Tests on *Treated* FENCE POSTS

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION
J. H. LONGWELL, DIRECTOR
BULLETIN 612 JANUARY, 1954

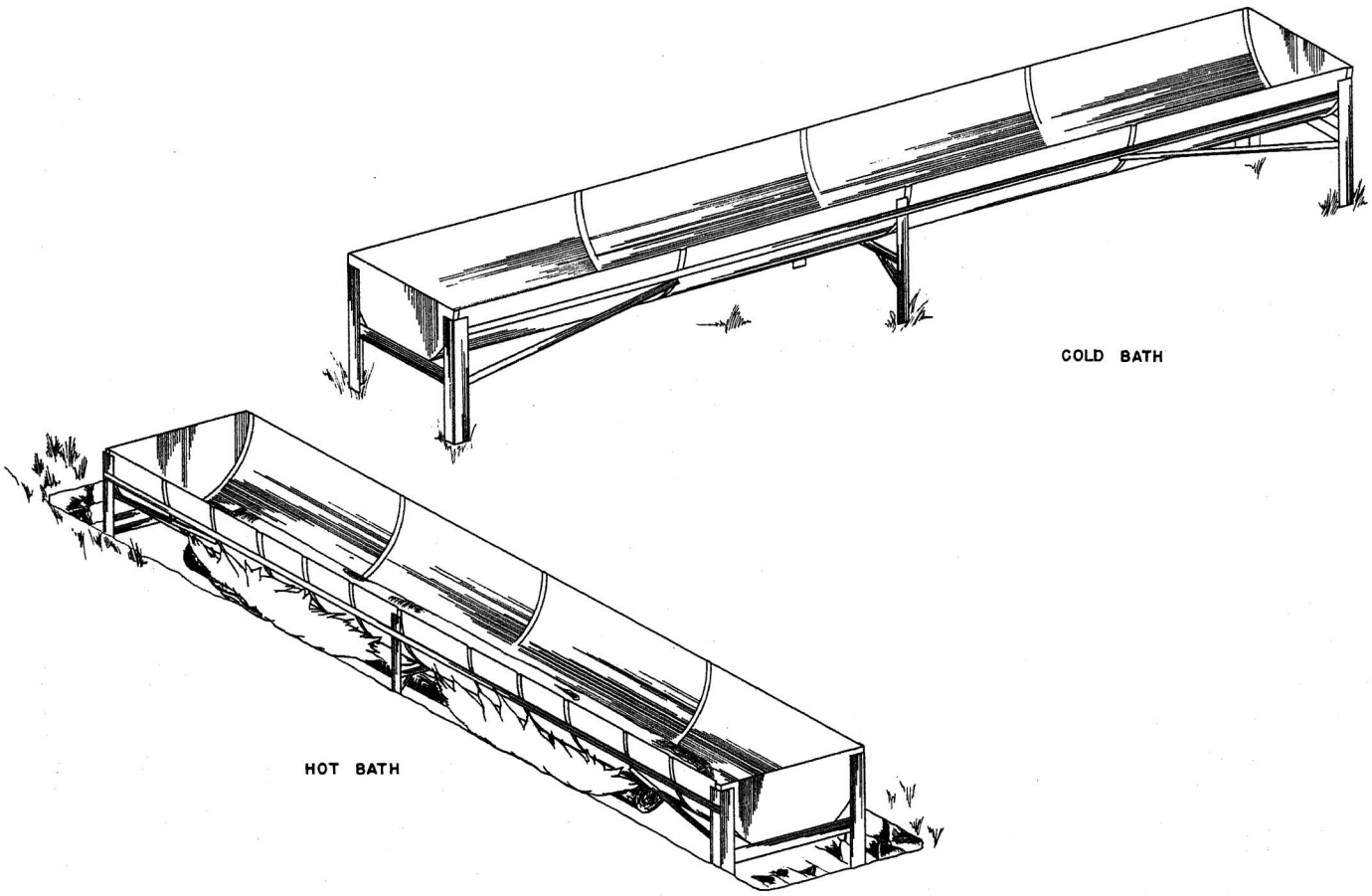

Fig. 1. Equipment needed for treating posts by the hot bath—cold bath creosote method.

Report on Department of Forestry research project
Number 120, entitled "Timber Crop."

Tests On Treated Fence Posts

W. J. O'Neil

What native tree species yield fence posts that are most serviceable for farmers under Missouri conditions? What kind of preservative treatment, other than pressure, is most effective in lengthening the life of non-durable fence posts? What equipment does a farmer need for treating his own fence posts? In 1938 the Department of Horticulture and Forestry in cooperation with the Department of Agricultural Engineering initiated a simple experiment to obtain answers to these questions.

It is estimated that over 7,500,000 fence posts are used annually in the state of Missouri. During the peak year, 1946, over 20,000,000 posts were utilized. Approximately 80 percent of posts used each year are replacements for posts rendered unfit for further service by insect and fungous attack. The rest of the posts are used for new fencing, which eventually will require replacements. A well constructed fence has a life expectancy of 25 years if made out of durable posts. Untreated posts of non-resistant heartwood often rot out in 3 to 5 years. If these non-durable posts can have their life extended by an inexpensive preservative treatment so that they last over 20 years, farmers can realize a considerable saving in time and money.

EXPERIMENTAL PROCEDURE

Selection and Preparation of Posts. The twelve species selected for study were basswood (*Tilia americana* L.), catalpa (*Catalpa speciosa* Ward.), eastern redcedar (*Juniperus virginiana* L.), American elm (*Ulmus americana* L.), slippery elm (*Ulmus rubra* Muhl.), hackberry (*Celtis occidentalis* (L.), shagbark hickory (*Carya ovata* (K.) Koch), black locust (*Robinia pseudoacacia* L.), black oak (*Quercus velutina Lamarck*), chinkapin oak (*Quercus muehlenbergii* Engelm), white oak (*Quercus alba* (L.), and shortleaf pine (*Pinus echinata* Mill.). All of these species are common to Missouri.

The fence posts were cut during the period of October, 1936, to May, 1937, and were stored on the second floor of the Agricultural Engineering laboratory for seasoning. Posts were of two types, split and round. The slippery elm posts were split, while the posts of cedar, basswood, black oak, and hackberry were a mixture of split and round posts. Posts of all the other species were round.

The posts were cut 6.5 feet long. They were measured carefully and the following data recorded: butt diameter in inches, top diameter in inches, number of annual rings in the last inch, and total number of annual rings. The size of the posts varied. The average butt diameter ranged from 5.9 inches to 4.1 inches with a maximum diameter of 7.7 inches and a minimum diameter of 3.3 inches. The average top diameter varied from 5.1 inches to 2.9 inches with a maximum diameter of 6.5 inches and a minimum diameter of 2.2 inches.

Types of Preservative Treatment. Most of the commonly known treatments which did not involve the use of pressure or expensive equipment were tested in this study. Since the experiment was initiated, several new preservatives have come on the market. Pentachlorophenol is one of the better of these new preservatives.

Because the hot- and cold-creosote bath treatment can be given readily with the equipment most farmers possess, eight posts of each of the eleven species received a hot bath of creosote at a temperature of 220°F, followed by a cold bath of creosote at air temperature (Fig. 1). The posts were left in the hot bath for 2¼ hours, after which they were placed in the cold bath for one hour. Catalpa posts were not treated.

Fourteen other treatments were applied to black oak and basswood posts. These 14 treatments involved a total of 71 posts of each of these species. The number of posts in the individual treatments varied from three to six. A large number of posts were used to test more fully the most promising preservatives and methods on a relatively soft hardwood, such as basswood, and a relatively hard hardwood, such as black oak.

Eight different hot- and cold-bath creosote treatments were applied to two or three feet of the butt end of black oak and basswood posts. Treatments varied in the length of time that the posts were left in both the hot and cold bath. After treatment the posts were allowed to drain for 24 hours by placing them across two parallel timbers so that the posts were elevated above the ground.

Fig.2. Treating posts with zinc chloride by the tire tube method. (Photo by U. S. Forest Service.)

The other six treatments employed were: (1) painting the posts with hot creosote; (2) painting the posts with hot carbolineum; (3) soaking the entire post in crankcase oil for one week; (4) soaking the entire post in a 5 percent solution of zinc chloride for one week; (5) using zinc chloride by the tire-tube method; and (6) using two proprietary products, Osmolit and Osmoplastic.

The tire-tube method consists of laying unpeeled green posts on an inclined stand or platform with the butt end elevated (Fig. 2). The butt end is then smoothed, and grease is applied so that the tire tube fits tightly around the post. A zinc chloride solution equivalent to a 5 percent solution (made by mixing 21 pounds of a 50 percent zinc chloride solution in 10 gallons of water) is poured into each inner tube. The solution is then carried by the force of gravity toward the small end of the post. The excess solution can be reclaimed as it drips out of the end of the post.

In using the Osmolit process, freshly cut posts must be peeled of all outer and inner bark. Osmolit is mixed with an equal part of water, by weight, and is then brushed over the entire outer surface of the post. The posts also may be dipped into the solution. In this experiment the posts were painted. When the posts are thoroughly covered with the solution, they are piled in a pyramid and covered with hay, straw, or similar material to prevent rain from washing off the solution and to slow up the seasoning of the post. The posts must remain covered for 3 to 4 weeks.

In the Osmoplastic treatment, the bark is removed for a distance of 4 inches above and 8 inches below what will be the ground line when the post is set for use in a fence line. The solution is brushed on the surface of the post. If the treated area is covered with a waterproof bandage, the treated posts may be set immediately; otherwise, the posts should be seasoned for two weeks before being set. In this study the water-proof bandages were used.

Settingof Posts and Subsequent Examinations. A total of 322 posts from 12 different tree species were set out in the field east of the University stadi-

um. The first posts were set out in October of 1937.

Seven posts of each of the twelve species were not treated. They were set out in the test field where they served a dual purpose. They served as a basis for determining the relative serviceability of untreated posts of different species, and as a basis for comparing the length of life of treated and untreated posts.

Inspections of posts were made at intervals varying from one year to three years. At each inspection, data on the condition of the posts were recorded.

SERVICE LIFE OF UNTREATED POSTS

The number of posts of each species in serviceable condition after different periods of time is shown in Table 1

TABLE 1 -- PERCENTAGE OF UNTREATED POSTS SERVICEABLE AFTER VARYING PERIODS OF YEARS.

Species	After 5 Years	After 10 Years	After 14 Years
Catalpa	100	100	86
Eastern Redcedar	100	86	71
Black Locust	86	86	71
Black Oak	100	29	29
White Oak	86	43	14
Shortleaf Pine	57	29	14
Chinkapin Oak	86	43	None
Hackberry	14	None	None
Slippery Elm	None	None	None
Shagbark Hickory	None	None	None
American Elm	None	None	None
Basswood	None	None	None

It is apparent that catalpa, eastern redcedar, and black locust were durable since most of the posts were serviceable at least 14 years. The catalpa and cedar posts which failed during the study were serviceable for a long time, over 10 years; and the failing locust posts lasted more than 6 years. The generalization that a large amount of heartwood in a durable species increases post longevity was borne out by the data. The two cedar posts which lasted less than 14 years had heartwood diameters at the butt end of less than 3 inches. The heartwood of the other cedar posts exceeded 3 inches in diameter. The smallest locust post failed first. However, there was no apparent relation of heartwood diameter to post life in the case of the other species.

The oaks and short leaf pine proved to be moderately durable; most of the posts of these species lasted at least 5 years, but only a small percentage were still serviceable at the end of 14 years. The pine posts had

Fig. 3. Condition of selected posts after 14 years of service. Left to right—untreated black oak (less than one-third of the posts are serviceable), untreated catalpa, untreated black locust, and creosote-treated shortleaf pine.

large diameters and were exceptionally resinous; this combination probably accounted for longer-than-expected serviceability of these species. The other species tested showed low durability.

The results obtained in this study were somewhat similar to those reported in the U. S. Department of Agriculture Farmers' Bulletin No. 2049. This study has not been carried on long enough, however, to obtain accurate estimates of the average life of posts of the moderately durable and durable species.

Analysis of the data indicated that there was no apparent relationship between durability and number of annual rings in the outside inch or the total number of growth rings in the post.

SERVICE LIFE OF TREATED POSTS

Results of the test of the 11 species treated with creosote (hot bath followed by cold bath) are shown in Table 2.

TABLE 2 -- PERCENTAGE OF CREOSOTE-TREATED POSTS SERVICEABLE AFTER DIFFERENT PERIODS OF TIME[1]

	Percentage of Serviceable Posts		
Species	After 5 Years	After 10 Years	After 14 Years
Black Oak	100	100	100
Eastern Redcedar	100	100	100
Black Locust	100	100	87
White Oak	100	100	87
Shortleaf Pine	100	100	87
Chinkapin Oak	100	100	63
Slippery Elm	100	37	25
Shagbark Hickory	100	37	None
Hackberry	100	25	None
Basswood	87	25	None
American Elm	87	13	None

[1] 2-1/4 hours in hot bath and 1 hour in cold bath.

This treatment increased the serviceable life of posts of all species. In the case of the non-durable species (elm, hickory, hackberry, and basswood), treated posts may be classified as moderately durable, lasting about 5 to 10 years. The life of the moderately durable species (oaks and pine) was significantly improved by this treatment, most of the posts lasting at least 14 years. The span of time of this experiment has not been sufficient to determine whether the life of the naturally durable posts (locust and cedar) will be extended by this treatment.

In the test to determine the most effective creosote method, the foregoing treatment—a 2¼-hour hot bath followed by a 1-hour cold bath—gave the best results for the two species tested. However, all black oak posts given a hot and cold bath creosote treatment on only the lower 2 feet were in serviceable condition after 10 years. It appears, therefore, that treatment of the entire post may not be necessary for black oak. In the treatment of basswood posts, soaking the entire post gave somewhat longer life than just soaking the lower two feet.

The tests with all types of treatments on black oak and basswood demonstrated that these two species did not react alike. In general the creosote bath treatments increased the life of the black oak posts most, but the other treatments, except the carbolineum treatment, were almost equally good. With basswood, the zinc chloride treatments gave essentially the same results as the best creosote treatment. Over 80 percent of the posts treated with zinc chloride were serviceable for at least 10 years, and over 40 percent were still serviceable at the end of 14 years. Zinc chloride applied through a tire tube appears especially promising for basswood. All zinc chloride-treated posts had a life of at least 10 years, and 83 percent of the posts were serviceable at the end of 14 years.

The Osmoplastic and Osmolit treatments did not lengthen the life of basswood materially, but improved durability of black oak posts. After 10 years all oak posts treated by these methods were still in service. At the end of 14 years, 60 percent of the Osmoplastic-treated posts and 20 percent of the Osmolit-treated posts were still serviceable.

Painting posts with either hot creosote or hot carbolineum did not increase durability significantly. Soaking posts in crankcase oil for one week apparently resulted in some increase in post longevity, although none of the basswood posts so treated lasted 10 years. The seven check posts of black oak which received no treatment of any kind gave similar results to those treated with crankcase oil.

CONCLUSIONS

Untreated Posts

1. The species tested may be grouped into three durability categories based on results of this experiment:

Durable—Most posts will endure for more than 14 years. Catalpa, eastern redcedar, and black locust.

Moderately durable—Most posts will endure for from 5 to 14 years. White oak, chinkapin oak, black oak, and shortleaf pine.

Non-durable—Most posts will not endure for 5 years. Slippery elm, hickory, hackberry, American elm, and basswood.

2. In order to insure long life, posts should be made from a durable species and should contain heartwood with a diameter of at least 3 inches at the butt end.

3. Rate of growth is apparently weakly related, if at all, to durability differences within a species.

Posts Treated with Preservatives

1. The most successful of the preservative treatments tested are: (1) creosote used by the hot and cold bath method, and (2) zinc chloride applied either by soaking or through a tire tube.

2. The most effective creosote treatment was a 2¼-hour hot bath followed by a 1-hour cold bath. This treatment prolonged the life of all species. Non-durable species lasted approximately 5 years longer with this treatment; moderately durable species were durable at least 5 more years when thus treated.

3. Zinc chloride applied through a tire tube by means of the force of gravity was more effective than any other treatment tested on basswood, a soft hardwood species. All basswood posts thus treated lasted more than 10 years.

4. The simple equipment needed for the two most effective preservative treatments used in this experiment is: (1) a supply of creosote, two metal barrels to hold the creosote, and an arrangement for heating the creosote in one barrel for the creosote hot and cold bath treatment; (2) a supply of zinc chloride, a mixing barrel, and a supply of old, truck tire inner tubes for the tire-tube method.

5. Painting the posts with either hot creosote or hot carbolineum is not effective in improving post durability.

6. It is not likely that a soft hardwood, such as basswood, can be improved in durability by soaking in oil or by treatment with Osmolit or Osmoplastic. Black oak apparently will have improved durability after these treatments, but the experiment has not extended over a long enough period to determine the exact amount of the improvement.

This project is financed in part
by
DIVISION OF FORESTRY
MISSOURI CONSERVATION COMMISSION