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# Cold-Soak Wood Preservation

— Simple
— Effective
— Inexpensive

UNIVERSITY OF IDAHO
College of Agriculture
EXTENSION DIVISION

In Cooperation With
Forest Wildlife and Range Experiment Station

this?

# Cold-Soak Guide

## *to better fences for more years*



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# Cold-Soak Wood Preservation

No farmer could conveniently operate his farm without wood, for wood is especially suited to many farm needs. It is one raw material we can use without having special equipment or training.

The average farm uses about 1000 board feet of lumber and 100 wood fence posts each year. Such a huge wood consumption is due to the fact that wood fits so well into farm operations; also, that it has to be replaced when it rots. Wood rots when fungus plants similar to bread mold feed on it. Their destruction weakens structures and eventually results in costly replacements on every farm.

We control rot by using a simple cold-soak preserving treatment with a material called pentachlorophenol. The name is long, so we call it "penta" to shorten the term. And penta is truly a "wonder drug" for saving our farm posts and timbers. Untreated lodgepole pine posts in a demonstration at Driggs lasted only 3 years. Many of the treated posts in the same demonstration, under identical conditions, are still in good condition after 15 years of service.

At the time this Driggs test began, untreated posts cost 20 cents, and setting costs were 10 cents more. The cost per year for these short-lived, untreated posts was 10 cents. Adding the 5 cent treating cost to the original cost of the posts we treated, their cost per year of service has to date been 2⅓ cents and they are still in use.

The demonstration to which we refer is located on the Jack Buxton farm west of Driggs. The posts in this oldest Idaho test were given only a fair penta treatment. Some have failed because the posts did not get a uniform treatment. Tests which followed the Driggs demonstration are showing better results and are open for inspection any time you are in their vicinity. The oldest and most descriptive demonstrations are at Heise Hot Springs, lodgepole, 1941; Carl Horn farm, Thornton, cottonwood, 1941; aspen in Arbon Valley; and Lombard poplar at the W. F. Ravenscroft farm at Tuttle. All of these are still giving service. Experimental tests have been established in the Sunshine mine at Kellogg and at the University forest nursery and University farm, both in Moscow. These service tests indicate that a standard cold-soak treat-

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ment with penta will make pine and poplar posts last at least five times longer than they do when untreated.

This simple treatment can reduce the post and lumber bill for every farm. Treating cost of less than 10 cents per post will result in $1 saving over the life of treated pine posts. Proportionate savings are possible when farm structures such as potato cellars, feed troughs, head gates, flumes, and other wooden items are treated.

In Idaho, wood preservation also helps in the management of our forests. We have only limited supplies of wood that is naturally durable; we have an abundance of wood that has little resistance to decay. Because of this, durable wood has been imported into the state or transported long distances within the state. The cost of posts and poles and certain grades of lumber has been excessively high. When treated, our abundant non-durable wood such as lodgepole pine can be harvested and will add to our forest resource. Two-way benefits resulting from the treatment of these woods are better and cheaper agricultural structures and use of a valuable forest resource.

These benefits come through the simple cold-soak application of penta to the wood. This chemical is readily available and reasonably priced. You need only an old oil drum, a supply of the chemical, and oil for a carrier in order to handle your own wood treating. By using the cold-soak method, you can treat wood incidental to the other farm work.

This type of treatment is now an accepted farm practice throughout Idaho. Since its introduction in 1937 the practice has developed rapidly until now one-fourth of all fence posts used in Idaho are given penta treatment. All posts should be treated. In setting up your treating operations you will need to know what trees take treatment best, methods and costs of making your own posts, care of the timber before treating, and the equipment and materials you will need for treating. Find out also the best treating schedules for various tree species. And you will need special information if you are treating cellars or lumber.

## What to Treat

Treat any wood you intend to use in a place where rot is probable. Rot usually appears where wood is in contact with the soil, in moist, poorly ventilated buildings, and where wood is joined on to another piece of wood or to other materials, such as cement.

The cold-soak method is of most value to you if you limit treatment to those species of wood that take treatment best. Idaho timber species are listed in table 1 by location and according to the ease with which they take treatment.

**Table 1.—Idaho trees—their source and suitability for treatment.**

| Tree Species | Location |
|---|---|
| Easy to Treat: | |
| Lodgepole pine | State-wide |
| Ponderosa pine | Southwest and northern counties |
| White pine | Northern counties |
| Satisfactory—special conditions and methods necessary: | |
| Aspen | State-wide |
| Birch | Northern counties |
| Siberian Elm | Southwestern counties |
| Western redcedar (Round or split posts containing thick sapwood | Northern counties, distributed |
| Cottonwood | State-wide, but scattered |
| Poplar | Planted state-wide |
| Difficult—not well adapted to cold-soak treatment: | |
| Larch | Northern counties |
| Douglas-fir | State-wide |
| Grand fir | Northern counties |
| Hemlock | Northern counties |
| No treatment needed: (Difficult to treat) | |
| Black locust | Southwestern counties |
| Heartwood cedar | Northern counties |

Farmers in southern Idaho can get posts for treating from state and federal forest lands. Prices are reasonable. Local forest rangers supply information, or you may get it by writing to the State Forester's office in Boise. Forest rangers can make a sale to any individual if the amount does not involve more than $300.

Farmers in northern Idaho usually have woodlots from which they can cut post wood.

# Woods Operations

## Cutting

Cut your trees any time of the year. Peeling is easiest when the "sap is up" which is about May 15 to August 1. In any case, cut about 3 months before you treat under spring or summer drying conditions. Except for peeling trouble winter cutting is good, and treating can proceed throughout the following summer.

## Falling, Limbing, and Skidding

If you get trees from public forests the ranger will mark the trees you are to cut. If you cut from your own woodlot, a selection cutting is best. Remove trees so that the remaining trees are

**Figures 1 and 2.—Thick second growth on a farm woodlot in Kootenai county. By thinning this farm woodlot much material suitable for post and pole treating was obtained. The growing condition for the remaining trees was improved. Right—The same woodlot after thinning.**

well spaced, are straight and healthy, and have a chance for fast growth. By this method you can fill your post needs and at the same time assure high quality products for a later date. Sound dead trees are in every way the equal of live trees. Remove them and treat them for posts. If you use dead trees, you can treat soon after cutting. Cut low stumps and fall a few trees before limbing and trimming. Cut off all limbs flush with the pole and trim the top so that you get desired lengths. Use large limbs and tops for fuel. Pile slash for later burning or scatter it to reduce fire hazard. Skidding to a central location is best done in tree lengths with small power equipment or horse. Whether you peel before or after skidding is a matter of personal choice. These operations usually can be performed with labor and equipment you have available on the farm.

**Peeling**

Peeling is the most expensive and time consuming operation in getting timbers ready for treatment. The peeling job must be complete and clean because the preservative solution will not go through the bark. Even the thin inner bark will stop treatment.

It is easiest and cheapest to peel the trees while they are still in tree lengths. Do your peeling soon after the trees are felled. If they lie 3 or 4 days in the hot sun the bark will tighten. The time for easiest peeling is the fast-growing season from about May 15 to August 1.

There are numerous tools which can speed up and simplify the peeling operation. For hand-peeling during the easy-peeling period, such tools as a straightened hoe, a shovel ground to a concave cutting edge, or a straight spade are good peeling tools. (See Figure 3.) During the best peeling period, many experienced peelers use a spade or an old tire iron to open up a large patch of bark. Then they strip a tree length section from the pole. A drawknife is needed for a clean job when the bark is tight. Some farmers

**Figure 3.—Round timbers must be peeled before they are treated. Hand tools such as a spade will make this work easier.**

cut poles during the easy peeling period then store them in a pond. Poles stored in this way peel easily at any time.

Mechanical peelers are now available. Some of these machines are of a size and price suited for use by large ranchers or a co-operative group of farmers. Mechanical peelers suited to small operations will peel one to two posts per minute using a two-man crew. These machines will cost from $300 to $1,000 each.

Peeling costs are lower if you take advantage of the easy-peeling season. Time studies show that it takes from 5 to 15 minutes to peel 5-inch by 7-inch posts. The difference was due entirely to variation in tightness of the bark.

## Seasoning

The method and length of seasoning are the keys to successful cold-soak treatment. Green timbers of some species can be treated,

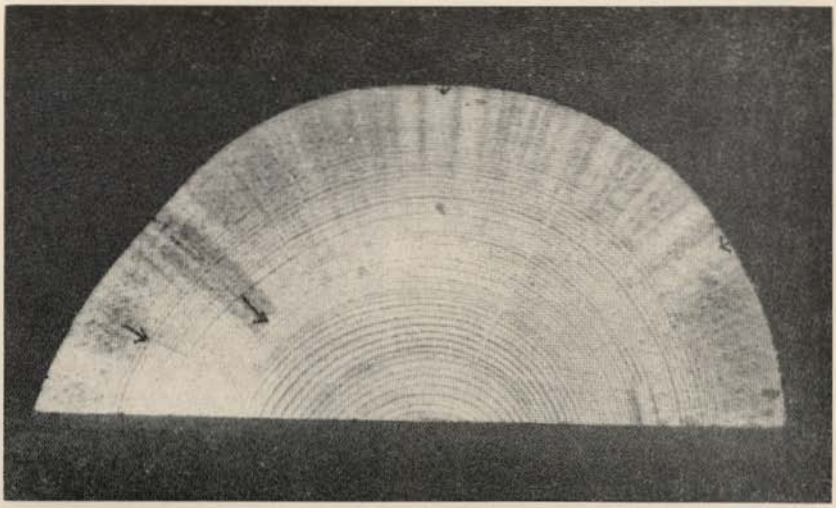

**Figure 4.—This lodgepole pine post had the slick varnish appearance descriptive of glaze. After a 24-hour cold-soak, this streaked penetration pattern was obtained. The wood in the many light areas is untreated and not protected. This post would rot.**

but well seasoned wood gives the best results. Well seasoned wood contains about 12 percent moisture. Around 20 percent is best for treating. About 2 months of summer weather usually will be a sufficient seasoning period. Seasoned timbers that have picked up moisture over the winter need about 10 days of spring drying weather before treating. If late winter or early spring treating is necessary, move your timbers or posts under a shed about 10 days before you expect to treat.

Seasoning introduces some problems. Rapid seasoning causes deep checks in round timbers, and a glazed surface condition often develops on peeled timbers. This glaze closes the pores in the wood and prevents successful treating.

You can prevent excessive checking by proper piling.

The way posts or timbers are piled regulates the speed of seasoning. There are two general methods—cross piling and parallel piling. Use parallel piling if timbers cut during the spring and summer are to be treated before winter. In all other cases, cross piling is recommended to prevent rot in the pile. Checking is not serious in parallel piled timbers except toward the top of the pile. Excessive checking in a cross pile is prevented by close spacing or shading the pile. Neither piling method will prevent the formation of a glaze. Pile your timbers on bumper logs so that there is at least a 12-inch space beneath the pile. This assures good ventilation and prevents rot. Pile timbers or posts near the treating location to reduce handling operations.

Appearance is the only argument for shed drying. Glaze forms as readily on shed-dried timbers as on those seasoned in the open. The glaze is slow to break down in timbers piled under shelter because there is no exposure to weather.

### What Can Be Done About Glaze

We can prevent glaze, or if it is set, we can break it. There are two ways to prevent glaze. The best way is to pile material in full shade such as in the farm woodlot. This will encourage the development of moulds. No treating problems exist if posts are mouldy. But do not leave moldy posts in the pile longer than over the winter. There is danger of rot if you do.

Another way of preventing glaze is to treat the posts before they are too dry and before the glaze sets. Usually this condition occurs about 2 months after spring cutting and when small checks are beginning to open up. In using this method, make careful checks during treatment to see if you are getting satisfactory treatment. As soon as penetration or absorption becomes poor, the glaze must be broken.

There are three ways to break glaze. If the glaze is set as determined by treating tests, the best and cheapest method of insuring a good treatment and breaking glaze is to let the posts cure over summer and winter and treat the next spring after 10 days of good drying weather. In other words, if you can wait for treat-

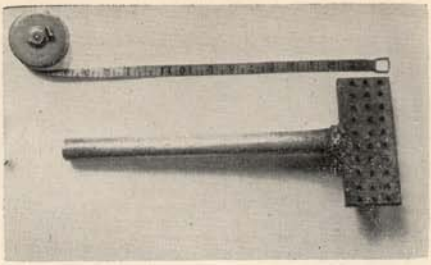

**Figure 5.—The incising hammer is made by welding a handle to a flat piece of iron in which hardened steel points have been brazed. The flat iron head is 6" x 2½" x ½". The teeth are sharpened to a dull pencil point and are ½ inch long. The space between the points is ¾ inch.**

ment, the best all around method is cut one spring, cross pile, and wait until the next spring for treating. You will then have no special treating problems if you can follow such a schedule.

Another way of breaking the glaze is by mechanical means. Figure 5 shows an incising hammer designed for this operation. If glaze sets on posts you wish to treat the same year as you cut, incise a band around the post to extend about 6 inches above and 8 inches below the ground line when the posts are set. By this method, treating can proceed into the winter until the posts are frozen. Then, unless they are thawed, treating should stop. Winter treating requires longer schedules, so spring and early fall are the best time for treating. Incising is good insurance for a satisfactory treating job under all conditions.

A long soaking period for the treatment will enable the oil to break through glaze. How long to soak depends upon several conditions. The best thing to do if you use this method is to determine your own schedules as explained under Measuring Treat later in this bulletin.

### End-grain Penetration

Birch and aspen have rapid end-grain penetration. This is especially true when the wood is slightly green. There is fairly heavy end-grain penetration on poplar. All have shown side or lateral penetration. Incise these species in a band at the ground line as suggested for the control of glaze. You will get better penetration in the incised area.

### Equipment and Materials

#### Tank or Vat

A 55-gallon oil drum makes a good treating tank for a farm operation. It will hold an average of 15 posts and has enough depth for butt treating to a 30-inch height. For full-length treat

**Figure 6. — Good treatment results when posts are incised. Incising assures high quality treatment in shorter schedules for all posts, even those with glaze. This post was treated 24 hours.**

or longer butt treat, you will need special tanks. Suggestions on this type of equipment are given on page 17.

**Preservatives**

You can buy penta in crystal form, in ready-to-use mixtures, and in liquid concentrates. Crystals are the cheapest, and the ready-to-mix is the most convenient. There is some danger in handling the crystals, and they are not easy to dissolve in the treating mix. The ready-to-use mix is ordinarily too expensive except for small jobs.

The liquid concentrates seem best for farm use. Various strength concentrates are available. These are always described by a ratio of parts of oil used in diluting one part of the concentrate. A 5 to 1 concentrate is fairly weak. A 10 to 1 concentrate is relatively stronger. In both cases the ratio means that you add oil in the amount of the larger figure to 1 part of the concentrate. Because of reduced packaging and freight costs, the stronger concentrate should be cheapest. In all cases the preservative mix used in treating should contain 5 percent by weight of penta. Follow directions in mixing.

Several manufacturers make these penta concentrates. You can get them in 5-gallon to carload lots. Your county agent can tell you about local retail and wholesale outlets.

During cold weather the penta may crystallize and settle to the bottom of concentrated solutions. If this happens, put the container in a warm room. Shake or stir the contents frequently until the crystals dissolve. Left-over preservative will not deteriorate and can be stored for future use.

**Oil**

Your choice of an oil to serve as the carrier depends upon what you are treating. Select thin, clean oils, such as naptha or mineral spirits, when treating any product that is to have a painted surface. These same oils, because of cleanliness and quick drying features, are advisable for treating potato cellar timbers. Their odor does not linger so long as that of heavier oils. If naptha or mineral spirits are not available, a high grade stove oil can be substituted. A longer drying period after treatment will be needed before painting or before cellar construction. Diesel fuel or low grade stove oil are satisfactory for treatment of posts, poles, rough lumber, and other such products. Used crankcase oil is not recommended because it is usually too thick and dirty to be an effective carrier.

**Mixing**

Penta concentrates will readily mix with diesel fuel or any of the lighter oil carriers. The manufacturer's label will indicate the proportion of oil that should be added to the concentrate. Follow these directions. You gain no advantage by adding more concentrate than is called for by the manufacturer's specifications. A 5 percent solution is adequate. Mixing it stronger merely adds to your cost of treating. The easiest method of mixing the oil and

the concentrate is to put the required amounts of both directly into the treating vat. Stir the solution until you are sure that the penta has been well distributed throughout the vat. About 20 gallons of mix will be sufficient in a 55-gallon oil drum to obtain your 30-inch treating level after the posts have been added. Have some extra preservative mix to use in bringing the level up to the exact point which you desire.

**Measuring Treat**

You can judge the quality of treatment by depth of penetration or by the amount of preservative absorbed. To get a good treat, you must have uniform penetration at least ½ inch deep. This is the minimum for a satisfactory treat. A penetration of ¾ inch is better. When you get an even penetration to a depth of ½ to ¾ inch this will amount to approximately 1 pint of preservative for a 5 inch post treated to a 30-inch level. The best way you can check penetration on fence posts is to saw through a few of the posts at ground line level. Note the depth to which the preservative mix has penetrated and the evenness or uniformity of treat. Regulate your treating schedule according to the time it takes to get the required penetration at ground line. Checking penetration in this manner is reliable and is easily done if a dark oil is used or if an oil soluble dye is added to the mix. If you use clear oils, you will find it difficult to note the exact depth of penetration. In this case it is better to check your treat by absorption.

You can check absorption in posts by noting the amount of preservative needed to maintain the level of the mix in the treating tank. This can best be illustrated by example. Suppose you put to soak 20 posts averaging 5 inches in diameter. From table 2 you note that this size post should absorb a little over 1 pint per post for satisfactory treat. Measure out 20 pints of mix. When all of the 20 pints have been added and the level of the mix in the treating tank is where it was at the start, the posts will have absorbed, on the average, the correct amount of preservative. The time necessary to get this absorption can be used as a guide in treating the rest of your posts if they are similar to the posts in the test run. In some cases it may be difficult to reach this standard, but if the penetration is deep and uniform you have a good treatment even though absorption is a little less than desired.

You can also check the amount of absorption by weighing sample posts or timbers before and after treatment. Increase in weight will give the absorption. Penta mix weighs .9 of a pound per pint. So in order to determine how much increase in weight is necessary, obtain the number of pints needed and multiply by .9.

For timber longer than 30 inches you can determine also how much should be absorbed from table 2. As an example you have a potato cellar timber which is 10 inches in diameter and 12 feet long and you wish to treat it full length. From the table obtain .99 pints for one foot of length for 10-inch diameter. For the 12-foot length the amount absorbed should be .99 x 12 or 11.9 pints (also 11.9 x .9

or 10.7 pounds). If you were treating 7 such logs the amount would be 11.9 pints x 7 or 83.3 pints or 10.4 gallons.

When starting out to treat posts or other timbers, check the quality of treat - both penetration and absorption - on the first batch of posts or other products you treat. These checks are advisable because it has been noted there is much variation in the time necessary to get satisfactory treat on different lots of posts. Hence, the treating schedules given for different species are valuable guides; but your own schedule for any given lot of posts should be determined by the results of the check you make at the start of any new lot.

**Table 2. Minimum recommended actual absorptions in pints for posts or timbers of varying diameters for 30 inches of length and for 1 foot of length.**

| Diameter | Absorption | |
|---|---|---|
| | 30 Inches | 1 foot |
| inches | pints | pints |
| 3 | .6 | .24 |
| 4 | .9 | .35 |
| 5 | 1.1 | .45 |
| 6 | 1.4 | .56 |
| 7 | 1.7 | .67 |
| 8 | 1.9 | .78 |
| 9 | 2.2 | .88 |
| 10 | 2.5 | .99 |
| 11 | 2.7 | 1.10 |
| 12 | 3.0 | 1.20 |
| 13 | 3.3 | 1.31 |
| 14 | 3.5 | 1.42 |

A pint is equal to .9 pounds. So to obtain pounds multiply by .9. Absorptions for lengths other than 1 foot multiply table value for 1 foot by the length of the timber.

## How to Treat Different Trees

You have seen the section above on glaze, penetration patterns, and incising which are items that can slow up or in other ways affect the quality of your treatment. Keep these items in mind when you read how to treat the trees in which you are most interested.

### Lodgepole Pine

For this tree the penetration pattern is mainly cross grain, from the side. Glaze is a serious problem. Because of glaze, the time necessary to give a good treatment to a lodgepole pine post will vary from ½ hour on well seasoned material or bug-killed timbers, up to as much as 3 days on heavily glazed posts. The consumption standards given in Table 2 have been computed for lodgepole. If you will cut and peal your lodgepole, season it until the checks begin to show, and then treat to these consumption standards you will always do a good job. If you follow these instructions and find that your treating is taking too long, then you can reduce that schedule by

incising. The "best and surest method" for treating lodgepole, without any extra work for incising, is to cut one spring, season out in the open until the following spring, then treat after 10 days of good drying weather. You will get a good quality treat in 24 hours.

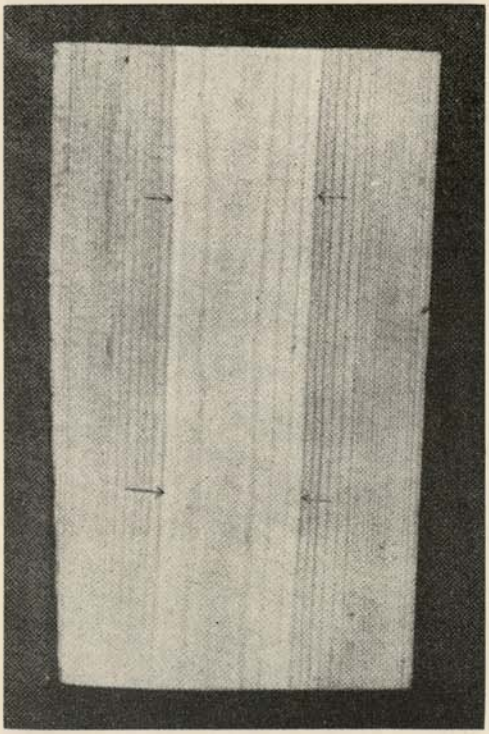

**Figure 7.—Deep, uniform treatment on a lodgepole pine post treated by the "Best and Surest Method." This post was cut one spring and treated for 24 hours the following spring.**

### Other Pines

Young stands of ponderosa pine (also called yellow pine or bull pine) and white pine often need thinning to improve the growing conditions of the remaining trees. Both of these species take good treatment. Handle them as you do lodgepole pine. Treat white pine to the consumption schedules in Table 2. Ponderosa pine has a deep sapwood and will take some limited treatment in its heart. Give this tree ¼ more preservative than the amounts indicated in the schedule Table 2. Both of these trees will glaze. Main penetration is from the side.

### Cedar

Cedar posts are commonly moved through commercial channels and are available statewide mostly in split form. Cedar heartwood takes very little treatment, but is durable enough that it need not be treated. Cedar sapwood decays quite rapidly. The sapwood takes good treatment but is usually in a poor condition for treatment. This is because cedar is subject to glazing and little attention is given by the producers to the requirements of peeling and seasoning for effective cold soak treatment. Untreated split cedar posts were examined after 4 years service in a range fence at Shoshone. Posts containing sapwood showed advanced rot. Posts containing all heartwoods were sound. During recent years, the percentage of sapwood on split cedar posts has been increasing. The anticipated service from cedar has therefore gone down.

Treatment is recommended for round posts and for split posts that contain sapwood. In most cases purchased cedar will still have

strips of inner bark on it. This bark must be removed before treatment.

Cold-soak for 48 hours or incise and soak for 24 hours. Absorption schedule in table 2 should be attained for round cedar. For split cedar ⅓ to ½ this schedule will be satisfactory.

**Aspen, Cottonwood, Poplar, and Birch**

At least one of these species is readily available on many Idaho farms. When treated, they all make excellent posts. They are hard to treat by the usual methods. The main penetration of the preservative is not from the side of the post, but is end-grain from the bottom. After the preservative has penetrated the first 8 to 12 inches of this end-grain, further penetration up the post is slow. Penetration will be spotty when knots or scars stop the up-grain movement. Absorption in these species is heavy. When the timbers are left in the vat long enough to give a satisfactory ground line penetration, the absorption will be 2 to 3 times that needed to treat pine of the same size. This causes high treating costs.

Incising offers the one sure way to give these species good treatment. Peel when it is easiest. Season timber until dry. Since glaze is no problem, no special seasoning care is needed. Treat after deep incisions are made at the ground line. The up-and-down-grain penetration is so definite that the incised area need be only 6 inches wide. Obtain absorptions of twice those listed in table 2. Cold-soak at least 12 hours for birch, 24 hours on all others.

After treating posts from any of these trees, turn them upside down to allow the excess preservative to drain down through the post.

**Grand Fir and Hemlock**

Results of tests on grand fir and hemlock show that they are difficult trees to treat. Side penetration is slow. Posts of both of these species are quite erratic in taking treatment. Some posts will take a satisfactory treat. Others in the same lot will take practically no preservative. Our best recommendation to date for these species is to incise the posts heavily around the ground line and cold-soak them at least 48 hours. Attempt to obtain at least ½ the schedule shown in table 2.

**Larch**

Larch posts consistently have slow penetration and low absorption. Results to date indicate that larch can be treated satisfactorily if the posts are heavily incised at the ground line area and soaked for a period of 3 to 4 days.

**Douglas-fir**

Douglas-fir is the most difficult of all native species tested to treat by the cold-soak method. The only instance where it would be advisable to treat Douglas-fir is when it is the only wood available. It is best to give these posts at least a year's seasoning then

incise them heavily in the ground line area. Even then it will ordinarily take a week of cold-soaking to get a satisfactory treat.

Observations indicate that grand fir, hemlock, larch, and Douglas-fir are much easier to treat when the posts have seasoned and weathered for 2 or 3 years. Long posts that have been butted off or posts that are cut from standing dead timber can be treated with shorter schedules than those indicated above.

**Black Locust**

Black Locust has been tested and found difficult to treat. Because of the natural durability of black locust wood and its high resistance to cold-soak treatment, we do not recommend treating it.

**Siberian Elm**

This tree will take a fair treatment if properly handled. The best method is to season over winter with the posts cross piled. At the time of treating, incise at ground line and soak for 28 hours. Absorption should be 1½ times that given in table 2.

**Other Species**

Such species as spruce, juniper, willow, and box elder have not yet been tested adequately at the University of Idaho. If you wish to try to treat these or other species, you can judge the quality of your treatment by the absorption and penetration tests given on page 11.

**Care After Treating and Top Treatment**

When the posts or timbers are not to be used immediately after treatment, cross pile them on bumper logs. When treated wood is to be used inside such as for potato cellars, it should be dried in this manner.

Examine your old standing posts to see if top rot is present. If you find top rot, then give your posts a quick top treatment. Turn the posts you are treating top ends down and give the tops a 15-minute dip in the preservative.

**Costs**

Treating pays even though it adds to the original cost of the post. The longer life from treated structures is something we all want. Treating costs are small compared to other costs such as the original purchase price. Remember, too, that treated small posts will last as long as large ones, thus, there is no necessity to obtain oversized material as has been the custom when using untreated posts. The saving in the cost of the smaller post over the larger one will often pay for the treating costs. Use the smallest material possible to carry the required load in posts and cellar timbers, and you will find that treating adds but little to the initial cost. For instance in a commercial post yard in southern Idaho a 4-inch post cost 43 cents and a 6-inch post cost 60 cents. The saving in the cost of the smaller post is 17 cents, about 3 times the treating cost.

Table 3 gives the cost of treating a fence post 30 inches, at the recommended standard, for various diameters and varying cost of ready-to-use mix. For example it cost 6.4 cents to treat a 5-inch post at 45 cent mix cost. Also, included are the costs for 1 foot lengths treated to the same standards. Thus if you wanted to estimate the cost of treating a potato cellar timber which is 8 inches in diameter at the middle and is 20 feet long when the ready-to-use mix costs 45 per gallon, the calculations would be made as follows: from the table it is seen that the cost to treat a foot of length for an 8-inch timber is 4.4 cents. This value x 20 will give 88 cents as the cost of treating. This table helps estimate what the costs will be. If more or less absorption is taking place than the 3 pound standard recommended, costs will vary accordingly.

**Table 3. Approximate costs to treat posts for 30 inches for varying diameters and costs of ready-to-use mix. Also cost to treat 1 foot of length.***

| Diameter of post | Ready-to-use mix cost per gallon (cents) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 35 | | 40 | | 45 | | 50 | | 55 | |
| | Cost per post 30 inches and for 1 foot length (cents) | | | | | | | | | |
| inches | per post | per foot | per post | per foot | per post | per foot | per post | per foot | per post | per foot |
| 3 | 2.6 | 1.0 | 3.0 | 1.2 | 3.4 | 1.4 | 3.7 | 1.5 | 4.1 | 1.6 |
| 4 | 3.8 | 1.5 | 4.3 | 1.7 | 4.9 | 2.0 | 5.4 | 2.2 | 6.0 | 2.4 |
| 5 | 5.0 | 2.0 | 5.7 | 2.3 | 6.4 | 2.6 | 7.1 | 2.8 | 7.8 | 3.1 |
| 6 | 6.1 | 2.4 | 7.0 | 2.8 | 7.9 | 3.2 | 8.8 | 3.5 | 9.7 | 3.9 |
| 7 | | 2.9 | | 3.3 | | 3.8 | | 4.7 | | 4.6 |
| 8 | | 3.4 | | 3.9 | | 4.4 | | 4.8 | | 5.3 |
| 9 | | 3.9 | | 4.4 | | 5.0 | | 5.5 | | 6.1 |
| 10 | | 4.3 | | 4.9 | | 5.6 | | 6.2 | | 6.8 |
| 11 | | 4.8 | | 5.5 | | 6.2 | | 6.9 | | 7.5 |
| 12 | | 5.3 | | 6.0 | | 6.8 | | 7.5 | | 8.3 |
| 13 | | 5.7 | | 6.6 | | 7.4 | | 8.2 | | 9.0 |
| 14 | | 6.2 | | 7.1 | | 8.0 | | 8.9 | | 9.7 |

* Figures based on recommended consumptions given in Table 2.

Table 4 gives per-post costs by operations. It is based on 1951 price levels and will vary from year to year depending on general economic conditions. These are based on what it would cost to have someone else do the job. Some of the charges would not be considered for most farm operations. Your immediate out-of-pocket costs will include stumpage, gas and oil, and treating materials. This would run under 15 cents per post.

**Table 4. Summary of costs per post by operation—1951.**

| Operation | Cost per Post |
|---|---|
| | CENTS |
| Stumpage | 2 to 5 |
| Woods operation including peeling | 15 |
| Hauling | 5 to 8 |
| Treating materials preservative, oil, and dye | 5 to 8 |
| Treating labor | 2 to 3 |
| Depreciation on equipment | 1 |
| Total post cost | 30 to 40 |

**Full Length Treating**

There are several places where you need to give a full length treatment to wooden structures used on your farms. Large timbers used as building foundations, bridge stringers, fence posts in wet climates, potato cellar timbers, lumber for certain types of flooring, and head gates all need to be treated their full length. Potato cellar timbers and bridge stringers especially need it since both are used where rot is serious. Important savings can be made by giving these timbers a satisfactory treatment with penta.

Equipment is the major problem for full length treating operations. It takes a heavy tank of some type to handle full length treatment on a 30-foot bridge or cellar timber. Lengths up to about 10 feet can be given a full length treatment by welding two oil drums together, burying them part way in the ground, and then giving the timber a double butt treatment. Treat first one end and then turn the timber upside down and treat the other end. For long timber a strong tank long enough for full length treatment is most practical. Metal tanks do this job best but they are expensive. On a custom or cooperative basis metal tanks are satisfactory.

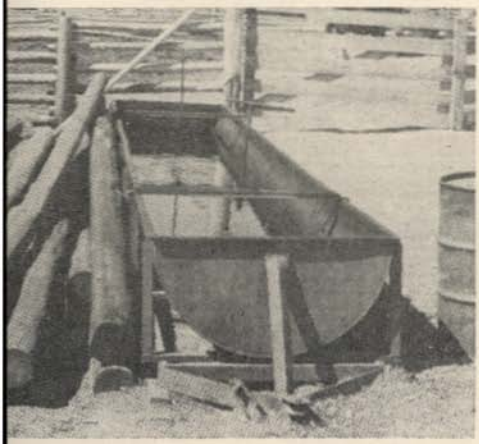

**Figure 8.—This portable metal tank built by the Idaho Potato Growers' Association has assisted cellar timber treatment in the southeastern Idaho counties. The tank is made of 10-gauge black iron. It is half round in shape and is well braced. It is 25 feet long, 46 inches wide at the top, and 23 inches deep.**

Engineers advise us that concrete tanks would be cheaper than metal ones. A concrete tank should be made from a dense concrete mix of: 1 part cement, 2 parts concrete sand, and 3 parts gravel. This is on a volume basis. If you purchase from a ready-mix concern, order their 6 bag mix which uses 6 bags of concrete per yard of aggregate. The sides of the concrete tank should be 6 inches thick. Use a 6″ x 6″ welded wire mesh for reinforcement for tank up to 6 feet wide and 3 feet deep. Place the reinforcing about 1 inch in from the inside surface. If you build a concrete tank, it will be wise to make a slanting tip at one end to make it easier to take timbers in and out.

"It is of the utmost importance that this concrete be properly handled. The treating solution will leak out unless the concrete is correctly mixed, placed, and cured. Mix the concrete

at least three minutes after all the materials are in the mixer; five minutes is better. Use only enough water to make the concrete workable. When the concrete is placed in the forms, do not allow the larger gravel to separate out and form layers. Use a spading tool between the wet concrete and the form. Work it up and down so that all the large rocks are pushed in from the form and all the air bubbles are driven out. This will result in a smooth wall which will not leak. Keep the concrete wet for several days after it has been poured. This can be done by covering it with wet burlap sacks. Wet straw, or earth placed on top of the sacks will hold the moisture so they will not have to be sprinkled so often. The longer the concrete is kept damp, the better; a practical length is five days."

Temporary tanks have been made from Douglas-fir plank. Such tanks should be calked and surfaced on the inside with a non-oil soluble product such as casein glue or water soluble tar. Wooden tanks are not satisfactory for use over any extended period.

When using any long, shallow tank or full length treatment, you will have to have some type of bobber control. This is necessary to hold the timbers entirely under the solution and thereby obtain complete treatment. Weights, levers, or overhead wheel devices can be used for this purpose.

When treating full length timbers, water in the bottom of the tank can be a serious problem. It does no good to soak your timbers in water instead of preservative. This water seems to accumulate. Some comes from the timbers themselves and some from the weather. Design your tank so that you have a drain suitable for the removal of any water which accumulates.

The amount of preservatives needed in any full length operation will vary with the use that is to be made of the timber. Treat round bridge stringers to the same standard as those suggested for fence posts. Treat gate lumber and sawed bridge stringers for 24 hours. Use rough-sawed pine. Timbers in a well-ventilated cellar will have sufficient protection when they pick up about ¾ as much preservative as the amount recommended in table 2.

**Treating New Cellars**

Treating wood in potato cellars will add only 7 to 9 percent to the total cost of building your cellar. Thus treating is inexpensive insurance which will assure your cellars having a long life without serious repair. If you desire to see some treated cellars, visit the University Experiment Station at Caldwell, the Joe Heward ranch at Ashton, or the Emile Neff ranch at Rexburg. The Idaho Potato Grower's association can refer you to several other treated cellars in the Idaho Falls area.

Here are some special points to consider when treating timbers for use in a potato cellar:

Use only lodgepole pine. Such species as aspen, cottonwood, and poplar take too much preservative. Sort your timbers.

There is likely to be considerable variation in the size and seasoning of the timbers which you have for your cellar. Timbers that have seasoned the same should be treated during the same run. Likewise timbers of similar size should be treated together.

Start your treating early. The tank shown in figure 8, held an average of 10 timbers per run. Even with a 12 hour schedule it will take 10 to 15 days to treat the timbers going into an average cellar.

Use a clean, light oil and dry before capping. Otherwise a strong odor of oil will remain during the first year's use. By using nothing heavier than light grade stove oils, the odor will be gone after about 3 weeks' drying.

Treat end of bin dividers and other exposed timbers. Only the ends of bin dividers are in contact with other wood or with the earth sides of the cellar. The treatment of the ends where the dividers are nailed to the uprights will be enough.

Size as much of the timber as possible before treatment. You will not, however, be able to anticipate all of the necessary cutting. When untreated wood is exposed by sizing, then apply two heavy brush applications of the preservative mix to these untreated surfaces. Make the second application after the first has had an opportunity to dry.

Use a dry capping-material. If you use willows let them cure before they are covered. Green willows covered with straw and dirt soon form a serious rot hazard.

**Rebuilding Old Cellars**

Many farmers want to know if it is possible to stop decay on timbers of an old cellar that is already constructed. This is a major problem, for a large percentage of the cellars needed by Idaho farmers have already been built.

Surface applications such as spraying or brushing are not satisfactory. However, encouraging results have come from the simple

**Figure 9.—This is what happens when untreated wood is placed in a cellar. Timber replacements started during the sixth year in this cellar near Thornton. It failed completely the tenth year. Treatment would have assured much longer use.**

practice of fully treating any replacement timbers before they are put into the cellar. Such a practice is inexpensive and will go a long way toward extending the life of any old structure.

An outstanding example of rebuilding an old cellar with treated material can be seen at the southern Idaho demonstration farm just west of the Burley city limits. The original cellar on the farm was constructed in 1938. It was a 45 x 36 foot underground cellar, with round lodgepole pine for the structure. The original cost was $750. By 1944 many of the timbers were badly rotted. Cost estimates of a new untreated cellar added up to $1,000. Foresters recommended replacing the damaged timbers with treated material. The cellar was repaired with treated material in 1944. Where a large number of the timbers had to be replaced, the dirt and straw were removed and the treated timbers put directly into place. Where only occasional replacements were necessary, heavy house jacks were used to lift the roof and the old timbers were knocked out and the new ones substituted. The total cost of this operation was $266. Only occasional timbers have been replaced since 1944, and the cellar is still giving excellent service.

**Treating Sawed Lumber**

When lumber is used for headgates, cellar siding, feed troughs, bridge timbers, or any other purpose where rot is a problem, it will be to the owner's advantage to treat. Rough-sawed pine will take a high quality treat. Planed material will take only a fair treatment. Lumber from fir, larch, and most other species can be given treatment only with a hot-cold or pressure method. Aside from selecting pine, there are a few other things to remember about treating lumber. Place small laths or sticks between each two layers of lumber to assure movement of preservative around each board. Lumber can be used as a filler when treating round timbers. Boards can often be slipped in between the round timbers without taking up any extra space. In general, a 12-hour schedule will give satisfactory results. However, if the lumber is to be put where rot conditions are severe, give the lumber a 24-hour soak.

COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS, D. R. THEOPHILUS, DIRECTOR UNIVERSITY OF IDAHO COLLEGE OF AGRICULTURE AND UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING.

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