How To Get Waterproofing Substances From Plants

Joseph H. Boatwright

a VITA publication

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PREFACE

This manual is concerned with the methods of waterproofing all types of soil construction. The basic thought is to show people how to utilize all forms of native vegetation to produce gums, resins, and oils that are useful waterproofing agents. The systems for the production of these substances are such that few implements are needed; the equipment required can be constructed from materials at hand, even by inexperienced workers.

Since the plants that bear these gums, resins, and oils vary considerably from one part of the world to another, no effort is made to identify the various plants. Some of the more common ones are cited as examples of what one might expect to use.

One portion of this manual is devoted to the method of extraction of the gums, resins, and oils; the other portion is devoted to the construction of necessary equipment from local materials, and general information concerning application, by-products, etc. Illustrations are used to assist in the explanation of procedures.

Since this manual is to be used all over the world, frequently in areas where people have not had an education, the terminology is universal. For instance, all measurements are expressed as the heighth of a man, the width of a man's hand, the length of a finger, etc. The language used is such that it may be translated directly into a native tongue with little or no paraphrasing. The manual is directed toward the reader himself.

It is our hope that this manual will enable people all over the world to protect their dwellings from wear and destruction by the weather, without spending money.

TREES

In general there are three parts of a tree which will produce a waterproofing agent. Seldom does a tree supply this agent in more than one place, so we shall treat each one separately.

The first and easiest way to obtain a waterproofing agent from a tree is through its sap. Since many trees will not have a free flowing sap, and many that do will not have a useful sap, all kinds of trees in the neighborhood must be tested. The best way to test a tree is to cut through the bark to the wood with a knife leaving a bare place on the wood about the width of one finger and as long as a man's hand. This cut should slant downward, so any sap that drains will flow toward the lower end. At the bottom of the lower end, place a cup to collect any sap that flows. These cups can be made from gourds, coconuts, or a section of bamboo stalk. See Figure 1. below showing how this should be done.

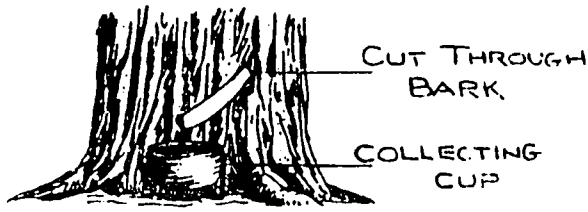

Figure 1.

Watch this cut for several days to see if any sap flows. If it does not, no other trees of this type should be tapped. If the sap does flow, collect a cupful. Test the sap to see if it will waterproof mud or soil walls. To do this brush or wipe the sap on the walls; be careful to soak all of the wall in the test area. It is better to have too much sap on the wall than not enough. Allow the sap to remain for two or three days - it may, or may not, dry. Then throw water on the test area. If the color of the wall darkens, it indicates that the water has wet the mud or soil, and the sap did not waterproof the wall. If the color of the wall does not change, then this sap is a good waterproofing agent. Be sure to remember which kind of tree supplied this sap, as all trees of this same type should be tapped for their sap. Search for all trees of this type, and tap every one of them just like the first tree. If there are not enough trees of this kind in the neighborhood, then test other kinds of trees for their sap. Test the sap in the same manner as before. Collect the sap from each useful tree every few days, and store it in a larger container - this container may be a bucket, skin, or a large section of bamboo. When a large amount of sap has been collected, waterproof another section of your home. Continue the process until the entire building has been waterproofed. Then waterproof the inside just like you did the outside.

When you have waterproofed your house, help someone else in your village waterproof his. Then, you and your friend help others until every

house in the village is waterproofed.

If none of the trees in the neighborhood give sap, then try the fruit of the tree, whether it be berries, nuts, seeds, or fruit. Whatever the fruit, allow it to ripen on the tree, then pick it. Place it in the sun so that it dries completely, and the seeds may be picked out easily. Do not start the next step until enough seeds have been collected to make a pile at least as high as a man's knee. Several piles this high will have to be collected to produce enough oil. The seeds should be crushed. Do this by placing them on a large, flat rock, and mash them with a smaller stone. Crush them thoroughly, deposit them in a cloth bag, place the bag in a large pot. Add water to the pot until it covers the bag, and then place the pot on a fire. Heat until the water comes to a boil. If oil comes to the surface of the water, skim it off and collect it in another container. Continue cooking the seeds until no more oil comes to the surface. At this point take the pot off the fire, drain off all the water, and put the bag in a press. See Figure 2.

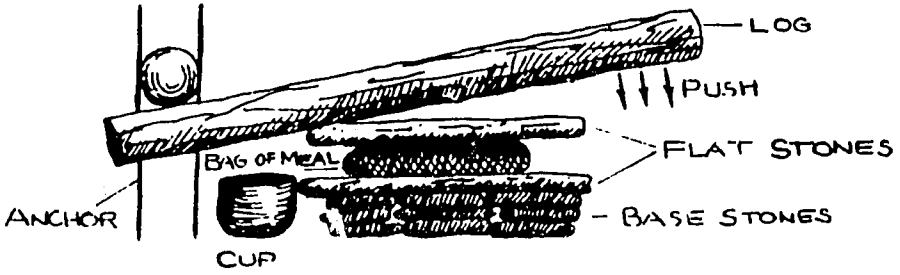

Figure 2.

Oil and water will be expressed from the seeds. Separate the oil from the water, and save it with the other oil you have collected. Continue pressing until no more oil is expressed. Since this is a rather involved operation, and not really a one man job, it should be done to provide enough oil to paint an entire village. Everyone in the village can contribute labor: gathering, drying, crushing, cooking, pressing, and then painting.

If the tree has nuts instead of berries or seeds, the hulls must be removed before the nuts can be crushed. Save the hulls separately, as they may contain a resin or oil. Crush the nuts, and express the oil from them as outlined above.

Test the hulls of the nuts to see if they have any oils or resins. Place the hulls on a sheet of metal, or in a metal can, and put it on a small fire of hot coals, no flame. If the hulls contain oil or resin it will flow out onto the metal. Do NOT let the metal get red hot, because the resin or oil will be burned. Any resin or oil should be collected and added to the oil already saved. The resin or oil from the hulls usually has a very high melting point so it will turn solid when cooled, and cannot be applied. It must be mixed with other oils with a lower melting point. Hulls that produce

no resin or oil may be thrown away.

Some trees produce a gum, and deposit it on their leaves. The easiest way to determine if the leaves have a usable gum is to dry the leaves, and cook them on metal as above. If a gum flows out on the metal sheet, save it and mix it with your oil. These gums also must be mixed with oil, or they cannot be used.

Bamboo, and possibly other grasses with tough stalks, contains a resin dispersed throughout the fibers of the stalk. The bamboo will have to be dried in the sun until it is brown, and then crushed with rocks until it is broken up into small fibers. These fibers will then be placed on a metal sheet, and spread out so that they form a thin layer. The metal sheet is placed over glowing coals and heated until the resin flows out on the metal. Collect the resin as it drips off the sheet, and immediately mix it with oil. One warning:if too much resin (from the bamboo or other plants) is mixed with oil, the oil mixture will begin to harden on cooling. This can be remedied by adding more oil until the mixture stays liquid on cooling.

Coconut palms may be treated separately, since they are a fairly common tree in many parts of the world. The trees will yield no sap or gum, but an excellent oil can be obtained from the coconut itself. Remove the husk from the ripened coconut. Drain the milk save it separately; it is nutritious, an excellent source of safe drinking water, and break the nut open. Allow the meat of the coconut to dry while still in the shell it is easier to remove it from the shell;after it has dried. The meat does not need to be crushed, but may be cooked as soon as a sufficient quantity has been gathered from the dried shells. Cooking alone may yield sufficient oil; pressing may be tried after cooking, but only if a significant amount of oil can be obtained.

By-products from each of the above should not be discarded, but saved and used to the best advantage. The meal from the seeds, berries, nuts, etc. is rich in protein and can be used as a food supplement. There is the danger that some seeds, such as the castor bean, can be harmful to human beings. Therefore it is wisest to use the meal from trees as fodder for cattle, hogs, etc. Only the meal obtained from grain and grasses is completely safe for human beings. If excess oil is produced, it may be used in lamps or made into soap, as described later. Coconut shells are most useful as cups, dishes, lamps, containers, etc. The residue from cooking bamboo, nut hulls, etc may be used as a form of charcoal for almost flameless fires.

BUSHES

Bushes may be treated in the same manner as trees, except that there is little reason to try extracting the sap from them since the stalk of most is so small it is impractical to tap them. However they do produce berries and nuts that may be dried, crushed, and pressed as described earlier in TREES. Many bushes produce an edible fruit which should be eaten first, and the seeds saved and dried for crushing and pressing.

VINES

Most vines produce berries, some of which are edible. The seeds, in either case, may be crushed for oil, just as shown earlier in this manual.

There are other vines from which the sap will flow quite readily. In this case the vines are simply skinned, or cut, on one side, and the sap will begin to flow out. This sap, like that of the trees, will have to be tested. Since the sap from some vines is as thin as water, it cannot be used just as it comes from the vine. A sap such as this will have to be cooked over a low flame first to try to thicken it. If cooking does not thicken the sap, simply discard it, and do not tap that type vine again. If cooking does thicken the sap, apply the thick sap to the walls of a house, and test it as was done with the sap from trees. If the thick sap acts as a waterproofing agent, tap as many vines of this type as can be found. After a large quantity of sap has been collected, cook all of it at once, and then use it as a waterproofing agent.

GRASSES

All grasses produce seeds of one kind or another, but most are much smaller than those found on other types of plant life. While it may seem impractical to bother with grasses, this is the largest source of vegetable oil for many people today.

The seeds should not be gathered until the grass has turned brown; the seeds will be easy to remove then by holding the stalk between the thumb and index finger. Draw the stalk through the two fingers, and the seeds will fall off in the hand. Collect as many seeds as possible, since each seed yeilds only a very very small amount of oil. Crush the seeds as discussed before, cook and press. If enough seeds are used, a large quantity of oil can be obtained. This oil may be used as is without testing, since it is well known that such oils are excellent waterproofing agents.

It must be added here that the oil, the meal, and the whole seed itself are highly nutritious. If the village is lacking in food, forget about waterproofing, and use all the edible seeds for food purposes. If the people have adequate food, then the seeds may be crushed, and the meal fed to any domesticated animals on hand: cattle, hourses, hogs, sheep, or similar animals. Under no circumstances should excess seeds, oil, or meal be discarded; it should be used as food.

OTHER PLANTS

Plants which do not fall into the category of trees, bushes,vines, or grasses still produce seeds of one kind or another. We suggest that all seeds be picked regardless of their origin, and cooked and pressed to see if they contain oil in sufficient quantity to be useful. If the oil yield is large enough, gather all the seeds of that type, and use them as a source of oil.

EQUIPMENT

One of the first pieces of equipment needed will be a brush. Bristles for a brush can be vegetable fibers, hairs from a horse's tail, or hair from the tail of any animal, if the hairs are long enough, stiff enough, and straight enough. The hairs should be fairly stiff (about as stiff as those from the horse's tail or mane, or those from hogs); they should be straight, and they should be as long as from the tip of the middle finger to the wrist. The handle can be any kind of hardwood, a piece of bamboo would be excellent.

Choose a piece of hardwood about as big around as the little finger, and twice as long as the bristles. Grasp a small bundle of bristles within a circle made by the thumb and forefinger. Insert the handle in the middle of this bundle of bristles so that one half the length of the bristles is along the handle, and the other half is loose. Tie the bristles around the handle with a leather thong, vegetable fiber, or any strong cord. Tie once at the end of the handle, then once at the end of the bristles; then tie once between these two. Be sure to tie as tight as possible, so the bristles will not come loose. It is better that two men make the brushes, as one man will find it difficult holding the bristles and tying at the same time. After the bristles are tied, trim the bristles at the loose end, so that all of them are the same length from the handle. See Figure 3. below.

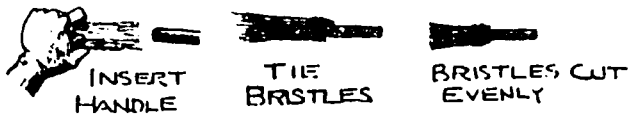

Figure 3.

The next piece of equipment needed is a cup for collecting the sap as it drains from the tree or vine. Any hollow object can be used with ease. We mentioned earlier that gourds, coconut shells, or sections of bamboo stalks may be used. Figure 4. below shows how these will appear:

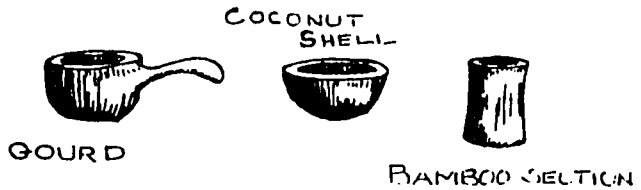

Figure 4.

Bags in which the meal is cooked may be made of any coarse fiber or cloth. Their size is immaterial; the only requirement is that they are not wider or longer than the stones in the press (they should be somewhat smaller). See Figure 2. They may be made in a square or round shape, and made to contain as much meal as may be cooked at one time. The cloth should be strong enough to withstand the pressure of the press. If the cloth is not strong, the bags will burst, the meal will spill out, and no oil will be expressed.

Two types of presses may be constructed: one is shown in Figure 2., and will be described below. The other, the Chinese wedge press, will be described and illustrated.

A small stone base, about ankle high, will support the flat bottom

stone of the press. The bottom stone of the press should be slanted so the oil flowing onto it drains toward one end into the container placed there. A flat stone about the same size as the bottom stone is the top stone of the press. A log about as long as the height of two men and as thick as a man's thigh is the lever for the press. This log will have to be very strong to support the weight of five or six heavy men. One end of this log is anchored as close as possible to the stone base, and to the ground very securely so it will not rise when the men press on the other end. To use the press, place the bottom stone on the base, and the collecting cup at one end. Place the bag of meal on the bottom stone, and the flat top stone on top of the bag. Next, place the long heavy log on the top stone, with one end anchored securely. When all of the equipment and log are in place, about five or six heavy, strong men should press down on the free end of the log, applying all of their weight to the log at once to exert as much pressure as possible. As they press, oil and water will be expressed from the meal. The mixture will run down the bottom stone, and be collected in the cup. Continue pressing until all the meal has been pressed, and all the oil collected. After the mixture has been standing awhile the oil will float on top of the water. Scoop off the oil, and discard the water. This process may be repeated until enough oil has been prepared for the entire village.

The Chinese wedge press requires more preparation. Figures 5. and 6. show how this press appears, and how it operates.

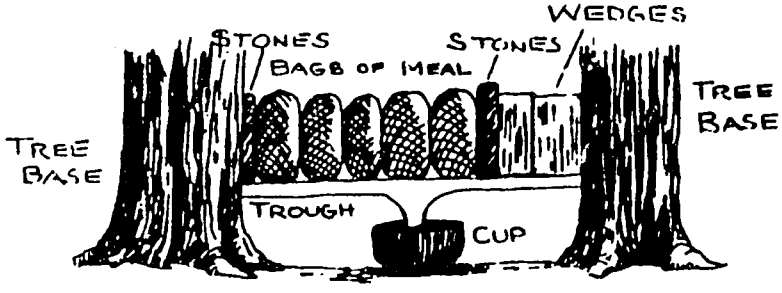

Figure 5.

Obviously, from the appearance of the press, it will require tools for both its construction and operation. If the tools are available, or can be constructed, this press is far more efficient than that shown in Figure 2. If tools, such as saws, axes, mallets, and an ample supply of cloth (for the bags) are available, we suggest that the wedge press be used.

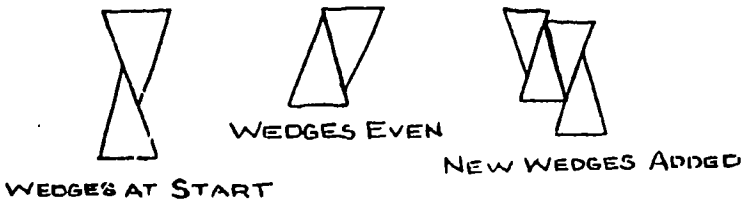

Figure 6.

Trees are the end braces since they are sturdy. If two closely placed trees are not available, two strong logs may be used in their place: each log should be as thick as the thigh of a man, and should be two-thirds as tall as a man. Each log should be buried upright in the ground one-half of its length. Then each log should have an angle brace (see Figure 7.) on the outside; the press will be placed between the logs.

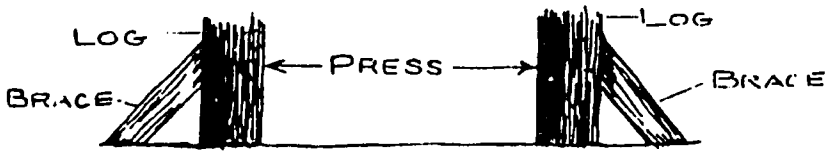

Figure 7.

Any number of bags may be placed in the press at the same time, as the force exerted by the wedges will be distributed equally throughout. Place the first two wedges in the press, and then add enough bags to fill the press tightly. The bags should have flat stones larger than the bags placed at each end so that neither the tree or wedge will press unevenly into the end bags. The bags may be of the same general size and shape as those used in the other press. The base trough may be made of wood or stone, as long as its shape permits the oil to flow into a container. The drain may be in the center, or at either end. The wedges should be started as shown in the diagram in Figure 5. The wedges are to be placed horizontally, so that they may be driven from the sides. As the wedges are driven in, new wedges can be added to increase the pressure. (The meal will be compacted as the pressure is increased, and more wedges will be needed to maintain the pressure). The wedges may be made of nearly any kind of wood, but a hard wood is preferable. The wedge should be as long as a man's arm from his wrist to his elbow, and as wide as the meal bag. The wedge should have a fairly fine edge at one end, and be as thick as the breadth of a man's hand at the other end. The wedges should be driven with a wooden mallet, which can be made very easily (see Figure 8.)

Figure 8.

Cut a log as thick as a man's thigh and as long as a man's foot. In the center and in one side, a hole should be drilled (burnt, carved, etc.) all the way through the log. The diameter of the hole should be the width of two fingers. Insert the handle (which is made of very tough wood) into this hole. The handle should be about as long as a man's arm. Drive it into the hole as deeply as possible, and so tightly that two men cannot pull them apart. When the handle is tight, the mallet is ready to use.

When all the oil and water have been pressed from the meal, take out the old bags and add a new lot. The operation can be repeated until all the cooked meal has been pressed.

One further note: when driving the wedges, one man should drive the wedge on one side, while another man drives the wedge on the other side. They should strike their blows at the same time. If this is not done, it is possible that the bags and wedges will buckle, and everything will be pushed out of the press.

PAINTING

In painting soil construction with sap, oil, etc. take care that the surface is completely covered with the waterproofing agent. The brush should be filled before each stroke, and the strokes should be made horizontally. Start painting at the top of the wall, and work toward the bottom. If any of the sap or oil runs down the wall, brush it out as you work down the wall. Since the application of these waterproofing agents will darken the soil, it will be easy to tell if any areas have been left unpainted. It is much wiser to apply too much agent to the wall than not enough one small unpainted area can absorb enough water to ruin the rest of the wall. These agents may be used on wood framing, windows, etc.

Before any painting is done, brush off all loose dirt, trash, vines, vegetable growth, etc. The soil should be as firm as possible for best results. It is also important to paint only in dry weather.

If the soil, or wood, is wet or even damp, the waterproofing agent will not adhere properly, and will not protect the walls.

While the resins in sap and gums will dry to a fairly hard film, it is doubtful that the oils will dry at all. However, this will not detract in the least from their waterproofing capabilities. Due to this lack of drying, the oils will be effective waterproofing agents for a longer period of time.

The easiest way to determine if the walls need repainting is to throw water on them. If the walls darken in color (from absorbtion of water by the soil), they need repainting. If they remain essentially unchanged in color, the waterproofing agent is still effective. If repainting is needed, add a new coat of waterproofing agent. It does not matter which type of agent has been applied first nor does it matter which type is used for the second, or even the third coat. Any type may be applied over the other with good results. On the average these waterproofing agents should last from one to two years, depending upon the weather, etc.

GENERAL

The classification of gums, resins, and oils is very general. The gums occur as solids as described earlier; the resins, while mentioned, are not identified - they are a component of the sap, and remain as a solid substance when the sap dries. The oils are found in virtually all seeds and nuts regardless of their source.

It is impossible for us to identify the various trees, bushes, vines, grasses, etc. that will provide the various types of waterproofing agents. The selection of these will have to be entirely on a trial and error method. Saps from several different types of trees often can be mixed together, but this too will have to be on a trial and error basis. The gums can be mixed with each other, occasionally with the oils, but seldom with the saps. All oils can be intermixed; in fact, the seeds and nuts themselves can be mixed together prior to crushing, and then cooked and pressed together. Sometimes oils can be mixed with saps, but this will have to be done on trial and error basis.

While it is easy enough to construct new brushes, it is also very easy to keep the original brushes in good condition. Since water will not clean these brushes, there is no point in trying to wash them. The best solution is to saturate each brush with oil, and then place it in a container of water. Cover the container so the water cannot evaporate. The oil will prevent the resins and gums from hardening, and the water will stop the oil from drying.

By-products have been mentioned earlier: as we said, the meal left from the pressing of seeds and nuts is an excellent source of protein for both people and animals. It can be cooked in cakes for human consumption, or it can be fed directly from the press to cattle, horses, hogs, chickens, or any vegetarian animal. A word of caution again: if a human being eats castor beans, or the meal from them, it will probably

kill him. It is impossible for us to pinpoint castor beans in such a manner that people everywhere would recognize them. Castor beans do grow on trees; therefore all beans from trees should be suspect until proven otherwise. This does not deter the beans, however, from being useful sources of oil. The oil from cashew nuts shells is highly corrosive to human flesh; care should be exercised in cooking any nut shells.

Another possible by-products is edible sap from trees (maple), vines (grape), and some grasses (sugar cane). Some plants in each of these groupings produce a sap with a high sugar content. If the sap from any of these is thin and watery, cook it slowly until it thickens. After cooling, taste it; if it has a sweet taste like sugar, it will be a source of nutrients. It is suggested, however, that it be fed first to animals to determine if it is non-toxic. If it does not harm the animals, it probably will not harm a human being.

There are two additional uses for oil besides that of a waterproofing agent; Lamps and Soaps.

Fill half of any small container, such as a half cocount shell, half gourd, etc. Place a wick made of vegatable fibers into this oil. The oil will rise in the wick, and may be ignited. The oil will burn with a small, bright, yellow light (producing black smoke) which provides illumination for the home. See Figure 9.

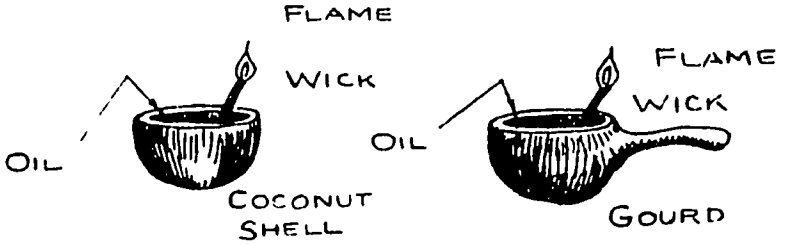

Figure 9.

Soaps can be made quite easily from any of the oils (or mixtures of them) and white wood ashes (the darker ashes are charcoal, and are of no use in making soap) directly to the oil. Heat this mixture until it begins to bubble, and continue heating as long as the bubbling lasts. When the bubbles no longer rise to the surface of the liquid, add more ashes to see if it starts again. Continue adding ashes until the bubbling stops, then allow the mixture to cool and harden. This solid mass will be a rather strong soap, but it will be ideal for washing clothing, utensils, and even for bathing.

COLORS

While these coatings will not change the color of the soil walls except to darken them, colors can be incorporated with these agents to

yield a range of yellows, reds, grays, and sometimes white. It is suggested that if coloring is desired, you contact the author for additional information on the subject.

PROBLEMS

It has been impossible to discuss every facet of the information contained in this manual, so the material has been presented in a brief, general way. Therefore it is quite obvious that questions may arise concerning, plants, soils, painting, cooking. If this happens, please contact the author directly; we are always ready to help in any way we can to assist in the improvement of housing. Of course, there will be no charge for this service. Please write directly to:

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