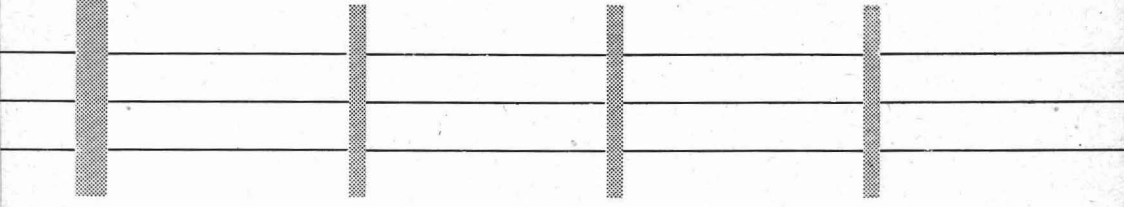
POLES *and* FENCE POSTS *for* OREGON FARMS



Oregon State System of Higher Education
Federal Cooperative Extension Service
Oregon State College
Corvallis, Oregon

Extension Bulletin 681 October 1947

TABLE OF CONTENTS

"The Proof of the Pudding Is in the Eating"

Actual tests show how long a fence post will last. Begun by T. J. Starker in 1928, the post farm at the School of Forestry, Oregon State College, has conducted 59 tests of various woods and preservative methods.

Round, Douglas-fir posts treated by the salt method in 1928. None had failed in 1947 although tops showed rot. Similar untreated posts lasted 7 years.

Split, black cottonwood posts given the hot- and cold-bath creosote treatment. No failures after 16 years, but tops are decayed. Top treatment was not given, but is shown to be needed.

Black locust posts are sound after 12 years in the ground. One yard tree furnished the 22 posts used in this test. Black locust is sometimes planted to grow posts. Trees set out 15 years ago at Corvallis are now about 8 inches diameter.

Poles and Fence Posts
for Oregon Farms

By DAN D. ROBINSON, Assistant Professor of Forestry,
Oregon State College,
and
CHARLES R. ROSS, Extension Forester

INTRODUCTION

MILLIONS of wooden fence posts, corral poles, cane fruit stakes, and hop poles are in service on Oregon farms. Costs of establishing and maintaining these essential farm improvements have increased sharply in recent years because of high labor charges plus the fact that the more desirable post and pole species are becoming less readily available in many areas of the state. This bulletin is designed to meet the demands of Oregon farmers for information pertaining to utilization and preservative treatment of native and introduced tree species for fence posts and poles.*

SPECIES OF WOOD USED

Tree species used for posts and poles are classified as either durable (redcedar, yew, juniper, redwood, black locust), or nondurable (pine, white fir, Douglas-fir, cottonwood, alder, and others). Durable species generally give satisfactory service in contact with the ground, but the nondurable species require some preservative treatment before a comparable service period can be expected. The kind of post material that a farm operator will use depends on its availability, cost, and lasting qualities. The farmer's primary objective is to obtain fencing material at the lowest cost per year throughout the life of the farm operation.

In some localities steel or concrete posts are proving popular and have been less costly than wooden material when comparative service periods, availability, and labor are considered. Metal posts are scarce at this time, and it is hard to get information regarding price or service to be expected. A Portland dealer was offering a galvanized steel fence post at 95¢ and a painted steel post at 55¢. The

* Professor T. J. Starker, of the School of Forestry, Oregon State College, established an experimental post farm at the Oregon Forest Nursery in 1928. His bulletin, *Preservative Treatments of Fence Posts,* Bulletin No. 9, Engineering Experiment Station, together with subsequent progress reports, has been the principal source of information pertaining to fence post treating methods in Oregon. Some of the research results described in the bulletin have been incorporated in these pages.

Figure 1. A heavy, rail type steel fence post with corrugated edges. Reports indicate that this type of post often lasts 20 years or more. Obtainable before the war, it is not on the market now. Some of the light steel posts are reported to be not very satisfactory.

better types of metal posts are said to be good for 20 years or more. The cheaper metal posts are reported much less satisfactory. Discarded railroad ties that have been treated make excellent posts and may often be purchased from railroad companies at low cost. Such material has been used to good advantage in several eastern Oregon counties.

PLANTATIONS FOR POST PRODUCTION

Some farm owners have established plantations of black locust, thus obtaining a continuous, dependable source of excellent fence post material. If the trees are planted in close spacing (8 feet by 8 feet) they will grow taller and straighter than trees spaced at greater distances. As the trees reach fence-post size they should be cut so as to provide additional growing space for the smaller stems. Black locust posts, 4 to 6 inches in diameter, may be harvested from plantings in 8 to 10 years under optimum temperature, moisture, and soil conditions. Stumps of black locust sprout vigorously and will produce new posts from sprout growth if all sprouts except one are cut back after a year or two.

The School of Forestry has one test of 22 black locust posts, all cut from one yard tree. After 12 years in the ground, all the posts appear well preserved, even slender ones made from limbs.

FACTORS AFFECTING DURABILITY IN AN UNTREATED POST

The lasting qualities of a wooden fence depend on a number of factors, the most important of which are discussed in the following paragraphs.

Kinds of wood

Certain kinds of wood are naturally more durable than others in contact with the soil. Black locust and yew are considered the most durable fence-post woods used in Oregon. Western redcedar, redwood, and western juniper also make excellent fence posts because of their natural durability. Oregon oak is fairly durable if larger trees containing mostly heartwood are used. Of 25 split-oak posts placed in the experimental post farm, all stood 8 years; 12 were standing after 17 years, with the heartwood quite sound.

Percentage of heartwood

Other things being equal, a post with a high percentage of heartwood will last longer than a post of the same species that is composed largely of sapwood. A large post will generally last longer than a small post because the former usually has more heartwood than the latter (Figure 2).

Soundness of wood

A post containing sound wood will last longer than one that contains defects or decay.

Figure 2. Post A has a greater percentage of heartwood than B, therefore is more desirable as a fence post.

Type and condition of soil

The type and moisture content of the soil is another important factor influencing the service life of fence posts, hop poles, and canefruit stakes. For example, posts set in alkali soil usually last longer than posts of the same species in nonalkali soil. Posts that are constantly wet or constantly dry usually outlast posts of the same species that are set in alternately wet and dry situations.

Amount and rate of seasoning

Contrary to popular belief, there is little difference in length of service of posts that are dried and seasoned before setting and green posts of the same species that are set immediately after cutting. The time of cutting has been suggested as a factor influencing post life, but additional observation and experimentation are necessary before definite conclusions can be drawn. Posts cut in the fall usually dry out more slowly and check less than posts cut in the spring or summer. Too rapid seasoning in hot, dry weather will cause the post to check badly and thus expose the new wood to decay organisms. Posts cut in spring and early summer peel more easily than posts cut in winter.

Split or round posts

There is considerable difference of opinion among farm operators as to whether split or round posts are the more durable. The fact is that one kind of post will last about as long as the other if they contain the same amount of heartwood. If the percentage of heartwood is decreased by splitting, the split post will be less durable, but if the percentage of heartwood is increased by splitting, the post will be more durable than a round post. Spruce, hemlock, or any of the true firs (white fir), are exceptions to this rule because their heartwood and sapwood are about equally durable.

Charred posts and poles

Charring is not recommended as a method of obtaining a longer service life from posts and poles. Tests show that charring actually shortens the life of a Douglas-fir post several months below that of noncharred posts (Figure 3). This practice reduces the cross-sectional area of a post, thus removing part of the wood volume. Charring affects only the surface of the post, but when the surface checks after the post is set in the ground the newly checked areas expose noncharred wood to attacks by decay organisms.

Method of setting posts

Posts last longer if the soil is packed firmly around that part of the post below the ground. No advantage is gained by setting posts in concrete if moisture is allowed to collect at the point where wood and concrete come into contact. Rocks piled around the base of a post usually catch and hold additional moisture that increases the opportunity for decay organisms to attack the wood.

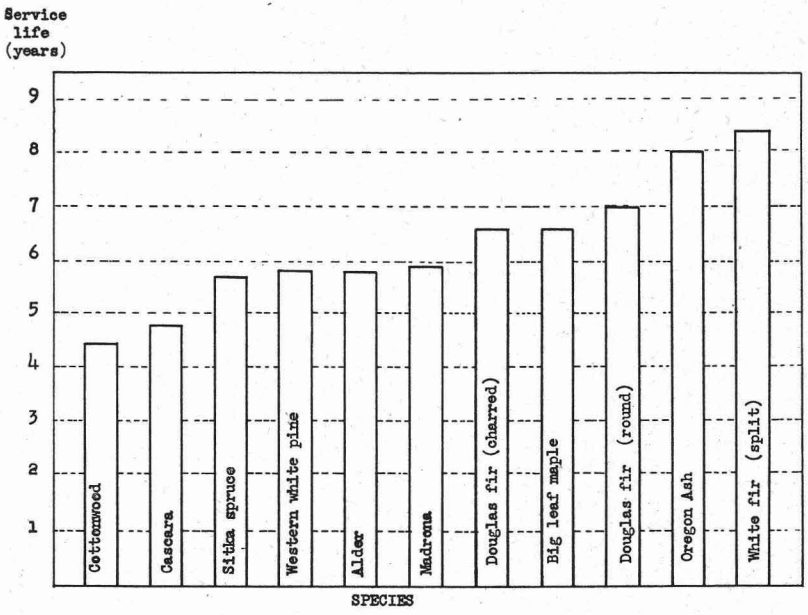


Figure 3.. Average service life of some untreated posts in post farm experimental plot near Corvallis, Oregon. Posts averaged 6 inches in diameter.

COMPARATIVE SERVICE LIFE OF UNTREATED POSTS

Many species of Oregon woods are not satisfactory as fence-post material because of their relatively short life in contact with the soil. Figure 3 indicates the average life of some of the more common Oregon woods when used as untreated posts in contact with the soil.

SUGGESTIONS FOR CUTTING AND USING UNTREATED POSTS ON FARMS

1) Select trees that are sound.
2) Choose trees growing in thick stands.
3) Cut trees 10 inches or more in diameter because trees of this size generally have a higher percentage of durable heartwood than smaller trees in the same stand.
4) Cut stumps low for close utilization. Black locust will sprout from the stumps and produce new post material.
5) Remove bark to reduce attacks by insects.

PRESERVATIVE TREATMENTS FOR FENCE POSTS AND POLES

Recent high costs of the more durable fence posts have caused many farm operators to use less durable species. The service life of nondurable woods is relatively short and necessitates frequent replacement unless a preservative treatment is applied. Many treatments have been tried with varying degrees of success, but for purposes of this bulletin only those treatments that have proved to be effective, easy to apply, and relatively low in cost are included.

Which treatment to use?

Perhaps the first thing is to make sure whether durable woods are available. If they can be had on the place, it will save money and labor to use them.

Many farmers read about preservative treatments for posts and become interested. Later on, their interest may drop when they learn that preparations have to be made. Usually, they find it better to treat many posts rather than a few, since the preservatives cost less in larger quantities. If seasoned wood is called for, posts then have to be cut several months ahead.

Nevertheless, many farmers have found preservatives worthwhile, just as have the utilities and railroads.

There are three good treatments to choose from: the salts, creosote, and pentachlorophenol. They are described on the pages immediately following.

The salt treatment, which is the easiest, will appeal to farmers in western Oregon for treating posts of Douglas-fir and other conifers. It has given good results with Douglas-fir, whereas considerable extra work is required to treat this species with pentachlorophenol or creosote.

Farmers in eastern Oregon, where pine is the principal wood, should consider pentachlorophenol. Pine is effectively treated by this preservative, although the salt treatment would probably work on eastern Oregon woods. Service tests, however, are not yet available for that region. One test being made in western Oregon indicates that salt is not as effective on lodgepole pine as it is on Douglas-fir.

Tests of the salt treatment are not yet available for hardwoods. It is assumed that salt probably will treat them.

Pentachlorophenol can be recommended for any wood, although considerable effort is required to treat several species. If western Oregon farmers desire a full length treatment of their posts or poles, pentachlorophenol is probably the best choice. The salt treatment apparently cannot be depended on for full length treatment.

What has been said here about the use of pentachlorophenol applies also to creosote. Both are oil-soluble preservatives and act similarly. Pentachlorophenol is rated first because it is easier to apply. The creosote hot- and cold-bath is the most effective known method for preserving posts on the farm, but it takes more work.

Preparing posts for treatment

When green posts are to be treated with a preservative little preparation is necessary other than cutting and collecting the posts before treating.

Certain preservative treating methods require that posts be seasoned before the preservative is applied. In such instances the following suggestions will aid in securing maximum effectiveness from the preservative.

1. The posts should be open piled so that the air will circulate freely around each one. The bottom of the pile should be raised at least 1 foot above the ground.
2. Green posts should be piled in shade or under cover during the hot, dry, summer months to prevent excessive checking and casehardening. If posts are cut in the fall or winter, they should be piled under cover for protection against rain or snow.
3. Posts should be seasoned for a period of 2 to 3 months prior to treatment.

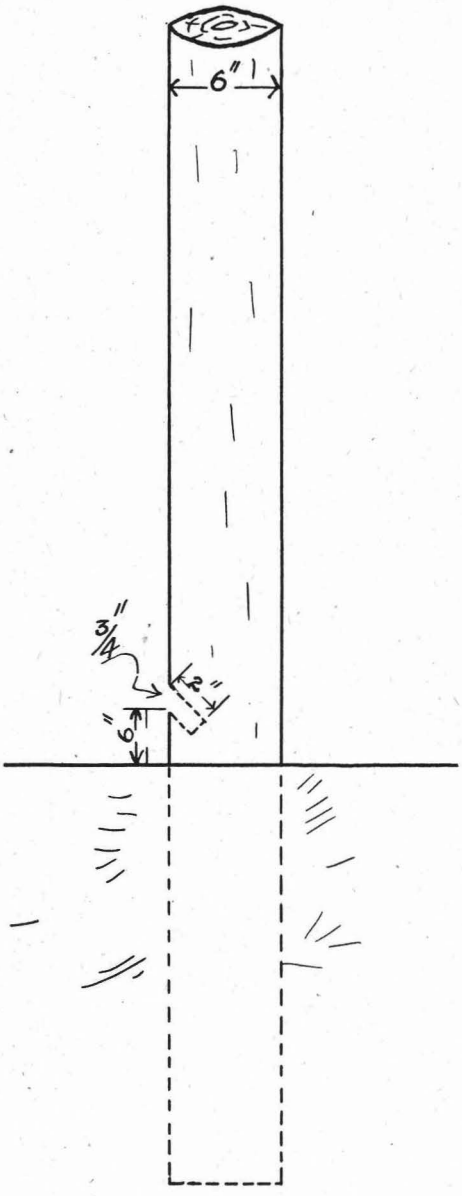


Figure 4. Diagram of post prepared for salt treatment method.

SALT TREATMENT METHOD

Results indicate that the salt treatment is effective, easy to apply, and relatively low in cost. In fact, it is one of the easiest treatments ever devised. Western Oregon farmers have used it more than any other treatment discussed in this bulletin.

The School of Forestry of Oregon State College began tests of the salt treatment method in 1928. Of 75 round, unpeeled Douglas-fir posts put in the ground at that time, all were standing 18 years later. The tops of many of the posts were badly decayed, but all withstood a 50-pound test pull. Had the posts been in a fence, it would have been necessary to restaple the wire on some of them after possibly 12 years of service. Sloping the top cut, and painting it liberally with pentachlorophenol solution or creosote, has been suggested in order to retard decay there, but actual effects are not known. Untreated posts similar to the 75 given treatment, failed in 7 years.

Douglas-fir and lodgepole pine have been the only woods tried so far with the salt treatment, but other softwood species can

be effectively treated by the method. A test of 25 pine posts has run 8½ years with no failures, but some posts have decay at the ground line. Information is lacking as to the hardwoods. There is no reason to think that the salt treatment would not work with them.

An interesting possibility, not yet tried, is treatment of Oregon white oak. The species has some natural durability, so the tops of posts should last well. The salt treatment might extend the life of the butts. Treated Douglas-fir butts seem good for 20 years or more.

Material

Freshly cut green material *must* be used. Success of the treatment depends on the amount of moisture in the post and that secured by absorption from the soil to dissolve the salts and distribute the solution throughout the wood fibers.

Peeling the posts might dry the sapwood and handicap spread of the chemicals. This has not been proved, but seems logical. It is an interesting fact that 4-inch posts have lasted as well as 5- and 6-inch posts in the tests at Corvallis. Round posts are preferred although the treatment may be applied to the sapwood side of a split post.

Formula

The formula used consists of equal parts by weight of corrosive sublimate, arsenic, and common salt. Three pounds of the mixture (1 pound of corrosive sublimate, 1 pound of arsenic, and 1 pound of salt) will treat 40 to 45 posts of 4 to 6 inches diameter. One tablespoon of the mixture is sufficient to treat one post of this size.

Application

A ¾-inch hole is bored in the post or pole approximately 6 inches above the ground line and slanting downward. The hole should be approximately 2 inches deep. One tablespoon of the mixture is inserted and the hole is plugged with a cork, wooden plug, or ¾-inch dowel stock; or it may be closed by nailing a small square of tin over the opening. *Particular care should be taken to close this hole tightly to prevent stock from licking the poison.* Posts 7 to 9 inches in diameter require 2 holes (one on each side of the post). For posts 10 to 12 inches in diameter 3 equally spaced holes are suggested. A small funnel with an opening slightly less than ¾ inch is a handy aid when inserting the mixture in the post.

EXTREME CARE SHOULD BE TAKEN IN APPLYING THE SALT AND COVERING THE HOLE TIGHTLY; THE MIXTURE IS POISONOUS.

Cost

The cost for material is 7¢ to 10¢ per 4-inch post. This figure does not include labor for preparing or treating the posts. One man can treat between 12 and 15 four-inch posts per hour if all materials are prepared prior to treating. Commercial grades of the powder are less expensive than the refined grades. As a soluble form of arsenic is desirable, white arsenic is recommended.

Advantages of salt treatment

1. The method is inexpensive as to both material and equipment required. In many cases posts may be cut along the fence line, thus saving distribution costs.
2. No time or labor is required in piling the fence post material for seasoning.
3. No training or experience is required in making the application.
4. Small material in the form of thinnings and otherwise unmerchantable saplings may be utilized.
5. Posts do not have to be peeled.

No instances have been recorded where stock have suffered ill effects by chewing on the treated posts. Apparently the salts do not dissolve out of the posts in sufficient amounts to poison water nearby. After the salts have dissolved and disappeared from the hole, there is little further danger to the stock if the plug falls out or is otherwise removed.

CREOSOTE OPEN TANK TREATMENT

(Hot and Cold Bath)

Creosote is the leading wood preservative. Although there is no question as to its efficacy, farmers have never used it a great deal. Creosote is dirty material to work with, and close attention must be given to heating it. Yet the results are worth the time required, if the farmer is able to give it the necessary time.

Lately there has been a tendency to recommend pentachlorophenol, discussed on page 14, in place of creosote. Both are oil-soluble and resist leaching.

The open tank method is recommended. Two tests of this treatment are in progress at the Oregon School of Forestry post farm. Butt treatment was given to 25 small, round Douglas-fir posts, of which 12 were standing after 17 years. Crankcase oil was mixed in equal parts with the creosote. Douglas-fir is one of the woods that resist penetration. For such woods, a longer bath is necessary.

The other test was with split cottonwood posts, and it did better.

Cottonwood, pine, and certain other woods absorb creosote readily. All cottonwood posts were standing after 16 years, although their tops were rotting. Pure creosote was used in this test. Tops were not treated, but top treatment appears necessary for nondurable woods like cottonwood.

When good penetration is obtained, treated portions of the post will usually last 25 years. Lodgepole pine posts given the open tank treatment lasted an average of 27 years in Colorado tests.

Material

Round, seasoned posts of any species that have been peeled of outer bark. Split posts may be used but treatment will be less effective.

Formula

Coal-tar creosote, grade 1, is generally specified as the most effective preservative. Oil-tar creosote is manufactured on the West Coast and is much cheaper. As oil-tar creosote has been used as a preservative only in recent years, our knowledge of its effectiveness is not complete. Several studies have indicated that it will serve as well as coal-tar creosote. Douglas-fir posts given butt treatment with oil-tar creosote 8 years ago remain well preserved, although the absorption was only ½ pint per post, a very light treatment.

Since information is not complete regarding oil-tar creosote, perhaps it should be used without dilution. Its lower price ordinarily makes this possible.

Coal-tar creosote is often mixed with fuel oil or used crankcase oil. In these mixtures, the proportion of creosote should never be less than 50 per cent, as it is the creosote that has the preservative value. The other oils are used to reduce cost; they give a slight preservative value by helping to waterproof the wood, but are not toxic to fungi. For woods that do not absorb the preservative readily, the mixture probably ought to have about 66 per cent creosote, or more.

Equipment

Two oil drums or metal tanks with one head removed from each drum or tank. Brick or rock foundation for fire box over which the drums are to be placed.

Application

Place the posts in one drum and fill both drums with the oil-creosote mixture to a point about a foot above the proposed ground line on the posts. An equal quantity of the liquid should be placed in the other drum.

Build a fire under both drums and maintain a temperature of 180° to 200° F. for 3 to 4 hours in the drum containing the posts. The oil should not boil as it may spill over the sides of the drum and catch fire. The oil is very inflammable, thus close watch should be maintained.

Quickly transfer the posts into the second drum in which the oil-creosote mixture has been heated to only 100° F. and allow the posts to remain 3 to 4 hours. The heat of the first bath drives the moisture and air from the posts, and the lower temperature of the second bath draws the preservative into the wood cells. If only a few posts are to be treated the same results may be accomplished with one drum by pulling the fire from under the barrel and allowing the solution to cool slowly. After the creosote mixture has cooled to lower than body temperature, absorption practically stops.

A light top treatment may be desirable, particularly in western Oregon. Take a few posts at a time and place them top down in hot oil (below boiling temperature). While holding the tops submerged for a few minutes, take a soft broom or swab made with burlap on a stick, and souse creosote well into all parts of the posts not covered previously. This completes the treatment.

It is desirable to have the creosote penetrate to a depth of about ½ inch on the butts (the lower 30 inches). Some of the posts should be bored at the ground line to see whether good penetration is being obtained. Plug test holes tightly with a creosoted plug. If penetration is not sufficient, the time of either the hot bath or the cooling period can be lengthened. Five-inch posts will take up from 1 to 2 quarts of the preservative mixture; this includes a light treatment for the tops.

Cost

At the time of writing this publication, oil-tar creosote is quoted at 25¢ per gallon f.o.b. Portland, in drum lots. At this price the cost per post will usually run 8¢ to 16¢. Coal-tar creosote, grade 1, is quoted at about 45¢ per gallon, making the cost per post substantially higher. Mixing with fuel oil or crankcase oil, of course, reduces the cost.

PENTACHLOROPHENOL COLD SOAKING TREATMENT

Pentachlorophenol is a relatively new preservative. Preliminary evidence shows "penta"* to compare favorably with creosote. The

* The term "penta" refers to the chemical pentachlorophenol and not to a trade product. Various commercial concerns sell pentachlorophenol preservative under trade names such as "Timbertox," "Lauxtol," "Permatol," "Penta Preservative," "Permawood," etc.

government has a test in Mississippi where heat and humidity cause very active wood decay. Pressure-treated sap pine posts remained 98 per cent sound after 10 years. Posts treated similarly with creosote lasted about the same. The Oregon School of Forestry has one test of penta. Sawed 4 x 4 Ponderosa pine posts were cold-soaked 17 hours in penta solution. They remain sound after 7½ years, although the absorption was not as heavy as recommended here. Similar untreated posts failed in 6 years.

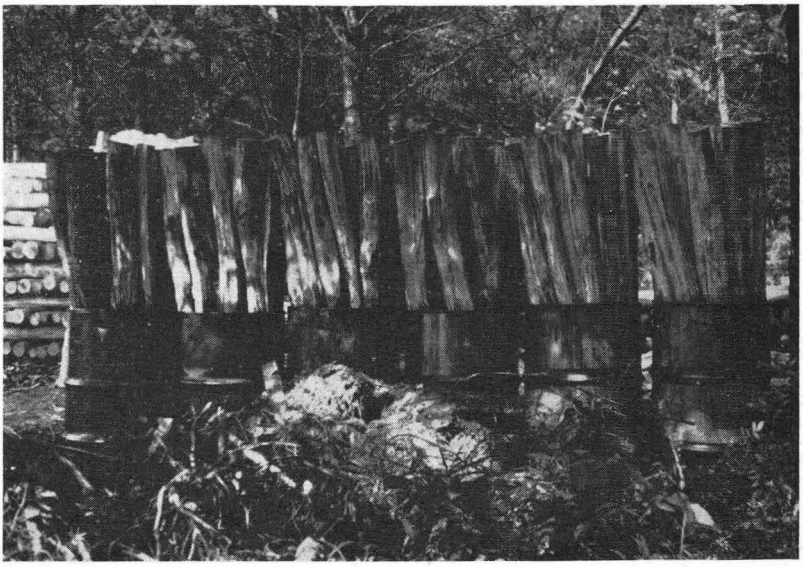


Figure 5. Treating pine posts with penta is not a hard job on the farm. The posts merely soak in the preservative oil for about a day. But they must be carefully seasoned beforehand.

Penta is clean, does not require heating, and permits the farmer to go about other work while his posts are left soaking. The following points apply to its use.

1. Most woods can be successfully treated with penta, but a few Oregon woods thus far have proved very difficult to treat by cold soaking alone. Woods that are difficult to treat require a longer soaking period, or incising, or the hot bath method as described in earlier pages for creosote.
2. For the foregoing reasons, it is not possible to give one set of rules for treating all Oregon woods. It is believed that a satisfactory treatment can usually be worked out by trial

with samples. When trials show the penta solution is penetrating the wood to the depth required, it is all right to go ahead.

3. Extension of from two to three times the normal ground life is believed likely for nondurable native woods when properly treated.

Southern Idaho farmers who have been using considerable amounts of penta to treat potato cellar timbers and posts are reported to be pleased with it. Pine, which penta treats readily, is the most available timber to Idaho farmers. Pine is plentiful in eastern and southern Oregon.

How Various Woods Respond to Penta Treatment

The pines respond especially well to treatment. Satisfactory treatments of cottonwood, red oaks, poplar, aspen, ash, and cedar by the cold soaking method have been reported. The same species may not give consistent results. On the whole, there has not been enough testing of western hardwoods. Information for alder is not available, nor is the information clear for western oaks, ash, and maple.

Douglas-fir and larch are difficult to treat. Incising, or the hot and cold bath, is believed to be necessary. A fair treatment of Douglas-fir results after incising, according to Idaho experience.

The Problem of Case Hardening

Sometimes the outer surface of a peeled post will harden during seasoning. When this happens, the preservative penetrates in a spotty, unsatisfactory way. Rapid drying in warm weather is usually the cause of case hardening. It is important to guard against it by piling the posts in shade or under cover during the hot, dry summer months.

At the same time, people who have treated posts say there will be some case hardening anyway, if the posts have been clean peeled. The usual method is to clean peel in the spring, when bark slips off easily. This method does not bruise or break the wood. Case hardening is a kind of "skin" on the outside of the wood which hardens during drying. It takes on a slick, varnished appearance. The farmer who peels in the fall does not have case hardening. He has to work the bark off, which bruises the wood and breaks the "skin" so preservatives get through it. Machine-peeled posts have no case hardening either, because the surface of the wood is pounded and scratched in the peeling. Seasoning with the bark on also prevents the condition, but decay should be watched. Decayed wood should never be treated.

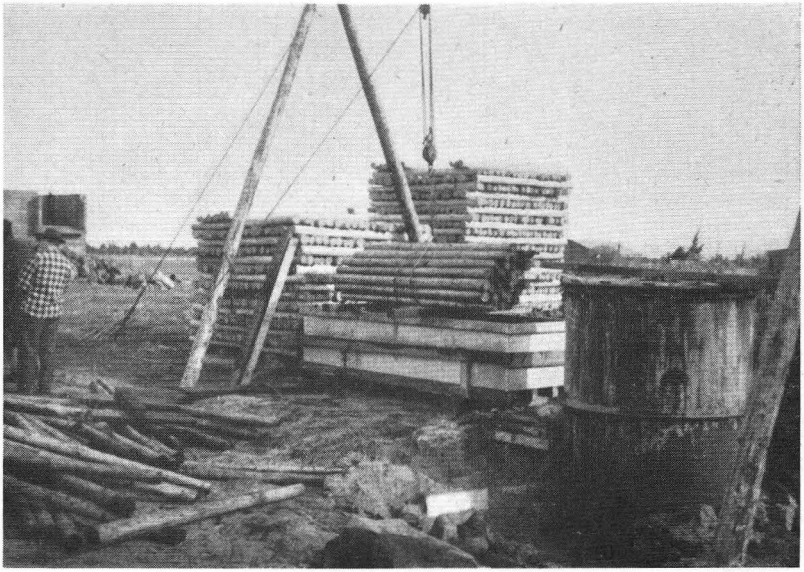


Figure 6. Jack pine posts being treated with penta in Deschutes County, at the U. S. Forest Service Nursery. Posts are given full length treatment. Those over the vat are being drained.

Since most farmers will clean peel, probably the safest rule is to expect some case hardening and be prepared to overcome it. Here are ways to meet it:

1. Treat the posts longer. Case hardening is reported to break down when the posts are soaked for 4 days.

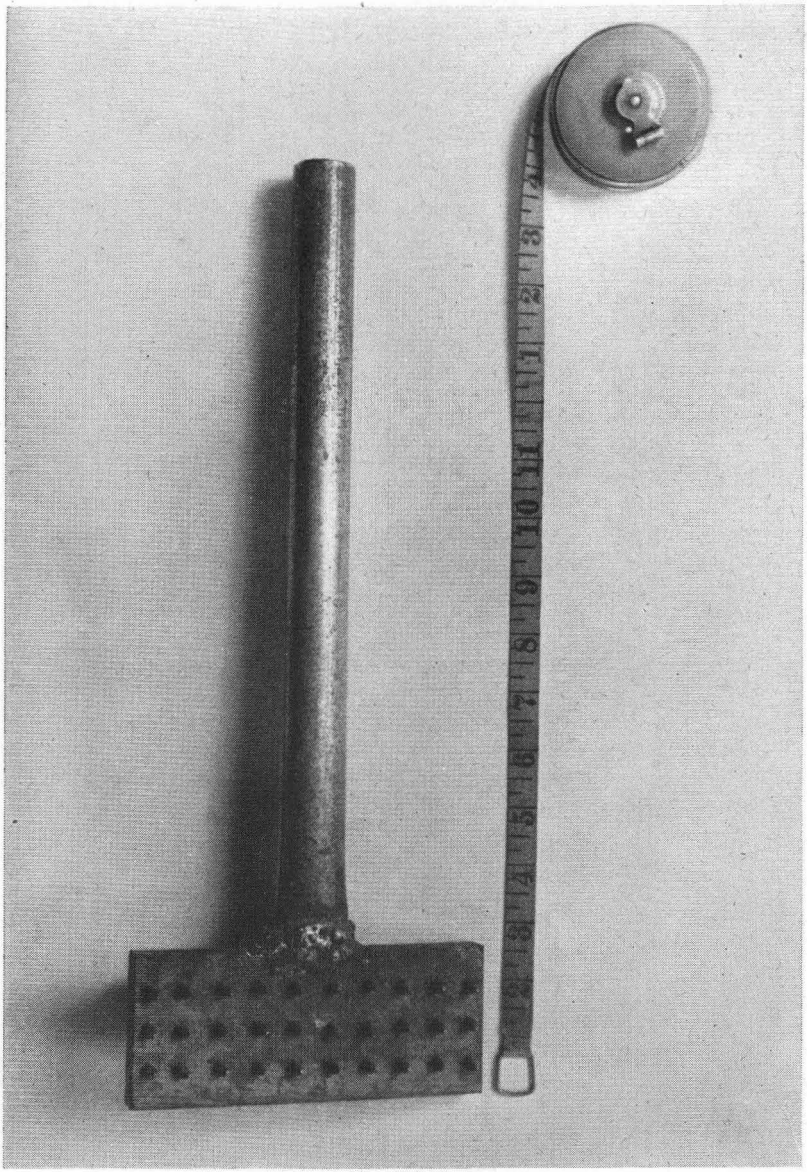
2. Another method is to allow the posts to weather for about a year after peeling. Probably it is enough to let them go through a half dozen fall rains after they have been thoroughly dried. Weather action breaks down case hardening.

3. A third method is to pretreat the posts in boiling water. Idaho experience indicates this overcomes the condition, particularly on pine. The case hardened "skin" seems to be paper thin on this species. An hour in boiling water is suggested.

4. A fourth method is to incise the posts. Incising is described in the next section.

Incising

For Douglas-fir, larch, or other woods whose structure naturally resists penetration, incising is recommended. It may also be used to break down case hardening on any woods. An incising hammer is



Courtesy of Vernon Ravenscroft, Idaho Extension Forester

Figure 7. This incising hammer has been used by Idaho farmers to break case hardening on pine and cedar posts. It was made by a local machine shop at a cost of $6 or $7. The head is fashioned from a flat piece of iron. Holes were drilled into it, through which sharpened steel points were inserted and brazed into place on the back of the head. The handle is a piece of pipe.

used. It has a heavy head, studded with chisel points, which punch small slits 2/5 inch deep into the wood. The usual plan would be to incise the portion of the post to extend 6 inches above the ground line, and 6 inches below it. The hammer is used by rolling the post with one hand while incising with the other. Commercial treating companies often give butt treatment to electric poles which are incised at the ground line to insure penetration. An incising hammer might be improvised at a local shop, or county agents may be able to furnish the name of a manufacturer.

If a farmer has an incising hammer, or can borrow one in the community, he can lick the case hardening problem in short order.

Material

Round posts should be used, since the preservative is absorbed principally by the outside zone of sapwood. Split or sawed products which expose mostly heartwood will require a longer treating schedule, and some species afford only slight penetration then unless incised. Present recommendations are that the posts be well seasoned. Posts should be peeled of all bark, at least that portion to be treated.

New research work at the University of Idaho indicates that posts can be treated while fairly green. Successful penta treatments have been given after about 20 days of summer drying, or 30 days of winter drying. At this stage case hardening is usually not present, which seems to be one advantage. If treated while partly green as described above, posts require about 48 hours soaking in the preservative.

Not enough experience has been had with green treatments as yet. The Idaho Extension Service still recommends thorough seasoning, and the same recommendation is made here. There may be a question about treating green since more cracks may open up when the wood dries out later. This would expose untreated wood.

Formula

Penta is usually purchased as a 50 per cent concentrate. This is mixed with diesel or light fuel oil at the rate of 1 gallon of concentrate to 10 gallons of solvent oil. The result is a 5 per cent solution of the penta chemical. A 50-gallon metal barrel with one head removed is an excellent container in which to mix the penta and oil. To give full length treatment to poles and lumber, some kind of tank is needed.

Application

Posts to be treated are stacked upright in the drum. The treating solution in the drum should reach a point on the posts approxi-

mately 6 inches above the proposed ground line. The posts should remain in the solution until a penetration depth of ½ inch is obtained in the sapwood. The Forest Products Laboratory recommends consumption of 5 pounds of solution per cubic foot submerged. A fence post of 4½ inches diameter, treated 30 inches high, would absorb 1½ pounds (or 1½ pints) of the solution. This consumption is hard to get. Idaho workers consider 1 pound (or 1 pint) sufficient, as it meets Bell Telephone specifications. Under favorable conditions from 10- to 12-hours soaking time is required to obtain the desired penetration in pine posts. This time may be lengthened or shortened according to the rate of penetration and the species of wood. More rapid penetration is obtained in warm weather. Heating of the solution to above 70° may be advisable in cold weather. Penetration appears to be active, however, when the liquid is somewhat below 70°.

Easily decayed woods, such as cottonwood, should have a top treatment along with the butt treatment. This should be at least a top dip. A certain amount of soaking would be preferable.

As a help in checking penetration depth, mix a pinch of oil-soluble dye with the solution. Sudan III is one suitable dye, which your druggist can order from a chemical concern. If dark fuel oil is used for the solvent, penetration can probably be determined without a dye.

Cost

The cost of the concentrate and oil used in this treatment will approximate 6¢ per 4½-inch post, 6 feet long, if the absorption is limited to approximately 1½ pounds of solution per post.

TREATMENTS BY DIPPING, BRUSHING, OR SPRAYING

Dipping, brushing, and spraying are surface treatments that ordinarily do not result in a penetration of more than 1/16 inch. They should be used only when more effective treatments cannot be employed. At the same time, thorough surface treatments with good oil-soluble preservatives will prolong the service of wood. The additional life obtained will usually be more than enough to pay for the cost of the treatment. Where the wood is in contact with the ground, 1 to 5 years of added life may result. A test in one of the southern states showed that dipping in hot creosote doubled the life of sappine posts. Where the wood is not in contact with soil or decaying wood, protection will be effective for a much longer period.

Material

Woods to be treated should be thoroughly air-seasoned or kiln-dried. All cracks must open up before treatment. Checking afterward exposes untreated wood. Posts or poles should, of course, be peeled.

Formula

Oil-soluble preservatives are used: penta, creosote, and zinc or copper napthenate. Penta and creosote solutions are prepared as described in preceding sections. The napthenates are reported very effective, but information is not at hand regarding availability and cost.

Application

A warm day is preferable, as cold wood absorbs less preservative solution. Heat is more necessary for creosote than for penta. Creosote solutions should be heated. Usually this is possible if the dipping process is used, in which case 200° F. is desirable. If creosote is to be used and cannot be heated, a thoroughly liquid type should be selected. Rainwater on wood will interfere with absorption of preservatives.

Dipping is considered better than using a brush or spray. It gives more assurance that all surfaces and checks have been thoroughly coated. Treatment by brushing will be almost as good, however, if the solution is flooded over the wood rather than only painted upon it. Every depression or check in the wood should be thoroughly filled. Leaving any untreated wood exposed is the same as leaving an entrance for rot. A second coat is advisable in the brush treatment.

Dipping and brush treatments are limited in usefulness and practicability. They are not recommended except where better methods are out of the question. Yet they do find a place on the farm for such structures as:

- Porch timbers
- Porch steps
- Sills
- Wooden gutters
- Timbers in farm buildings
- Wooden parts of farm machinery
- Cabin logs
- Lawn furniture
- Sash, millwork, etc. (before painting)

Treatments require 10 to 15 gallons of solution per 1,000 square feet of surface.

Cost

The penta solution as used costs about 30 cents per gallon, including shipping costs. Oil-tar creosote costs about the same. (Pur-

chases of both penta and creosote must be by the drum to obtain the price quoted.) Coal-tar creosote costs substantially more. A mixture of $\frac{2}{3}$ creosote and $\frac{1}{3}$ fuel oil is probably permissible and will reduce costs.

OTHER TREATMENTS

Materials being studied

There are other materials that may prove satisfactory for treating posts and poles. From time to time products appear on the market under trade names. Labels may not disclose the composition of the preservative. Although some of these have proved of value, others have been doubtful, so the U. S. Department of Agriculture suggests the farmer obtain advice. The U. S. Forest Products Laboratory, Madison, Wisconsin, is one source of information.

Scientists are constantly at work to improve both the materials and the methods for farm preservative treatments. Among the various possibilities being experimented with in other sections, one appears worthy of mention, although no test of it on Oregon woods has been made. Anyone interested in a trial can obtain information by writing to the sources named.

End-flow method

Round, fresh-cut sapwood posts and poles, with the bark left on, have been satisfactorily treated by the end-flow method. However, quite a number of species have proved difficult or impossible to treat in this manner. Pentachlorophenol with a solvent oil has been successful in Texas with cottonwood, red oaks, elm, and seasoned willow. Full length penetration is claimed in California for many hardwoods tested there. Penetration has not been satisfactory on California conifers, including white fir and incense cedar.

The preservative solution (as recommended in California) consists of 1 part penta 50 per cent concentrate mixed with 3 parts fuel oil or kerosene. A circular piece of felt or heavy cloth, and a small jar with a metal screw cap, are used. Several holes the size of a pencil lead are punched in the cap. The post is stood upright, the felt placed on the end, and the jar containing preservative solution placed upside down on top of the felt. Eight fluid ounces is the amount specified for treating one 7-foot post. The time required for absorption is usually less than a day.

Sharpened sections of pipe, tapped into the post, have been used to hold the preservative instead of the drip-cup described.

Wood of saplings, especially at the ground end, is reported treated better and cheaper by end-flow than by other methods. The

solution, by its own head pressure, flows in at the elevated end of the green post and pushes the sap out the other end. Since the large end is said to absorb more preservative, it should be the one treated and put in the ground.

The extension forester, University of California, Berkeley, and the extension forester at College Station, Texas, can supply information regarding end-flow treatments.

CALCULATING THE VOLUME OF POSTS AND POLES

It is often necessary to determine the cubic foot volume of a post or pole when estimating the amount of preservative required for a given number of pieces. The most practical way of determining the volume of posts and poles is to measure the diameter at both ends of the piece and figure the cubic foot volume from the table on the back of this bulletin.

TABLE FOR CALCULATING CUBIC FOOT CONTENT OF POSTS AND POLES

Diameter of large end—Inches	Diameter of small end—Inches											
	4	5	6	7	8	9	10	11	12	13	14	15
4	.087											
5	.111	.136										
6	.138	.165	.196									
7	.169	.198	.231	.267								
8	.204	.235	.269	.307	.349							
9	.242	.275	.311	.351	.395	.442						
10	.284	.318	.356	.398	.444	.493	.545					
11	.329	.365	.405	.449	.496	.547	.602	.660				
12	.378	.416	.458	.504	.553	.605	.662	.722	.785			
13	.431	.471	.515	.562	.613	.667	.725	.787	.853	.922		
14	.487	.529	.575	.624	.676	.733	.793	.856	.924	.994	1.069	
15	.547	.591	.638	.689	.744	.802	.864	.929	.998	1.071	1.147	1.227
16	.611	.656	.705	.758	.815	.875	.938	1.005	1.076	1.151	1.229	1.311
17	.678	.725	.776	.831	.889	.951	1.016	1.085	1.158	1.234	1.314	1.398
18	.749	.798	.851	.907	.967	1.031	1.098	1.169	1.244	1.322	1.404	1.489
19	.824	.875	.929	.987	1.049	1.114	1.184	1.256	1.333	1.413	1.496	1.584
20	.902	.955	1.011	1.071	1.134	1.202	1.273	1.347	1.425	1.507	1.593	1.682
21	.984	1.038	1.096	1.158	1.224	1.293	1.365	1.442	1.522	1.605	1.693	1.784
22	1.069	1.125	1.185	1.249	1.316	1.387	1.462	1.540	1.622	1.707	1.796	1.889
23	1.158	1.216	1.278	1.344	1.413	1.485	1.562	1.642	1.725	1.813	1.903	1.998
24	1.251	1.311	1.374	1.442	1.513	1.587	1.665	1.747	1.833	1.922	2.014	2.111
25	1.347	1.409	1.474	1.544	1.616	1.693	1.773	1.856	1.943	2.034	2.129	2.227

HOW TO USE THE TABLE

1. Find the average diameter at each end of the post or pole.
2. Find the number in the table corresponding to these two diameters.
3. Multiply this number by the length of the piece in feet. The result is the cubic foot content of the post or pole.

EXAMPLE:

The average diameter of a pole is 6 inches at the small end and 7 inches at the large end. By following down the 6-inch column in the table under the heading "Diameter of Small End" until coming to the line marked "7 inches" under "Diameter of the Large End" we find the number to be .231. If the pole is 7 feet long multiply .231 by 7, which gives 1.617 cubic feet as the volume of a post or pole of this size.

Cooperative Extension Work in Agriculture and Home Economics
Wm. A. Schoenfeld, Director
Oregon State College and United States Department of Agriculture, Cooperating
Printed and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914