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BASAL APPLICATION OF HERBICIDES FOR CONTROL OF WOODY PLANTS

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During the past fifteen years numerous herbicides for control of woody plants have been evaluated at the Alexandria Research Center of the Southern Forest Experiment Station. Herbicides have proved effective as basal treatments when applied to cut surfaces, as basal stem sprays, or when applied directly to the soil at the base of trees. The method to use will depend largely on the species, size of stems to be treated, density of stand, and the herbicide that is used.

Cut-Surface Treatments

Frill Method

Frill applications of esters of 2,4,5—trichlorophenoxy acetic acid (2,4,5—T) kill undesirable species effectively on upland and bottom sites. Eight pounds of esters of 2,4,5—T in one hundred gallons of diesel oil is effective. Frills should be made near the ground and thoroughly saturated with the solution for good root kill. Best results were obtained when the hardwoods were treated during spring and early summer. Cost of chemical and labor is approximately 0.6 cent per inch of stem diameter measured 4.5 feet above ground level (d.b.h.) when 21 milliliters (ml.) (D/3 tablespoonfuls) of solution is applied per inch of diameter. For hardwood control near sensitive crop plants, a solution containing two pounds per gallon of ammonium sulfamate (AMS) in water is safer to use than 2,4,5-T.

Notch Method

Applications of AMS crystals at the rate of one-half ounce (one tablespoonful) per notch are effective when used throughout the year. Notches should be spaced four to six inches apart, edge to edge, around the base of trees at ground level for killing trees less than eight inches in diameter. Cost of chemical and labor is approximately 0.7 cent per inch of stem

diameter. AMS applied to stumps at this rate also controls sprouting effectively. The use of AMS for hardwood control has declined, since less laborious methods have been developed.

TABLE 12. Effect of esters of 2,4,5-T basal spray applied to bands of various widths on kill of blackjack oak after three growing seasons for treatments applied April, 1955, to February, 1957.*

Month	8-inch band	12-inch band	16—inch band	Average all bands
		Per cent kill		
April	82	92	78	84
July	80	63	83	75
October	85	67	60	71
February	90	85	78	84
Average	84	77	75	79

*Each band received 64 ml. of herbicide per inch of stem diameter of a solution containing eight pounds of acid equivalent per hundred gallons of diesel oil.

Basal Stem Spray

Trees less than eight inches in diameter can be killed by basal stem applications at all seasons of the year (Table 12). An effective treatment consisted of a solution containing eight pounds of acid equivalent of 2,4,5—T ester per hundred gallons of diesel oil sprayed on the lower 8—12 inches of the tree trunk at the rate on 48 ml. to 64 ml. (3*4 to 4 tablespoonfuls) per inch of stem diameter. The herbicide should be applied at pressures of fifteen to thirty pounds per square inch until the solution runs down the trunk to the root collar (Table 13). This treatment also is effective on stumps of felled trees provided the entire stump is wet with the solution. The cost to apply 48 ml. of solution per inch of trunk diameter is approximately-0.6 cent for chemical and labor.

Tree Injections

In recent years tools ‘have been developed for injecting herbicidal solutions into the base of trees. These tools must be sturdily constructed of corrosion-resistant materials and have heavy blades that are made of metal hard enough to remain sharp for considerable time but malleable enough to prevent breakage and to permit successful resharpening. Injections should be made into the sapwood near ground level, and the injector should be rocked slightly to form a pocket. The outer edges of the incisions must be level so that the solution will be retained in the pocket. An effective herbicidal solution can be made by mixing twelve to thirty-two pounds of acid equivalent to an ester of 2,4,5—T with one hundred gallons of diesel

TABLE 13. Effectiveness of esters of 2,4,5-T for control of blackjack oak when applied in a concentration of eight pounds per hundred gallons of diesel oil as basal spray treatments in May, 1958, and March, 1959, as shown by data recorded in September, 1959.

Methods of application	Tops dead		Trees with basal sprouts		Average of treatments	
	1958	1959	1958	1959	Tops dead	Trees with basal sprouts
	Per cent					
Spray lower 2" of stem and wet soil within 4" of trees	84	100	10	0	92	5
Cover soil and spray lower 12" of stem	84	100	10	4	92	7
Treat 12" band by conventional method	100	100	23	3	100	13
Protect soil and lower 4" of stem and spray 12" band above protected area	63	73	80	43	68	62
Cover stem and roots and spray 6" band on soil around trees	50	0	7	0	25	4
Girdle — no herbicide applied	56	3	70	100	30	85

oil. Approximately 8 ml. (one-half tablespoonful) of the solution should be applied in each incision. For red oak, post oak, blackjack oak, and the white oaks, injections should be spaced two inches apart, edge to edge, around the base of trees less than nine inches in diameter. Trees larger than nine inches require injections at one-inch intervals. The hard-to-kill species such as sweetgum, blackgum, elm, willow, water oak, and hickory need injections one inch apart for stems less than nine inches in diameter and one-half inch apart for those over nine inches in diameter (Table 14). The cost of using this method of treating hardwoods with esters of 2,4,5-T

TABLE 14. Proportion of blackjack and post oak trees killed within thirteen months after treatment with esters of 2,4,5-T applied with a new type tree injector. Injections were spaced two inches apart around the base of the stem.

Species and diameter in inches*	Average kill	
	Tree kill	Tops dead
	Per cent	
Blackjack oak:		
1-3	93	99
3-6	100	100
6-9	86	99
Over 9	63	97
Average all sizes	86	97
Post oak:		
1-3	100	100
3-6	100	100
6-9	•91	99
Average all sizes	97	99.7

*Ten trees were treated per plot for each size class of each species on two plots located at random with a solution containing twelve pounds of an ester of 2,4,5-T per hundred gallons of oil applied at the rate of 8 ml. per inch of stem diameter.

will range from 0.25 to 0.35 cent per inch of stem diameter, depending on density of stand, concentration of herbicidal solution, and the spacing of injections. Injecting 2,4,5—T in this manner is effective at all seasons of the year (Table 15).

TABLE 15. Average mortality in October, 1958, of blackjack oak trees two to ten inches in diameter treated during February, May, and October, 1956, with an ester of 2,4,5-T applied with tree injectors at the rate of 8 ml. per inch of trunk diameter.

Types of injectors*	February	May	October	Average all seasons
			Per cent kill	
Older	68	80	83	77
Newer	88	84	91	88

'Twenty trees were treated on each of two plots selected at random with a solution containing thirty-two pounds of 2,4,5-T ester per hundred gallons of diesel oil.

Soil Applications

The application of 3—(phenyl)—1.1 dimethylurea (fenuron) to the soil at the base of trees is more effective for controlling upland hardwoods than other herbicides tested by this method. Surface applications are effective when the herbicide is applied as a spray, as a finely ground powder, or in pellet form. The rate of application for effective hardwood control is two grams of active material for each four inches of trunk diameter (Table 16). The cost of chemical and labor for applying fenuron as a soil-surface treatment at this rate is approximately 0.5 cent per inch of trunk diameter. According to the information that is available, late winter or spring is the best time for applying fenuron to the soil for upland hardwood control. Also, effective control of trees less than nine inches in diameter is obtained when the chemical is injected adjacent to the underground axis

TABLE 16. Results obtained from applying fenuron as a soil-surface treatment to upland hardwoods in March, 1959, as shown by data recorded in September, 1959.

•Dosage per tree	Form of material	Trunk diameter	Top defoliation	Trees dead	Trees with sprouts
Grams		*Inches*		*Per cent*	
2	Pellets	1-4	92	72	0
2	Powder	1-4	92	68	5
4	Pellets	1-4	99	83	0
4	Powder	1-4	98	75	0
2	Pellets	4-8	78	30	0
4	Pellets	4-8	86	30	5
4	Powder	4-8	89	48	0
8	Pellets	4-8	99	50	5
8	Powder	4-8	99	68	16

of the tree. Injections should be made to a depth of three to four inches, and one injection is required for each two inches of tree diameter.

Fenuron should not be applied in the root zone of desirable plants.-

Summary

Several methods for basal application of herbicides to woody plants have been developed. Solutions containing eight pounds of 2,4,5—T per hundred gallons of oil or two pounds of ammonium sulfamate per gallon of water are effective for killing trees when applied in frills made around tree trunks near ground level. For cut-surface treatments, good kill of trees under eight inches in diameter can be achieved at all seasons by applying one or two tablespoons of ammonium sulfamate crystals per notch in notches spaced four to six inches apart around the base of trees. This treatment, when applied on stumps of felled trees, also controls sprouting.

Trees under eight inches in diameter can be killed at all seasons of the year by thoroughly wetting the lower eight to twelve inches of the trunk with esters of 2,4,5—T applied in a concentration of eight pounds per hundred gallons of oil. This treatment also is effective when applied to stumps.

Injections of a solution containing twelve to thirty-two pounds of esters of 2,4,5—T per hundred gallons of oil into the sapwood at the base of trees is effective for killing woody plants throughout the year when injections are made one-half to two inches apart.

Upland hardwoods are killed by a soil application of fenuron near the base of trees at the rate of two grams per each four inches of trunk diameter during late winter and spring.

The cost of chemical and labor is about 0.3 cent per inch of trunk diameter for injecting the herbicide with an injector, compared to 0.5 cent for soil application. Basal spraying and applying a solution of 2,4,5—T in frills cost about 0.6 cent per inch of diameter, while the old method of killing hardwoods with ammonium sulfamate in notches costs about 0.7 cent per inch.

DISCUSSION

Question: It appears that in tree injection work, the 2,4,5—T has to be absorbed in the tree in order to do the work. Why not use water instead of oil?

Mr. Peevy: Water is used to some extent, but experience indicates that in some seasons of the year oil works better than water.

Question: A better kill results?

Mr. Peevy: Yes. The same thing happens in the case of frill applications. A quicker kill and less basal sprouting occurs with 2,4,5—T in oil.

Question: (Continued)
This may be true, but in the long run will there be as complete a kill with water as with oil solutions?

Mr. Peevy: During the main growing season fairly good kills occur when herbicides are used in water solutions. I have not thoroughly explored the comparison between water and oil.

Question: What is the extent of the residual effect of fenuron? Would it all be used up in a year or two?

Mr. Peevy: It takes about two growing seasons. Hardwoods were treated at Alexandria, Louisiana, with fenuron, and pine trees Were planted within one foot of them after one and two growing seasons subsequent to treatment. Some kill occurred among the pines that were planted one year after the hardwoods were treated with fenuron, but little, if any, damage occurred during the second year.

Question: What is the correct level of application?

Mr. Peevy: Two grams (as active material) per four inches of tree diameter. Fenuron does not come in 100 per cent active material. The pellets are 25 per cent active, and the powder material is 80 per cent active, I believe.

Question: Have you tried fenuron on the cabbage-palm?

Mr. Peevy: No.'

Question: There are many manufacturers of the 2,4,5—T solution, all having four pounds of acid per gallon of 2,4,5—T, and each claims a superior ester for use in forestry. Is there any real difference in effectiveness?

Mr. Peevy: There are a number of ways in which the solution of 2,4,5—T can be applied, but three different esters were tried experimentally and, as far as has been determined, there was not any significant difference in the quality of the three formulations.

Question: Is a combination of 2,4—D and 2,4,5—T as good for frills or injection as straight 2,4,5—T?

Mr. Peevy: I have not made that comparison.

Question: What method do you use in applying fenuron?

4/r. *Peevy:* There are several different methods. In some early tests injections were made in the soil at the base of the trees with a special injector; later, a spray of the soil around the base of the tree was used. In more recent tests the finely ground powder has been applied around the base of the tree. That is also the way the pellets were applied. Any of these methods will kill trees, but applying the pellets is less laborious than the other methods.

Question: Is there any residual effect of the fenuron powder? Would it affect pine seedlings in the same area? What about planting shortly after its application?

Mr, Peevy: At least two years' wait before planting pine is indicated. Further testing is needed to confirm this.

Question: How long do you expect the potency of this to last in the soil?

Mr. Peevy: As far as pine is concerned, it would probably continue for two to three growing seasons after the material is applied.

Question: How far will the fenuron drift from the tree to which it has been applied?

Mr. Peevy: No examples of lateral movement in the soil have been observed. There may be cases where some occur.

Question: Is there any noticeable effect on the surrounding vegetation?

Mr. Peevy: Yes, but this probably occurred because the roots of the affected plants were reaching into the zone of application of the fenuron.

Question: Is fenuron poisonous to livestock?

Mr. Peevy: No.