PRUNING HIGHWAY TREES

Report of Project Committee on Roadside Tree Techniques

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THE highway administrator is ever confronted with problems of pruning. Sometimes he finds them difficult because he must not only consider the health and beauty of the plantings which adorn his highways, but is at the same time compelled to weigh even more carefully the safety and efficiency with which these highways must carry the vital flow of both traffic and utilities. Improved planning is making the combination of utility and beauty more compatible.

To a far less degree, a brief statement on pruning may at times be helpful to the administrator striving to attain the same goal on highways which have not benefited by such planning.

Restriction of Subject

Man's emergence through the veil of antiquity is replete with references to pruning. True, for the most part, his early efforts were restricted to the fruit trees, the olive and the vine. Nevertheless, he established the fundamentals of the art, and laid the broad foundation for the voluminous and readily available literature which today so well covers the field in its entirety.

Because that priceless jewel "time" limits what a busy administrator may read, the present report is restricted to the subject of pruning established trees.

The important role of nursery pruning is here omitted, even though it is recognized that the rubbing off of a few buds may spell the difference between a good or a poor tree when it is grown to transplanting size. Also excluded is the subject of root and top pruning at transplanting time, despite the fact that, skillfully performed, such cutting may be helpful to the best establishment of the young tree.

An abbreviation which is even more regretted is the omission of the highly specialized subject of line clearance. Fortunately the reader may be referred to an outstanding as well as beautifully illustrated textbook which covers this subject in its entirety.*

Pruning Crews

In maintenance pruning of shade and roadside trees, as opposed to line clearance and brush cutting, it is customary to group the workers into small crews. A 4 to 6-man crew is frequently selected but the number must be varied with the nature of the work to be performed and the men available to perform it.

One man on each crew acts as a working foreman and is in complete charge. It is usually advisable that another worker be appointed as a driver, in order that a single individual, rather than the group as a whole, may be responsible for the

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*Blair, George D. Tree Clearance for Overhead Lines. Second edition, revised. 242 pages. Electrical Publications, Inc., 22 East Huron Street, Chicago 11, Ill. $4.75.

care of the truck. Where the equipment includes a power saw for take-downs, it is also best that it, too, be in the charge of a given worker.

All members of the crew, regardless of their responsibilities, carry on the actual work of pruning. On a crew of 5 men, it is essential that at least 3 of them be proficient climbers.

Pruning Process

In pruning it is usual to work from the top of the tree downward. The worker climbs the tree and crotches his rope before making any cuts except for the removal of unwanted branches or thorns that may interfere with his climbing. Not only does this add to the safety with which the task is accomplished, it speeds the work by permitting easier clearance of the cut branches as the work progresses downward.

Unless bleeding prevents the immediate application of wound dressings, flush cuts are usually painted at the time they are made.

In all cases, procedure must necessarily be varied to best accomplish the specific purpose for which the pruning is performed. Regardless of that specific purpose, skilled workers make few exceptions in following five simple rules which determine what should be removed in pruning.

1. Remove dead wood and broken branches.
2. Remove branches that grow straight upward, main stems excepted.
3. Remove branches that turn back toward the center of the tree.
4. Thin out interfering and closely parallel branches.
5. Take out suckers unless they are needed to renew an open space or to prevent sunburning of the bark.

Pruning Equipment

The following equipment is suggested for a 5-man pruning crew.

(A) Truck Equipment

1 Truck	-	Ton and half or equal. Power winch may be desirable.
1 Tarpaulin	-	
1 Water Cooler	-	With sanitary drinking cups
1 Power Saw	-	One or 2-man saw when needed for take-down
1 Tool Box	-	To safely store tools in an orderly fashion
1 Ladder	-	18 to 24 foot extension
1 Block and Tackle	-	2 Doubles or 1 Double and 1 Triple
1 First-Aid Kit	-	Plus supplies locally necessary
2 Axes	-	Regulation in locality used
1 Pruning Shears	-	Hand-type
3 Lopping Shears	-	Regulation-Type
3 Danger Signs	-	As per local requirement
2 Bull Ropee	-	For lowering, etc., manila 3/4 or 1-inch one to be at least 150 feet long
2 Crosscut Saws	-	One-man-type 30 to 36-inch

(B) Spare Replacements

2	Hand Saws	- 26 inches long
1	Climbing Rope	- ½-inch manila, 150 feet
2	Paint Pots	
6	Paint Brushes	
1	Gallon Wound Dressing	- Unopened can in addition to opened lots in use by crew
2	Saw Handles	- Including bolts

(C) Individual Equipment

1	Pair Boots	- Boots or high shoes with composition soles
1	Climbing Rope	- ½-inch manila, 100 to 150 feet
1	Hand Saw	- 26 inches long
1	Pole Pruner	- 12-foot handle
1	Pole Saw	- 12-foot handle
1	Pair of Belt Snaps	- For saw and paint pot
1	Paint Pot and Brush	- With wound dressing
1	Pocket Knife	- Pruning or jack as preferred
1	Wide Belt 1½ - 2-inch	- Web or leather

Figure 1. This American elm growing under forest conditions illustrates self-pruning. The dead branch at the top shows a ring of callus forming. Callus has completely closed over the knobs below.

Pruning in Nature

Nature decks her trees lavishly with buds. It is not possible that all of them ultimately grow into twigs, branches, and large limbs. In the forest, competition between closely grown trees shades out many of the lower branches. These ultimately die and fall from the tree in a process sometimes described as self-pruning. (Figure 1.)

Shade trees grown in the open are not subject to shading by adjacent trees, yet the same process takes place less markedly by competition between the many branches of the same tree. Here too, then, we have self-pruning, but it is less well performed than under forest conditions.

In addition to the kind of natural pruning just discussed, any trees, especially the elm and the oak, occasionally show a quite different type of self-pruning. It is restricted for the most part to twigs and to small branches. These twigs are cut off by much the same process that deciduous trees rid themselves of leaves in autumn. By it unwanted twigs break sharply at a node. In this case the resulting wounds do not afford easy entrance points for fungi.

Quite the contrary is true where larger limbs have died from shading. Here various fungi or insects attack and destroy the dead wood. While this process is under way, a roll of protective callus growth forms around the base of the dead branch. After the branch is sufficiently decayed to fall, a ragged stub protrudes from this ring of callus. Not only is this untidy in appearance; the fungi which have caused the decay are often able to travel down through the ragged stub and gain entrance to the trunk where they may cause heart rots and other diseases.

Much of the pruning which we perform is an attempt to aid Nature in this less efficient self-pruning of trees grown in the open.

When to Prune

For efficient planning of the overall pattern of pruning, it is not always practical to weigh too carefully the advantages and disadvantages of performing the work at a particular season. There are, however, several exceptions which seem of sufficient import to warrant statement in even so brief a presentation as the present paper.

Certain trees tend to bleed if pruned during the dormant season. Notable among these are the maples, birches, and dogwoods. Generally it is safer to prune these trees after they have come into leaf. The rule is not one which should be adhered to so rigidly as to prevent removal of an occasional branch during the dormant season. On the other hand, wherever extensive pruning is performed, adhere to it closely. Otherwise weakening of the tree through excessive bleeding is possible. Even more to be feared is the development of slime flux which is both unsightly and detrimental to healing.

Dormant pruning tends to be followed by a long type of branch growth, whereas pruning during the growing season has a general tendency to make the new growth more compact. Careful workers frequently take advantage of this fact to obtain a desired type of growth structure.

Dormant pruning is especially advantageous for sanitation work in that during the lower temperatures and drier atmospheric conditions of winter the fungi have less chance to infect cuts. An outstanding example of the value of dormant pruning is the control of canker stain of London plane. This disease is not spread by careful pruning performed between December 1st and February 15th.

Summer has marked advantage for clearance pruning. Workers see clearly the degree to which the weight of the foliage pulls down the branches. Many types of trouble which attack an occasional branch are most easily detected during the growing season because the withered foliage acts as a flag among the normal green branches to direct the attention of the worker to the need for removal.

Importance of Rapid Healing

Slowly healing, ragged wounds provide easy entrance points for harmful insects and fungi. Hence, in pruning, strive to leave wounds which will heal rapidly. Use flush cuts that will not interfere with normal sap flow in order that all parts of the callus margin may roll over the wound quickly and completely.

All such flush cuts should be made to a bud if the wood is small, or if pruning involves larger wood, to another branch or to the trunk. The growth of this bud or branch will aid in the rapidity of healing by providing normal sap flow.

By use of sharp cutting tools, whether these be pruners or saws, endeavor to remove the wood cleanly without undue bruising of the surrounding live bark. Such cuts heal more quickly.

The rapidity with which a tree is able to callus over its wounds is also correlated with its vigor. Building up the natural vigor of the tree is often an important adjunct to wound treatment, especially if the wounds are large. As far as it is possible to do so, assure that the soil provides adequate water, air and food - building materials for normal, vigorous growth. Protect the tree against insects and fungi which cause defoliation. By so doing you will further assure the rapid healing of its wounds. In occasional isolated instances it may be possible to give important wounds the added healing stimulus provided by wrapping with burlap or even shading with boards.

Pruning to Buds

In pruning the smaller wood to buds, one of the most important things which the skilled worker looks for, in addition to the length at which the cut is made, is the selection of a bud pointing in the direction in which he wishes growth to take place. Having chosen such a bud, he cuts a little beyond it and at an angle sloping slightly downward away from the bud. (Figure 2). The exact length of stub to leave requires a nicety of judgment which comes with experience. If the cut is made too far from the bud, drying out causes the death of the stub back to the point at which growth is still taking place. This leaves a possible entrance point for fungus organisms. On the contrary, if such a cut is made too close to the bud, drying out will kill the bud itself and result in an even longer stub, for the new growth will start from the first bud located below the one originally selected.

Figure 2. These twigs of American chestnut have been pruned to buds. The twig on the left shows a proper length of stub. The center twig shows a stub that is somewhat long. The twig on the right has been cut so close to the top bud that it may dry out, causing growth to start from the bud below.

Selection of the exact place to cut is further complicated by the season of year at which the pruning is performed. If the work must withstand the drying effect of winds during a protracted dormant season, more length of stub must be allowed than as though the work were done when new growth will very quickly heal the wound.

Preliminary Cuts in Branch Removal

Branches should be removed by flush cuts at their intersection with other branches or with the trunk. Before making such cuts, it is necessary to remove the weight of the limb in order to prevent tearing down the bark under the

flush cut. Small limbs can be supported with one hand while the sawing is done with the other, or the weight of a large branch can be supported by roping.

In general practice, however, the weight of the branch is most often removed by two preliminary saw cuts. (Figure 3). The first of these is made from the under side of the branch about 6 to 12 inches beyond where the final flush cut will be made. Continue this undercut until the saw begins to bind. A second cut is then made from 2 or 3 inches to either side of the undercut. Sawing is continued from above until the limb splits off.

Figure 3. The first preliminary cuts on this Chinese chestnut have been made from below. The second preliminary cuts from above have been made both away from and toward the trunk with no difference of result. The final flush cut is almost complete.

Skilled workers differ slightly in the technique which they use for the second preliminary cut. If the second cut is made nearer to the trunk than the undercut, the jump of the branch away from the trunk will be increased. Conversely, if the second cut is made further away from the trunk than the undercut, the limb will fall more directly to the ground. For trees which have wood that does not split easily, such as the elm, the latter type of second cut is often preferable. Where a speed saw is used, the curvature of the cutting edge sometimes enables the worker to make the second preliminary cut directly above the first cut.

Flush Cuts in Branch Removal

The flush cut, which follows these preliminary cuts or other methods of removing the weight of the branch, must be straight and smooth. No markedly protruding stub should remain. In the majority of cases, it is best to cut close enough so that the swollen ring of callus which surrounds the branch base is cut into slightly. Not only does this improve the appearance of work, it stimulates the rapidity with which the callus rolls over the cut. Insistence on an extremely flush cut in order to parallel the trunk must, however, be avoided. In many instances it may not only increase the size of the resulting wound but may structurally weaken the part.

By cuts which are reasonably flush we enable the sap to flow in natural lines about the wound. Thus we leave no protruding areas of bark where sap flow will be unable to encourage callus growth.

Preliminary Cuts in Topping

In topping trees, and in removing large upright limbs, preliminary cuts are employed similar to those described for branch removal. These cuts are usually referred to as "jump cuts". In making them, it is frequently desirable first to rope the top where it is to be removed, using a running bowline or timber hitch in order to guard against breakage.

Having determined the most desirable direction in which to have the top fall,

the first preliminary cut is made on the side in which this fall is desired. The cut should be at right angles with the desired angle of fall. Keeping the saw level, the cut is continued half way through the part to be removed.

The second preliminary cut is similarly made from the opposite side of the tree from 2 to 8 inches above the first cut and parallel to it. When the second cut is deep enough to be directly over the first, the top can be pulled or pushed off.

A useful variation of the jump cut just described consists in first removing a triangular wedge of wood with two converging saw cuts. The notch is faced in the direction of desired top fall. The second preliminary cut which follows it is, in this instance, made in a somewhat downward direction to dissect the upper of the two cuts made in removing the wedge.

Flush Cuts in Topping

Following completion of the jump cut, the final flush cut is made to remove the stub. This type of flush cut differs from corresponding final cuts for branch removal in two regards. (1) It is cut to a smaller rather than to a larger branch, so that, while on a much larger scale, it is not unlike the cuts already described under pruning to buds. (2) Because of the upright growth of the part removed, the flush cut must be made at an angle sloping away from the smaller branch to which it is cut. Not only will this angle be helpful to callus production, it will permit water to drain off rahter than become pocketed in the cup-like depression which will ultimately be formed by the ring of inrolling callus.

Correcting V-Crotches

Narrow V-shaped crotches formed by branching tree tops are common. This type of crotch tends to be structurally weak. (Figure 4). Grown to large size, it is subject to splitting in high winds and when heavily laden with glaze, sleet, or wet snow.

Correction at an early stage by the removal of one member of the V-crotch is no more difficult than pruning of an ordinary branch. As the parts grow to large proportions, corrections becomes increasingly difficult. The lines of sap travel are divided between the two members of the crotch. An ordinary flush cut does not provide lines of flow which favor rapid and sure healing of the resulting wound. Large cuts in this case require a long slant downward and away from the crotch.

Where it is not essential to immediately remove one member of a V-crotch, the work can be performed much more successfully and with greater ease by the simple expedient of heading back the unwanted member. The principal subsequent growth of the top will then be by the leader which has not been headed back. After a lapse of several years, the unwanted stub can be cut back much more safely because the greater amount of sap flow will then be through the main leader.

Shaping Large Cuts

When its normal flow is obstructed by a large wound, sap streams downward in an elliptical course. For this reason it is sometimes advantageous to streamline very large cuts by removing a triangle of bark from the top and bottom of the wound before painting the cut. By so doing, occasional dying back above and frequent dying back below the cut are less likely to leave areas which are unprotected by wound dressing. (Figure 5).

Figure 4. Narrow V-crotches, such as that shown by this hickory, tend to be structurally weak in high winds and when heavily laden with sleet or wet snow.

Figure 5. Had this 10-in. cut been streamlined before the wound was painted, dieback at its base would probably not have left the unprotected area shown in this photograph.

Such streamlining, particularly at the base of the wound, is also helpful in smaller cuts which may be difficult to callus. Among these are wounds made by the removal of one member of a V-crotch, or even normal cuts on tree species which produce relatively weak callus growth, or on trees or parts of trees lacking vigor.

Disinfecting Pruning Tools

Much of the wood removed in pruning is diseased. In some instances these diseases may be transmitted to healthy wood by means of the tools used in cutting. To guard against possible spread of infection, it is usually important to sterilize pruning tools before making the final flush cuts.

In shade-tree care this is most frequently accomplished by dipping, swabbing, or thoroughly spraying the tools with a 70 percent solution of denatured alcohol. Because it is readily obtainable at automobile filling stations, antifreeze alcohol is often used for this purpose.

Sterilizing Cuts

If the wound dressing selected for use is not an antiseptic, a sterlizing agent should be applied to flush cuts made in diseased wood. This precaution should be taken to prevent contaminating the wound dressing in the paint pot and the brush used in applying it. This will avoid spreading infection to healthy wood subsequently treated with the paint.

A 1 to 1,000 solution of bichloride of mercury is frequently employed for this purpose. If denatured alcohol rather than water is used as the solvent, waiting for the cut to dry before applying the wound dressing is avoided.

Extreme caution must be exercised in the use of this deadly and corrosive poison.

Painting Cuts

Wound dressings are usually applied as promptly as is possible to final flush cuts. Occasionally, profuse bleeding prevents the application of dressings immediately after the cuts are made. The exposed wood is painted in the hope of protecting it against the ravages of weather and pests during the period required for the growth of callus to close over the wound. (Figures 6 and 7).

Figure 6. Infection by the fungus Phytophthora interfered with the healing of these wounds and caused them to increase in size.

Figure 7. This unpainted cut became infected by a wound parasite which causes heart rot. A fruiting body of this fungus appears at the base of the scar.

Such treatment is considered less important for some conifers that coat their wounds with a resinous exudate than for trees that do not form such protective coatings. (Figure 8).

Painting of small wounds that will heal over in a single season is sometimes omitted. Economy thus effected may prove false. True, such wounds do present smaller targets more briefly exposed to infection by fungus spores. None the less, since they do provide potential points of entrance which can easily be avoided, they should be painted.

Figure 8. A resinous exudate acts as a natural protective coating on the wounds of this Scotch pine.

All dressed surfaces should be examined periodically. If they are defective, repaint them after scraping loose or blistered areas.

Numerous types of wound dressings are employed by various workers for painting cuts. A brief statement on two such dressings follows.

Asphalt Base Paints

Asphalt base mixtures are very popular wound dressings for shade-tree work. Both water emulsions and asphalt cut with various solvents are used. For the most part, the material containing a solvent is widely used in general work, while the water-emulsion type is valuable for application to wet wood. These paints are reasonable in cost.

Asphalt used alone permits the production of excellent callus growth. Unfortunately, used either alone or mixed with small amounts of creosote, asphalt applied to wounds that have not been sterilized before they are dressed often fails to prevent the spread of infection. For this reason fungicides are sometimes included in asphalt mixtures. One of these, a 0.2 percent concentration of phenylmercury nitrate, will prevent the transfer of infection from one cut to another by means of the paint or the paint brush used in applying it.

Avoid applying asphalt paints too thickly, for blistering of very heavily applied asphalt sometimes permits the entrance of decay through surface breaks.

Bordeaux Paint

Bordeaux paint is outstanding in its ability to protect wounds from infection, but even this dressing will not penetrate bark or wood and destroy fungus mycelium that is already established.

Weighted against its superior fungicidal properties are marked disadvantages. It is expensive. It will not adhere to wet wood. Callus growth under this material is not as good as under asphalt used alone. It must be freshly made. It has an objectionable blue or green color.

To prepare bordeaux paint, enough raw linseed oil is stirred into fresh commercial bordeaux powder to make a very stiff mixture. After standing a short time, it is stirred again. The second stirring should produce a product of about the same consistency as toothpaste. If the mixture is thinner than this, stir in more powder, for an excess of oil may be detrimental to callus growth.

Bordeaux paint should be applied generously to the cut surface with a swab or with a very short-bristled brush.

Sanitation Pruning

Removal of diseased branches is highly important in the control of numerous tree diseases. Among such disorders are various cankers, galls, witches' brooms and diebacks as well as such specific diseases as black knot and fire blight.

In performing such sanitation pruning, be sure that all final cuts are made at least 6 inches below the area of diseased wood. Sterilize both the wounds and the cutting tools. Do the work when the trees are dry and not when the casual bacteria and fungi are oozing new infection.

Even during routine pruning, observe as far as is possible these basic principles of sanitation pruning if areas of disease are cut into. To do so will accomplish much in preventing the dissemination of disease both in the tree itself and from diseased trees to healthy trees.

Sanitation pruning is also important in the control of certain insect pests. Work now being done by highway administrators throughout the northeast demonstrates the value of such an approach. By removing elm branches infested with bark beetles they have slowed the spread of the Dutch elm disease, for these bark beetles are the known carriers of the casual fungus.

Regardless of whether sanitation pruning is used to combat insects or disease, the task is never complete until the wood removed has been rendered harmless. Burning is usually the most practical and certain means of its disposal.

Conclusion

Pruning is the high trump in the highway administrator's deck of closely interrelated tree maintenance practices. Play it well.

Good pruning, systematically performed, conditions trees to better withstand the brunt of storms. It aids in their repair when broken. It helps to combat many of their diseases and some of their insect pests. By it, so far as visibility is concerned, the administrator follows the admonition to "make straight the highway", and safeguards against many a breakdown in vital utilities carried by wires. Through it he emphasizes at will the natural beauty of form of the specimen tree, or, by the suppression of unwanted discordant notes, blends their collective contribution into a symphony of tree mass.

Badly played, the card can yield not only the heartbreak of goals unattained; it may even result in ugliness, disease, and destruction in excess of the all-too-common aftermath that follows in the wake of mere neglect.