economical.

A look at figure 5, or table 5, will show that the only preservatives which gave a significant increase in post life were penta and creosote.

In choosing a preservative and a method of treatment, some thought should be given to safety factors as well as economics. Preservatives should be purchased only from reputable manufacturers or their authorized representatives and all recommendations as to protective clothing and equipment should be followed. There is no particular danger in heating pure creosote to the temperatures used in these experiments when using the equipment described in this bulletin. However, creosote will burn and therefore it should not be heated over open fires. The diesel oil used in these experiments had a flash point of 150° F. It can easily be seen that to have heated the solutions containing diesel oil to 210° F. would have created a serious fire hazard. For this reason the creosote-diesel mixture and the penta in diesel were confined to the cold-soaking treatment only.

It has been noted that in some locations untreated posts will remain sound enough to hold staples for some time after the post has rotted off at the ground line, especially if the staples are driven on the leeward side of the post. If posts to be set in such locations are to be treated by the cold-soak method, it may be practical to treat only the lower half of the posts.

However, treating only the lower half of a post by the hot and cold bath method is not recommended since we do not know how long posts treated by this method will last and the tops might be rotten before the butts if such a procedure were followed.

SUMMARY AND CONCLUSIONS

Properties of a good wood preservative are: poisonous to organisms that destroy wood, stable and permanent, able to penetrate the wood deep enough to form a barrier or soluble in a cheap vehicle to make a penetrating solution, non-corrosive and safe to handle, available in quantity, and reasonable in price.

Common preservatives which meet the above criteria are coal tar creosote and pentachlorophenol. Common methods of applying these preservatives are by pressure, hot and cold bath, and cold soaking.

Four preservatives, creosote, pentachlorophenol, Osmosalts, and Permawood were tested on two woods, blue gum and swamp mahogany. These were applied by cold soaking, hot and cold bath, and pressure. Posts were set in three areas, dry, medium, and wet.

In each of the three areas blue gum posts were set having the following treatments:

1. Check........................no treatment
2. Creosote........................hot and cold bath
3. Creosote........................96 hours cold soak
4. Creosote........................168 hours cold soak
5. Penta........................96 hours cold soak
6. Penta........................168 hours cold soak

In the medium rainfall area pressure-treated posts of both species were set as well as swamp mahogany having the following treatments:

1. Check........................no treatment
2. Osmosalts........................dip
3. Permawood........................dip
4. Creosote........................168 hours cold soak
5. Penta........................168 hours cold soak

The cold soaking and and hot and cold bath were full-length treatments using open iron tanks which had electric heaters for the hot bath. Pressure treatments were made in a small plant built at the Hawaii Agricultural Experiment Station.

In the hot and cold bath treatment the posts were soaked 3 hours at 210° F., moved to the cold tank for 3 hours, another 3 hours in the hot tank, and then placed in the cold tank overnight. For cold soaking, equal parts of diesel oil and creosote were used, and a solution of 5 percent pentachlorophenol in diesel oil.

Both Osmosalts and Permawood were used according to manufacturers' instructions. The pressure treatment used was similar to the Lowry Process described in Forest Service Report No. R154 (8), except that no vacuum was used to remove surplus preservative from the wood.

An untreated *Eucalyptus* post can be expected to last from 2 to 4 years. The increase in post life due to treatment with Permawood was too small to have any practical value. While Osmosalts added about 1½ years of post life, it is less effective than other treatments that are easier to apply. Posts soaked for one week in a cold solution of either creosote or penta will last about twice as long as untreated posts. There are some indications that posts treated by the hot and cold, or pressure methods may last five or six times as long as untreated posts. Of the treatments tested those recommended are:

(a) Pressure treating with creosote
(b) Hot and cold bath with creosote
(c) Cold soaking one week with either penta or creosote

Not recommended are:

(a) Osmosalts
(b) Permawood

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