

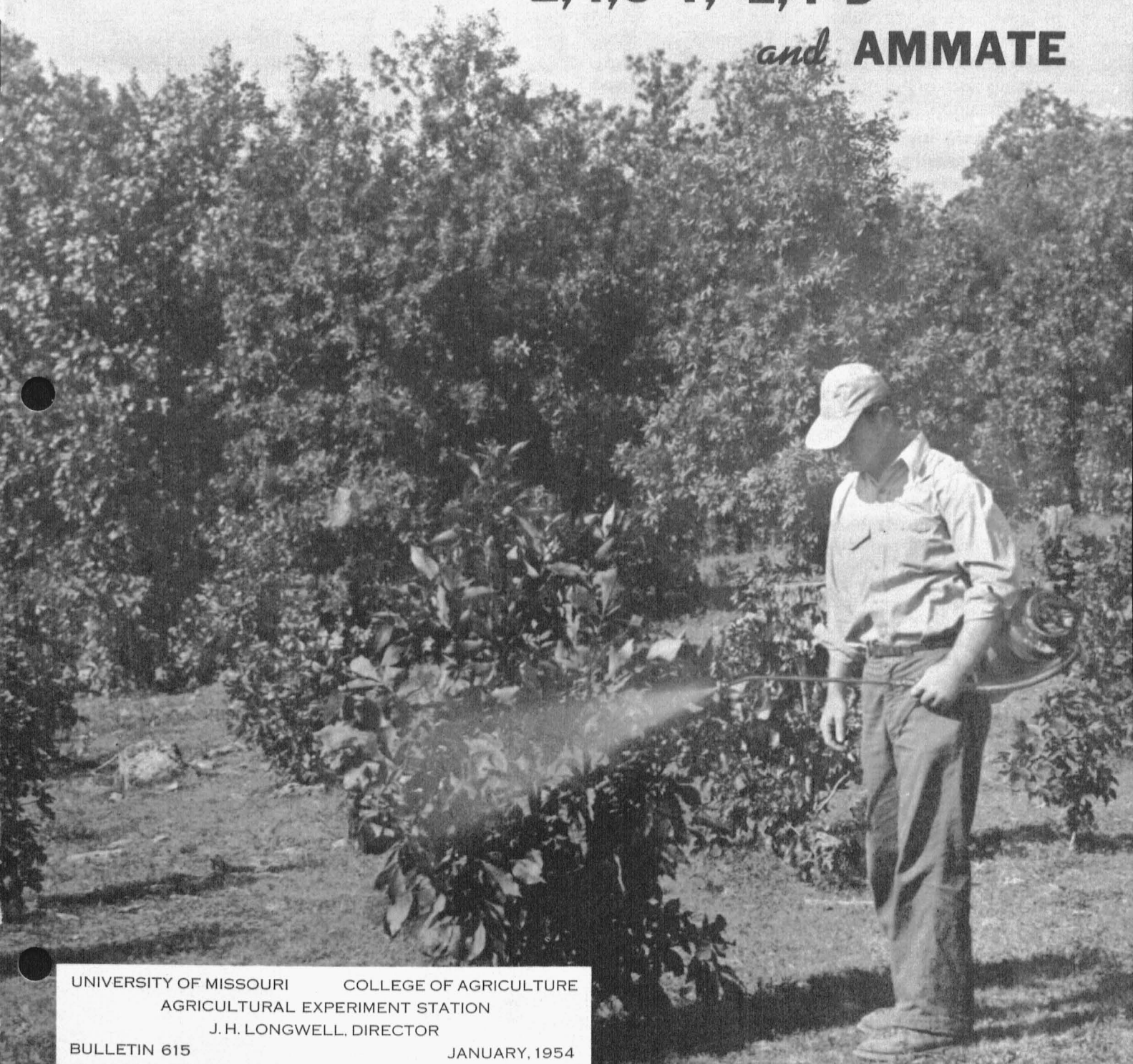
Controlling

WOODY PLANTS

with

2,4,5-T; 2,4-D

and **AMMATE**



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Controlling Woody Plants With 2,4,5-T; 2,4-D and Ammate

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Most native woody plants sprout if their tops are cut off. Killing the top usually is easier than killing the roots. Chemical control methods can reduce greatly the amount of labor and ultimate cost of woody plant control by reducing the amount of sprouting. Chemical methods described in this bulletin have many uses in the management of both forested and open lands.

In the woodlot or forest, chemical methods can be used to kill poor trees to make room for good crop trees. For example, herbicides are used in southern Missouri to kill low-value hardwood trees that may prevent satisfactory establishment and growth of short-leaf pine or valuable hardwoods. Chemical methods give more rapid top kill, retard or prevent sprouting, and kill many trees that cannot be killed by girdling or chopping alone. Since the usual objective in forest management is to release crop trees, it is not always necessary to obtain complete kill. Control may be adequate if regrowth from the treated trees is retarded enough to let the crop trees get ahead.

In range and pasture work, the ultimate objective of woody-plant control is to grow more grass. Since all woody plants compete with grasses for water, plant

nutrients, and light, the plant control work is directed toward complete eradication of all woody species. Girdling, burning, chopping, and goating have been the principal methods used in clearing land for range or pasture. These practices seldom result in a satisfactory kill of woody plants (Fig. 1, 2). Burning and goating may destroy most of the forage plants before the woody plants are killed. Chemical control methods can greatly reduce the amount of time, labor, and soil losses involved in killing unwanted brush and trees on range and pasture land.

Clearing is costly. It will not pay on all types of wooded or brushy land. In general, clearing should be confined to land that is not too steep, rough, or rocky to till or mow; where the possibilities for timber income are relatively poor; and where it is practical to apply the necessary lime, fertilizers, and seed to grow improved pasture or tilled crops. Before deciding to clear a patch of woods the farmer should get his county agent's opinion about how much income can be expected from the area if it is converted to another use. He also should consult with a trained forester about the potentialities for forest income. The forest may yield a higher net income per acre than can be obtained from any other crop.

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Figure 1—Girdling and burning have failed to clear this Howell County, Mo., area of woody growth. Chemical controls can be more effective.



Figure 2—Chopping and goating have almost whiped the sprouts in this Barry County, Mo., field, but overgrazing has also eliminated most of the forage.





Figure 3—Sprouts have taken over this bulldozed area in Texas County, Mo., less than one year after treatment.

LARGE-SCALE METHODS

Large-scale chemical and mechanical methods for controlling woody plants are useful for clearing large areas in a hurry. Such methods are impractical for many Missouri farmers, either because the required cash outlay is too great or because their control job is too small. However, because of their popular appeal, power spraying, airplane spraying, and bulldozing are discussed briefly.

Power Spraying is effective but requires costly equipment. The farmer who has a large area of brush or sprouts should consider hiring a reputable spraying contractor who is experienced in up-to-date chemical control methods. The local county agricultural agent should be consulted before investing in expensive spray equipment.

Airplane spraying for brush control is spectacular, has a lot of popular appeal, and has possibilities on extensive range areas. However, it has disadvantages which limit its usefulness in Missouri. Continuous tracts of at least 40 acres are required for successful airplane spraying. Since "hormone" type herbicides are used, spraying should be done only where drift damage to sensitive crops or garden plants is not likely. This is especially important as the most effective time for airplane spraying is in June when crops and gardens are most susceptible to 2,4,5-T and 2,4-D.

Bulldozing is the quickest method available for clearing wooded or brushy land. It leaves the land looking clean, smooth, and in good condition for seeding. The bulldozer usually uproots trees larger than 3 inches in diameter, leaving no stump to sprout. But many trees smaller than 3 inches in diameter are merely pushed over or are broken off above ground. Stumps that are not completely uprooted usually sprout (Fig. 3).



Figure 4—Sprayer, pouring can and axe: the brush killer's tool kit. Disposable cans are best for ammate as it rusts sprayer parts.

SMALL-SCALE METHODS

Small-scale chemical control methods increase the effectiveness of hand clearing. They include foliage spraying, basal spraying, and frill and stump treatments. Chemicals are used to reduce the amount of labor required for the initial clearing and to reduce the amount of sprouting so less follow-up work is required. The herbicides are readily available and non-poisonous. The farmer can use these methods to keep ahead of brush and sprouts in his fence rows and pastures, to kill cull trees or weed trees in his woodlot, or to increase his pasture acreage by clearing.

EQUIPMENT

The basic equipment for small-scale chemical control methods is simple and inexpensive (Fig. 4). A 2- to 5-gallon sprayer is the essential tool. A light, sharp axe is needed for frill and stump treatments. For pouring ammate solutions in frills or on stumps, a 1-gallon tin can fitted with a pouring spout works well and can be replaced at little or no cost. A piece of ¼-inch copper tubing forced through a cork makes a good pouring spout. A small nail hole in the corner opposite the spout completes the pouring can.

A 1-gallon measure is convenient for measuring oil and water but is not necessary if the sprayer tank is plainly marked off in gallons. Scales are useful for weighing ammate but, since ammate weighs about 1 pound per pint, it can be measured by volume if scales are not available.

Commercial 2,4,5-T and 2,4-D compounds are very concentrated and should be measured accurately. A convenient unit for general use is the fluid ounce. Some kitchen measuring cups, medicine bottles, and nearly all baby bottles are graduated in fluid ounces. A wide-mouth type baby bottle probably is the most convenient and accurate but for many jobs a pint or half-pint bottle is satisfactory.

HERBICIDES

The chemicals recommended for the control of woody plants are not poisonous and may be used to kill brush or trees without hazard to livestock in the area or to the person applying the chemical. There are many new plant-killing chemicals but the ones best known are 2,4,5-T, 2,4-D, and ammonium sulfamate (better known by the trade name ammate).

2,4,5-T and 2,4-D

The 2,4,5-T and 2,4-D chemicals are "hormone" type plant killers which can be absorbed through the leaves and carried down to the roots in the sap stream. Thus, it is possible to kill the roots of woody plants by applying 2,4,5-T or 2,4-D to the leaves. Both 2,4,5-T and 2,4-D are much more harmful to broad-leaved plants and trees than to grasses and grass-like plants. Since grasses are not seriously damaged by normal applications of 2,4,5-T and 2,4-D, these chemicals are especially useful in range and pasture work where the objective is to remove trees and brush.

Several chemical forms of 2,4,5-T and 2,4-D are sold. The "esters" or "ester" forms are best for brush control. Esters of 2,4,5-T and 2,4-D can be used either in water or in oil; whereas, most of the "salts" and "amines" work well only in water. Although 2,4-D is cheaper than 2,4,5-T; 2,4,5-T is effective on more species of woody plants. Mixtures of 2,4,5-T and 2,4-D that are sold commercially as "brush killers" are often recommended for general use on mixed species. In all commercial 2,4,5-T and 2,4-D compounds, the amount of active chemical is measured by the amount of 2,4,5-T and 2,4-D acid. Most commercial formulations contain from 2 to 4 pounds of 2,4,5-T or 2,4-D acid per gallon. The type of 2,4,5-T or 2,4-D (amine, ester, or salt) and the acid content are usually listed on the label.

Commercial 2,4,5-T; 2,4-D; and brush killer mixtures are easy to use, relatively inexpensive, and are not harmful to spray equipment. These chemicals are not poisonous to humans or livestock but are very toxic to certain crop and garden plants. They should not be used close to sensitive crop plants such as cotton, tobacco or tomatoes during the growing season. Also, since there is no practical cleaning method that will positively remove all traces of 2,4,5-T or 2,4-D from a sprayer, it is not advisable to use your brush sprayer to spray bugs in the orchard or garden.

Woody plants vary considerably in their susceptibility to 2,4,5-T and 2,4-D. Most species can be killed with them but a few seem to require a different type of herbicide, such as ammate. Specific information on susceptibility of each species develops slowly and much remains to be learned about Missouri species and conditions. Present recommendations for foliage

TABLE 1 -- GENERAL RECOMMENDATIONS FOR HERBICIDES TO BE USED FOR FOLIAGE AND BASAL BARK SPRAYING ON MISSOURI SPECIES OF WOODY PLANTS

Species	Foliage ^{1 2} Spray	Basal Spray ¹ Frill or Stump ²
Ash	Ammate	2,4,5-T
Blackberry	2,4,5-T	2,4,5-T
Black locust	2,4-D	2,4-D
Boxelder	2,4-D	2,4-D
Buckbrush	2,4-D	2,4-D
Cottonwood	2,4-D	2,4-D
Elm	Ammate	2,4,5-T
Gum	2,4,5-T	2,4,5-T
Hackberry	Ammate	2,4,5-T
Hawthorn	2,4-D	2,4-D
Hedge	2,4,5-T	2,4,5-T
Hickory	2,4,5-T	2,4,5-T
Honey locust	2,4,5-T	2,4,5-T
Maple	Ammate	2,4,5-T
Oak	2,4,5-T	2,4,5-T
Persimmon	None	2,4,5-T
Poison oak	2,4,5-T	2,4,5-T
Poison ivy	2,4,5-T	2,4,5-T
Raspberry	2,4,5-T	2,4,5-T
Sassafras	2,4-D	2,4-D
Sumac	2,4-D	2,4-D
Sycamore	2,4,5-T	2,4,5-T
Willow	2,4-D	2,4-D

¹If "brush killer" is used on species for which 2,4,5-T is recommended, use enough brush killer to contain the recommended amount of 2,4,5-T acid.

²Ammate will work on almost all species but is generally more costly than 2,4,5-T or 2,4-D. Use in locations where injury by 2,4,5-T or 2,4-D to susceptible plants is likely.

spraying and for basal bark spraying for common woody species in Missouri are summarized in Table 1.

Ammate

Ammate is toxic to almost all species of plants and is a good herbicide to use if there are many species to be controlled. Since ammate kills grasses, it usually is the second choice for foliage spraying in pastures. However, ammate can be used for frill and stump treatments without much damage to grasses or other forage plants.

Commercial ammate is a finely ground, yellow salt. It is soluble in water and is an effective plant killer because it moves in the sap stream of the plant. It is often possible to kill the roots of plants by applying ammate to the leaves or to freshly cut frills or stumps. Ammate should not be used in oil or as a basal spray.

Ammate is not poisonous to livestock and can be handled safely. However, it will burn or sting if it gets into cuts or scratches in the skin. One disadvantage of ammate for foliage spraying is that it rapidly rusts or corrodes iron, galvanized steel, and brass sprayer parts. Stainless steel spray tanks give good service but are expensive. Cheap pouring cans that may be replaced with little or no cost are suitable for stump or frill treatments.

APPLICATION

For best results the method of application must be suitable for the size of plants treated. Sprouts less than 6 feet tall, with slender stems, are best treated with foliage sprays. Sprouts or trees that are too tall to spray conveniently from the ground but do not exceed 4 inches in basal diameter may be killed with basal sprays or with stump treatments. Frill treatments are best for trees that exceed 4 inches in basal diameter. Foliage sprays, basal sprays, and frill and stump treatments are described in detail.

Foliage Sprays

Where To Use Foliage Sprays

Foliage sprays are effective on brush and trees of any size if thorough coverage is obtained. However, sprouts that develop following the death of large tree tops are small in relation to the root system. It is hard to kill such large root systems by applying chemicals to the small sprouts attached to them and it may be advisable to delay treatment a year or so until the sprouts are larger.

Foliage sprays are most practical for controlling plants that can be easily and thoroughly covered from the ground (Fig. 5). The most serious limitation in foliage spraying is that it must be done during the growing season, preferably in June, when the hazard to sensitive crop plants is greatest and when other farm work may be pressing.

Which Herbicide To Use

(1) 2,4,5-T or 2,4-D solutions containing 0.025 pounds of acid per gallon of water, or

(2) ammate—1 pound (or 1 pint) of ammate crystals per gallon of water. (One tablespoonful of soap powder or detergent per gallon of ammate solution will improve its wetting and covering properties).

Use the herbicide best suited for your species (Table 1). Be sure to read the label before you buy or apply 2,4,5-T or 2,4-D. The label should list the type and the acid content. The proper amounts of commercial 2,4,5-T or 2,4-D to mix with 1 gallon of water for foliage spraying are listed in Table 2.

Acid Content of Herbicide ¹ (Pounds per Gallon)	Amount of herbicide to mix with 1 gallon of water ²			
	Table- spoons	Fluid Ounces	Cups	Pints
2.0	3.2	1.6	0.2	0.1
2.6	2.4	1.2	0.15	0.08
3.3	2.0	1.0	0.12	0.06
4.0	1.6	0.8	0.10	0.05

¹2,4,5-T or 2,4-D

²The amounts shown contain about 0.025 pounds of acid.



Figure 5—Foliage sprays are best for killing sprouts of the size and type on this Texas County pasture.

How Much Spray To Use

The simplest rule is to cover leaves and stems thoroughly. The actual amount of material used may vary from a few gallons per acre to more than 100 gallons depending on the height and density of the stand.

How To Apply Foliage Sprays

For small scale work, the ordinary 3-gallon compressed-air, or back-pack, garden sprayer is satisfactory. Pressures in garden-type sprayers should be maintained at 35 to 40 pounds per square inch. Nozzle tips that produce a spray angle of about 40 degrees are better because they deliver a more forceful spray than those with a wider angle. If there is some air movement, good coverage of individual sprouts can be obtained by spraying through the foliage against the wind so that the spray drift comes back through the plant and wets the opposite side of the foliage. Spraying should not be attempted if the wind is so strong that plants can be covered on only one side.

When To Apply Foliage Sprays

Foliage sprays should be applied in late spring or early summer about the time the trees have reached full leaf. This will range from around June 1 in southern Missouri to June 30 in the northern part of the State. Fairly good results can be obtained in July or August but ammate appears to be better than 2,4,5-T and 2,4-D for late summer treatments. Best results may be expected by spraying when the weather is warm and when there is moisture in the soil.

Precautions with Foliage Sprays

Since the drift from foliage sprays is a threat to any susceptible plants that are nearby, foliage applications of 2,4,5-T and 2,4-D or "brush killer" should not be made close to garden plots or near fields of such susceptible crops as tobacco or cotton. If foliage sprays must be used near crops that are sensitive to 2,4,5-T or 2,4-D, it is safer to use ammate.



Figure 6—Frills should be made as close to the ground as practical, with axe cuts overlapping and completely encircling the stem. Chips should be left in place to help retain the chemical.

Basal Sprays

Where To Use Basal Sprays

Basal sprays are effective on brush and sprouts that are too tall for foliage spraying but do not exceed 4 inches in diameter at the base. Stems less than 1 inch in diameter are difficult to spray without waste and results often are disappointing. On larger trees, the expected percent kill decreases with increase in diameter. Basal bark sprays require no chopping, frilling or other laborious preparation before spraying and they are about as effective at one time of year as another. Thus basal bark spraying can be done in the dormant season when other farm work is not pressing, when it is cooler and more pleasant to work in the brush, and when sensitive crop plants are not growing and therefore are not threatened.

Which Herbicide To Use

Use ester types of 2,4,5-T or 2,4-D. For single species it is best to buy either 2,4,5-T or 2,4-D; whichever is required (Table 1). However, most species that can be killed with 2,4-D can be killed with a "brush

killer" mixture of the same concentration and those that require 2,4,5-T can be killed with "brush killer" by doubling the concentration. The proper concentration of 2,4,5-T or 2,4-D for basal bark spray is 0.16 pounds of acid per gallon of oil. Any light oil such as kerosene or fuel oil is a satisfactory carrier. Heavier oils such as used crankcase oil should not be used. The amounts of commercial 2,4,5-T or 2,4-D ester to mix with 1 gallon of oil are listed in Table 3.

How Much Spray To Use

The number of trees that can be basal sprayed per gallon of solution depends on the diameter of the trees. One gallon of solution will adequately treat up to 150 diameter inches. Thus, 1 gallon of solution will treat up to 150 one-inch trees, 75 two-inch trees, 50 three-inch trees, or 35 four-inch trees.

How To Apply Basal Sprays

Spray the lower 6 to 12 inches of trunk on all sides until some solution flows down the bark into the soil. Hold the nozzle close to the tree and direct the spray against the bark so the oil gets into all the cracks and crevices. Nozzles producing a narrow spray angle or cone are preferred because a wide angle spray is harder to direct and usually wasteful. Pressures of 15-20 pounds per square inch are adequate.

When To Apply Basal Sprays

Basal sprays are effective the year around.

Precautions with Basal Bark Sprays

Be sure the 2,4,5-T or 2,4-D is an "ester" type. Use oil solutions and use them liberally. Water solutions of 2,4,5-T; 2,4-D; or ammate will not work. Avoid basal bark spraying when the bark is wet.

Frill and Stump Treatments

Where To Use Frill and Stump Treatments

The only difference between frill treatments and stump treatments is that the top is removed in the stump treatments (Figs. 6, 7). Frill treatments are recommended for trees larger than 4 inches in diameter

Figure 7—For stump treatments, small stems should be cut close to the ground. A "V" shaped stump surface will help hold ammate crystals in place.

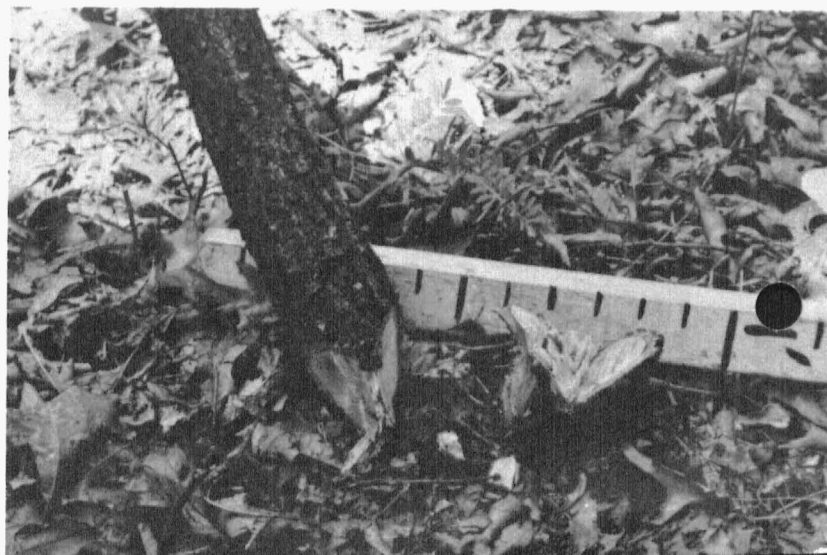


TABLE 3 -- SOLUTIONS FOR BASAL SPRAYS, AND FOR FRILL AND STUMP TREATMENTS

Acid Content of Herbicide ¹ (Pounds per Gallon)	Amount of herbicide to mix with 1 gallon of oil ²			
	Table- spoons	Fluid Ounces	Cups	Pints
2.0	20	10	1.3	0.64
2.6	16	8	1.0	0.50
3.3	12	6	0.8	0.40
4.0	10	5	0.6	0.32

¹2,4,5-T or 2,4-D

²The amounts shown contain about 0.16 pounds of acid.

at the base. Large trees can be frilled more easily than they can be chopped down. Frilling large trees before spraying saves chemical and gives better results than basal spraying alone. Trees up to about 4 inches in basal diameter can be cut off about as easily as they can be frilled and can be killed by basal sprays about as effectively as by stump treatments. For trees of this size the choice between basal spray and stump treatments depends on whether or not it is desirable to chop the trees down and take out the tops.

Which Herbicide To Use

(1) Oil solutions of 2,4,5-T or 2,4-D esters containing 0.16 pounds of acid per gallon of oil. (Table 1 and Table 3).

(2) Ammate—(a) *for frill or stump* use 4 pounds (4 pints) of ammate crystals per gallon of water; (b) *for stump only* use ammate crystals placed on the top of the stump at the rate of 1 teaspoonful per inch of stump diameter.

How Much Herbicide To Use

Wet the cut surfaces and fill frill with as much solution as it will hold. Spray stumps thoroughly to ground line. One gallon of solution should treat up to 400 diameter inches.

How To Make Frill and Stump Treatments

Single hack frills completely encircling the tree at the lowest practical height are recommended (Fig. 6). If trees are cut as in Figure 7, the stump height should not be much greater than its diameter. Apply chemical to the frill or stump as soon as possible after chopping. The oil solutions of 2,4,5-T or 2,4-D can be applied with a sprayer. Since ammate solutions are corrosive and will soon ruin the ordinary sprayer it is better to apply them with a cheap 1-gallon can fitted with a pouring spout (Fig. 4). All cut surfaces should be wet thoroughly and the frill filled to overflowing.

When To Make Frill and Stump Treatments

The most effective period for frill and stump treatments is in the late spring and early summer, but good results can be obtained throughout the year.

Precautions with Frill and Stump Treatments

If 2,4,5-T or 2,4-D is used, be sure it is an "ester" type and apply it in oil. If ammate is used in spray equipment the sprayers should be thoroughly cleaned immediately after each use.

PRACTICAL CONSIDERATIONS

In appraising the results of chemical treatments on woody plants remember that herbicides are tools and not magic wands. If properly applied, herbicides will kill a high percentage of the treated plants. But some follow-up work is almost always necessary on

any area where complete removal of the woody plants is the objective.

To be effective, the chemical control method must fit the job. The herbicide must be toxic to the species treated and the application method must be suitable for the size of plant. All herbicides do not behave alike, nor do all species nor all sizes of the same species.

Many Missouri oaks and hickories sprout mainly from the stem, at or near the ground line. The ability of some of these species to sprout usually decreases as the trees grow older and larger. For example, peel girdling will kill the roots of about 90 percent of all blackjack oaks larger than 10 inches in diameter but only 30 percent of those less than 2 inches in diameter. Most oak trees larger than 10 inches in diameter will produce weak, short-lived sprouts or none at all if girdled in June. On such trees herbicides hasten the kill but are not necessary.

Sassafras, persimmon, willow, sumac, elm, cottonwood, and black locust are common woody species that sprout both from the stem and from the roots. Sprouts may appear on or near the stumps or on roots several feet away. Root-sprouting species usually are more difficult to control than those that sprout only from the stems. Some root-sprouting species retain their ability to sprout much longer than do the oaks and, if cut or girdled, sprout vigorously even after they have reached diameters of 12 inches or more. Chemical control methods are needed to kill even the large trees of many root-sprouting species.

To avoid damage to sensitive crop or garden plants, avoid using foliage sprays of 2,4,5-T or 2,4-D close to the crop or garden during the growing season. Areas of brush adjacent to cotton fields or garden plots can be treated with 2,4,5-T or 2,4-D during the dormant season or with ammate during the growing season. Likewise brush in grass-legume pastures may be treated in the dormant season to avoid damage to the legumes.

Remember that extremely weak solutions of 2,4,5-T and 2,4-D can damage or kill sensitive crop or garden plants and there is no practical cleaning method that will positively remove all traces of "brush killer" from the tank, lines, hoses, and nozzles of the sprayer. The only safe rule is—don't use your brush sprayer to kill bugs in the garden or orchard.

Buy 2,4,5-T and 2,4-D "brush killers" according to the cost per pound of 2,4,5-T or 2,4-D. Don't buy the mixture with the lowest cost per gallon unless it also has the lowest price per pound of acid. For general use be sure that you get an ester type formulation. Ester formulations can be used either in water or in oil. Most of the salt and amine forms cannot be used satisfactorily in oil.

The success of chemical treatments on woody plants should not be judged by immediate appearances such as the drying of leaves and small twigs. Final results should be based on root kill which will not be apparent until a year or more after treatment. If sprouts seem discouragingly thick after chemicals are applied remember that without chemical treatment they would have been both bigger and thicker.

Controlling the weed trees or brush is only part of the job. The farmer may have to add lime and fertilizer and plant grass or the forester may have to plant crop trees. Good range, pasture, or crop-land management is essential on cleared lands. Without good management the brush may be replaced by worthless weeds and low-value grasses or the land may be left bare.

GENERAL RECOMMENDATIONS FOR CONTROLLING WOODY PLANTS OF DIFFERENT SIZES

Size of Plant	Treatment ¹	Herbicide		Carrier		Concentration (Pounds per Gallon) ²
		2,4,5-T or 2,4-D	Ammate	Water	Oil	
Less than 6 feet tall	Foliage spray	X		X		0.025
			X	X		1.
6 feet tall to 4 inches diameter at base	Basal bark spray or stump	X			X	0.16
	Stump only		X	X		4. ³
4-10 inches diameter at base	Low frill or stump	X			X	0.16
			X	X		4.
Larger than 10 inches diameter at base	Frill	X			X	0.16
			X	X		4.

¹All these treatments except the foliage spray may be made at any time during the year. The foliage spray treatment should be made in late spring or early summer.

²See tables 2 and 3 for amounts of commercial 2,4,5-T or 2,4-D to use to get amount of acid indicated here.

³Ammate crystals, applied at the rate of one teaspoon per inch of stump diameter, are also very effective.

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