Economical Tree Killing

By Lewis C. Swain

AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF NEW HAMPSHIRE
DURHAM, NEW HAMPSHIRE

STATION BULLETIN 408

ACKNOWLEDGEMENTS

The author is indebted to Dr. Joseph Seiberlich of the University of New Hampshire Engineering Experiment Station: Roger P. Sloan. Extension Forester in Rockingham County: and Aldis J. Christie, Consulting Forester. Each rendered valuable assistance in advice and field tests.

COVER: This is the simple method of inserting the chemically treated paper tab into a tree which is to be killed.

PHOTOGRAPHS BY THE AUTHOR

April 1954

ECONOMICAL TREE KILLING

By LEWIS C. SWAIN
Associate Forester

A GOOD WAY TO increase the value of forests is to make sure that the promising trees have plenty of growing space. Almost everywhere there are stands of young timber where owners could get much higher financial returns later on by carrying out practical thinning operations now.

Many otherwise valuable forests are crowded to the point of stagnation. On the other hand there are stands of crooked, defective, ill-formed trees with good ones scattered among them. It is common to see extensive areas of low value hardwoods, such as red, black, and white oak, mixed with white pine which is prevented from developing because of too much competition.

Owners of timberland may be fully aware of these existing conditions but hesitate to take action because of high immediate cost and low return in salable products.

Thinning is efficiently done with modern hand tools and light-weight power equipment. Much progress has been made in this direction but still the cost per acre is often so high as to limit the practice to fairly small areas.

Thinning By Poisoning

FOR MORE THAN 25 years scientists have been experimenting with chemicals for the purpose of killing unwanted trees. Their efforts have met with considerable success both in regard to the chemicals and methods.

This soft maple has been girdled with an axe and brush-treated with liquid sodium arsenite.

One of the most promising chemicals is sodium arsenite. It can be used to promote debarking if applied to a girdled band of exposed wood during the natural bark peeling season. Killing action takes place in a matter of days and bark loosening follows after several months.

Sodium arsenite is toxic to plant and animal life alike. For this reason it must be handled with caution.

Another chemical, ammate, which is the trade name for ammonium sulfamate, has been widely used but it is not as effective in killing certain species. However, ammate is not poisonous. 2-4-D and 2-4-5-T used singly or in combination are chemicals of proven value particularly in killing out shrubs and the smaller trees.

Application of Poisons

There are many ways of applying poisons. In the case of small trees, shrubs, and bushes, poisonous materials may be sprayed on. 2-4-D and 2-4-5-T are used as foliage sprays to kill vegetation which has to be cleared from power lines. These poisons can also be used to kill small trees during the dormant season. When so used they are called basal sprays as they are applied on the lower part of the trunk and on those portions of the roots which are exposed.

When trees of more than two inches in diameter are killed, a common practice is to cut through the bark into the wood with an axe or other tool in such a manner that ragged frills are left, upon which the poison can be deposited. The usual way of making these bark frills is to strike slanting blows downward with an axe which tends to force strips of bark and sapwood away from the trunk. This type of cutting is continued around the tree. A convenient height for frilling is just above the root swell. Chemicals in either dry or liquid form can be used.

Tree poisons are available at farm-supply houses in most sections of the country. They are packaged in convenient form with full directions for use and proper warning about handling those of a highly toxic nature. At the present time there is no single chemical or method of application that can be pointed out as best for killing brush and trees of all sizes.

Where there are many stems per acre, as in the case of shrubs and brush, a broadcast treatment is usually satisfactory. This involves the use of chemical sprays which will cover the largest area at lowest cost. Where there are fewer stems per acre as large as two inches in diameter, the so-called basal spray may be best. Here again, the use of such sprays or methods depends upon the unit cost. One advantage in basal spraying over the broadcast type is that selection of individual trees is possible. The better ones can be saved and those unwanted killed.

Whenever 2-4-D or 2-4-5-T are used separately or in combination as a spray the spraying equipment should not be used for any other purpose. It is nearly impossible to cleanse sprayers sufficiently for safe use after once using these chemicals in them. A drawback to ammate solutions is that they tend to rust metals to such an extent that thorough washing is always necessary if the equipment is to be kept in usable condition.

Killing Large Trees by Girdling

In the next larger-size group, whatever method is used will take more time owing to the fact that each tree must be treated individually. The present

study was undertaken with the objective of economy in time and material in safely killing these larger trees.

In order to test the reaction of trees to bark girdling and chemical treatment, several experiments were outlined recognizing that bark is easily separated from wood in a growing tree during the peeling season. This is the period of rapid growth ordinarily beginning in the latter part of May and continuing until late July or early August.

A tool was made which is similar to the ordinary bark-peeling spud, but smaller and lighter. With this tool, a section of the trunk of living trees was girdled and the tree left standing. The extent of the peeled area on the tree trunk depended considerably upon the natural bark characteristics and resistance to peeling. Girdling by peeling in this manner takes only a few seconds.

The reaction of most trees to girdling is to continue for several years in a healthy condition and in some species to develop a new coat of bark to replace the one peeled away. Tamarack proved to be an exception to this general rule. A test plot of 100 trees was girdled by peeling in 1950. Several weeks after girdling, seasoning checks could be observed in the bare wood. One year from the date of girdling most of the trees were dead. By the second year 98 percent were dead. The two living trees had live branches below the peeled area. White pine also reacted differently. Two plots of 50 trees each were girdled and the bare wood was treated with 2-4-D and 2-4-5-T mixed with fuel oil. This treatment was more effective. After two years only the largest and most vigorous trees were still alive.

A mixture of 2-4-D and 2-4-5-T in fuel oil was applied to the spud-girdled area of this white pine.

Similar treatment to white oak, red oak, soft maple, hard maple, aspen, and cherry produced poor results. Only a few of the sample trees were dead after two years.

Experiments in Tablet Insertion

THE TECHNIQUE OF inserting tablets into trees was developed during the peeling operations which have just been described. The spud used in this operation is about one-half inch in width and a little less than a quarter of an inch thick. The end is flattened and slightly bent so as to conform to the curve of the tree. It is easily slipped between the wood and bark for several inches before tearing occurs. If the tool is thus forced horizontally between the wood and bark for two or three inches and then withdrawn, a very good pocket is formed. Such a pocket is an ideal repository for testing the action of various chemicals. It was found that tablets could be made of ammate, and that the weight of the chemical used in each tablet was easily controlled. Thirty ammate tablets were prepared which ranged in weight from one-half to three grams. They were first tried as a means of thinning a 22-year-old plantation. The trees to be eliminated were selected and numbered. Bark pockets were made with the small spud and one tablet was inserted in each pocket. After a week, browning could be observed in the tops and branches of all treated trees.

A second plot was established and treated as soon as browning was observed in Plot No. 1. This consisted of 50 trees, each of which was treated with a two-gram ammate tablet. The reaction was identical to that previously observed.

In a white-pine plantation of this kind there is considerable variation in the size and vigor of the individual trees. There had been uniformly repeated attacks by the white pine weevil so that some trees had multiple stems with heavy branches beginning at a height of five or six feet. In such trees it was not uncommon to find that the effect of the ammate could be seen principally in one branch while the others remained healthy. Later the exact path of the chemical reaction was easily observed as the bark became darker in a strip running upward from the point where the tablet was inserted. This strip varied little in width in its upward course, but if anything became somewhat wider. In other words it enclosed a little more of the perimeter of the tree as it progressed upward. The edges of the strip were so well defined that they could be seen as two parallel lines following the grain. In some cases, the strip was spiral in form so that if an insertion was made on one side of a tree the effect could be seen spiralling upward to the opposite side in a matter of 16 feet or less. Below the tablet insertion the strip came to a point in 10 to 12 inches.

The entire operation of making bark pockets and inserting tablets in 50 trees of Plot No. 2 took 25 minutes.

Paper Strips Treated with Sodium Arsenite

One objection to using ammate tablets is that they absorb moisture so easily they tend to fuse in storage. To overcome this difficulty, two-inch blotting paper squares were cut and soaked in an ammate solution. It was found that after drying they could be handled quite easily, and that the effect on trees was the same as when tablets were used. In either case the dry chemical was readily absorbed.

Because of prejudice, sodium arsenite had not been used previously in these tests. However, treated tabs of blotting paper tucked safely under the bark with none of the material left on the outside of the tree appeared to

offer an exceptionally good means of determining its effectiveness without the usual hazards.

A 32 percent solution of sodium arsenite was poured into a jar containing cut blotting paper. The liquid was then poured back into the original container. The paper tabs were shaken apart and allowed to dry. A two-inch square of blotting paper thus prepared was found to contain two grams of the chemical. After experimenting with a size and dosage of sufficient strength and convenience for handling, strips two inches long and one-half inch wide were adopted for use. These pieces or tabs can be stored without apparent change, and because they are so thin, are easily slipped into the bark pockets.

As a test plot for the blotting-paper tabs treated with sodium arsenite, 30 trees were marked in a dense white-pine stand of volunteer origin. These trees averaged 30 feet in height, and 3 to 5 inches in diameter. Only one insertion was made per tree. All of the trees in the plot displayed definite browning of the foliage in six days. The perimeter of bark affected could easily be seen by the parallel lines extending upward as previously described. These lines were from two to three inches apart. The inner bark occurring between them turned a reddish brown in contrast to normal inner bark which

A white pine treated with a sodium-arsenite tab.

has a light green color. This band or strip of bark increases slightly in width as it approaches the top with the result that the entire perimeter is encompassed several feet below the terminal bud. None of the treated trees survived.

Treatment of Large Trees with Impregnated Paper Strips

Large trees as well as small ones can be killed by inserting impregnated paper strips into bark pockets. However, in the case of larger trees it is necessary to make a number of insertions at properly spaced intervals around the tree trunk. In the case of trees with a single stem, like the white pine, satisfactory killing can be obtained by spacing the insertions four or five inches apart. If a tree has numerous large branches in the crown, a spacing

This is the equipment for killing trees with treated tabs. The picture shows the spud, tab, and pointer, with the tab partly inserted in the bark pocket.

of three inches would prove more satisfactory. This spacing is sufficient to kill single trees growing in the open. An advantage of using such a method is the assured success of killing by increasing the number of insertions. Also, it is not necessary to make them all at the same height. Frequently defects are found which would make it quite difficult to continue at the same level. This is avoided by working either above or below the defect. In some cases it may prove advantageous to stagger the insertions to be sure of completely treating a given tree. Bark loosening follows this practice.

Reaction of Various Species

As growth habits vary among the species, the reaction to chemical treatment also varies. For example, white pine is killed quite easily, while the birches show a somewhat higher resistance. Also, there is considerable difference in the ease of peeling. For this reason, it takes a little longer to make bark pockets in some trees than others. Red maple may be classified as mechanically easy to treat. White oak would fall in the medium or moderately difficult class, while black oak, which has a thick tough bark, would be among those classed as difficult.

It is quite common to see branches with green leaves scattered throughout the crowns of treated hardwood trees, while the remaining foliage is dead. These may persist for several months or possibly through a second growing season.

Another reaction to the chemical treating of trees is that new shoots frequently grow from the base of the tree at the ground level. Such sprouting in most cases can be prevented by making the insertions lower down on the tree. The downward action in this case is often sufficient to prevent sprouting. A factor in favor of using the tab insertions is that some continued action remains in and around the insertion pocket which is sufficient to wilt and kill much of the new sprout growth. Here again quite a little variation has been noted among the species.

Cost in Time and Materials

Up to 100 three- to five-inch pine trees can be treated in one hour. It took one hour to treat 50 white oak trees of approximately the same size. There are two reasons for this. First, the white oak bark is tougher, and second, more insertions are necessary for a complete kill. Black oak takes longer still, so that the average number per hour is around 30. The cost of the chemical varies with the number of insertions. It amounted to 10 or 15 cents per hundred trees in experimental plots.

Tree Poisoning As a Forest Management Practice

IT HAS OFTEN been stated that the greatest need for developing high-quality timber stands is an economical means of removing the low value or weed species. Tree poisoning offers a good approach to the problem, and the simpler the method the more widespread the practice will become. It may not be necessary to effect complete killing of all trees which are treated. A simple reduction of competition may achieve the purpose. Also the treated

The fire hazard increases where slash is not removed when the trees are felled with axe or saw. After two years the slash is still highly inflammable.

trees. even though partly living. become weakened to such an extent that they are no longer able to compete with their more vigorous neighbors.

In drying. treated trees become stiff enough to act as props for others which might be severely bent or broken by heavy snowfall. This was observed following an early winter storm where other trees near the treated plot had been damaged while those supported by chemically killed trees were unharmed.

It takes a year or less for treated white and red pine to become bare of foliage. During that time the light reaching the ground gradually increases. Since no abrupt change in the canopy takes place. the remaining trees appear to accommodate themselves to the changing conditions without a setback which accompanies the usual type of thining operation where the trees are felled.

Thinning with axe or saw leaves the pine forest in a tangled inflammable condition. Dry needles remain on the tops and branches for several years. The chemically killed trees dry out. remain standing. and do not prevent easy access throughout the stand. The increase in fire hazard is not significant.

Sample Field Results

A 70-ACRE mixed stand of hardwoods and white pine was treated to release the pine from an overstory consisting of white. red. and black oak, soft maple. and other hardwoods to a lesser degree. The average canopy height of the hardwoods overtopping pine was 30 feet and the pine understory 10 to 15 feet. Sample counts showed a distribution of about 400 hardwoods and 600 white pine trees per acre. The average diameter of hardwoods at breast height was four inches.

The decision to destroy hardwoods in favor of pine was due to the low quality of the hardwoods. There was little prospect of developing a hardwood stand of even moderate value without radically altering its composition

The chemical treatment was done by a four-man crew working between brushed out property lines. Each man was equipped with a carpenter's apron holding several hundred treated tabs and a treating tool or spud.

Rubber gloves. which were tried for a few days. were discarded as the men complained of discomfort due to excessive hand perspiring. A protective hand cream proved to be a satisfactory substitute for gloves with no complaints about its use.

Crew members received about a half hour of instruction following which they carried on with one man acting as a working foreman. He assisted in keeping the line of progress straight and made decisions relative to skipping small areas containing insufficient pine to warrant treatment of the hardwoods.

Most of the trees were treated with one tab. The larger ones required two or more. according to diameter and size of crown.

Observations

Color change. accompanied by some wilting. was observed after 48 hours. After six days treated trees showed browning of the foliage over the treated area.

Light at the ground was more than doubled six weeks after the work was done.

In this mixed stand, low-quality hardwood (red oak) is crowding out white pine. Two weeks after the oak (at left) was treated with sodium-arsenite tabs, its foliage was completely withered. The picture at right shows red oak crowns thinned out with treated tabs to provide increased light for the white-pine understory.

Costs

The four-man crew progressed at a rate of approximately eight acres per working day of eight hours with smoking periods. This resulted in a cost very close to $6.00 per acre including chemical tabs.

White Pine Pole Stand

A dense stand of white pine 30 to 40 feet high and 3 to 8 inches in diameter at breast height was thinned to stimulate diameter growth on the remaining trees. The stand covers an area of four acres.

Since the crew was experienced, no training period was required. The results were satisfactory as all treated trees showed brown tops after one week, and falling of leaves later on.

Because of the large number of trees treated, the cost per acre was the same as that on the pine hardwood area where hardwood only was treated. However, pine is mechanically easier to treat and the cost per tree is less.

Results on Gray Birch

Twenty-five gray birch trees ranging in diameter from 3 to 6 inches and 30-40 feet tall were treated in May, 1952.

Birch bark is smooth and tears around the tree, consequently three- to four-inch vertical slits were made with a linoleum knife. These allowed the spud to enter between bark and wood for pocket formation. Two to four tabs were inserted per tree, depending on diameter.

Leaf development appeared normal during the early part of the growing season. Later, browning and falling of foliage occurred in some portions of the crown.

By early fall (September) the trees were bare of leaves. In late November several trees had broken tops following a heavy snow fall. The bark had curled away from the insertion slits for an inch or more exposing the wood. There was no tendency toward cracking, although the bark appeared loose.

Gray birch killed with sodium arsenite tabs. Treated several months earlier, the tops weakened by decay have broken off during an early winter storm.

To test bark loosening, long vertical slits were made through the bark with the linoleum knife. When next examined several weeks later, some of the bark had fallen off and the rest could easily be picked off by hand. Wood in the upper one third of the tree was considerably weakened by decay.

Red Pine

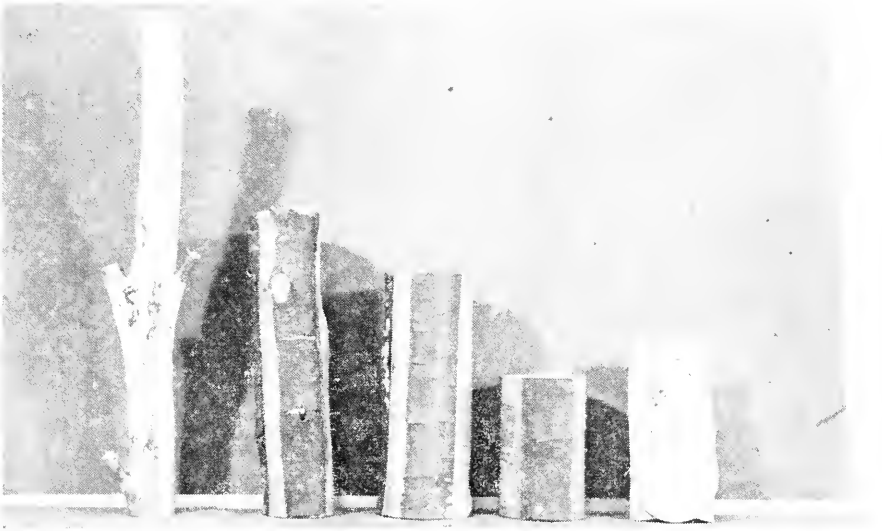
A plot of 16 red pine trees in a 30-year-old plantation was selected and treated with ½-gram tabs. The average diameter was 5 inches and the height 32 feet. The date of treatment was July, 1952. Browning of the foliage was seen on the first revisit to the plot 10 days later.

In October, examination showed all tops brown and apparently dead. By the latter part of February the bark was loosened from the insertion point upward, the top 10-15 feet showing bare wood with only patches of bark still clinging to the stem. The wood in the top was infested with insects, and birds, especially woodpeckers, were seen actively working on it.

Two of the treated trees were cut to observe evidence of the path of chemical action. One had received two insertions and in the other a single tab had been used. The upward effect was shown by darkened strips which followed a spiral path toward the top. The strips increased in width as they approached the top so that where two insertions were made they merged

at a height of 13 feet below the tip. They also showed a tendency to increase in width at the branch whorls and around defects.

Bark removal from the entire tree was easily accomplished. It practically fell off.



Sample blocks cut at intervals from gray birch treated with sodium arsenite tabs. The upward path of killing action shows as dark bands. The top section has been encompassed and exhibits decay.

General Observations

WHITE PINE CAN be treated with chemical tabs at any time throughout the year. Killing action progresses slowly during the winter months but is continuing and accelerates with rising temperature. Closer spacing of tabs in winter treatment assures more rapid results as the ascending strip of dead tissue produced by the chemical is somewhat less in width than one following the same treatment in summer. Other softwoods may also be treated at any season.

Hardwoods, because of the difficulty in making bark pockets, are not well adapted to winter treatment.

The wood from chemically killed trees can be used just as in any other dead tree. White pine trees three to five inches in diameter were cut two years after treatment and found to be entirely sound. Red pine deteriorates more rapidly and should be cut for use as soon as convenient after the top shows complete browning.

The sapwood in most species is subject to stain and decay. Early use of the cut trees is advisable.

When treated trees are left standing they remain a part of the forest but do not complete for space. It is not necessary to remove them as they gradually decay and ultimately become a part of the forest litter.

Portion of a pole from a red pine tree treated with sodium arsenite tab seven months earlier. The path of chemical action is seen by the parallel lines on the post.

Summary

KILLING OF unwanted trees is effectively accomplished through the use of chemicals. Sodium arsenite not only kills but in addition causes separation of the bark from wood when introduced into living trees.

Sodium arsenite has one characteristic which tends to limit its use. It is toxic to human beings and wildlife. During the past three years a new technique has been under examination to determine whether it is possible to inoculate unwanted cull trees with toxic materials sufficient to kill them and to leave them standing in the woods.

Using ordinary blotting paper as a medium for absorbing sodium arsenite, small tabs one-half by two inches are treated and dried. These tabs contain approximately one-half gram of poison. A special tool is used to create a pocket between bark and wood of the tree so the tabs can be inserted. This tool is a small bark-peeling spud similar to a slightly bent chisel. When it is forced straight through the bark a vertical slit is started which readily opens when it is pried back with the spud. Then the spud is slid between wood and bark for about two inches. One of the tabs is applied in the edge of the slit, the spud is withdrawn, and the tab forced into the bark pocket. More than 15,000 trees have been treated in this manner. Results show that pine trees up to 4 or 5 inches in diameter and from 15 to 30 feet high may be killed with only one tab. However, if the top is limby and there are many heavy branches, it is much safer to insert one or two more tabs since the time involved is only a matter of a few seconds.

Hardwood trees may be killed by using the same method. However, because of the irregular branching habits of hardwoods with the tendency to form spreading crowns, it is necessary to use more insertions per tree then is the case with pine. Another difference between hardwood and softwood trees is that the softwoods can be treated throughout the year, while the bark on

hardwoods becomes so tight that it is not easy to make satisfactory bark pockets except during the normal peeling season (roughly from late May to early August).

Trees treated in this manner show wilted foliage in a few days and dead crowns within a month.

Since the poisonous material used to kill the trees is deposited underneath the bark, it is not available to human beings or wildlife.

Arrangements for manufacture and distribution of treated tabs are underway. It is planned to make them available through farm supply houses. Sodium arsenite is toxic to human beings so home preparation of tabs can be dangerous.