OCCASIONAL REPORT NUMBER 9

AUGUST 1961

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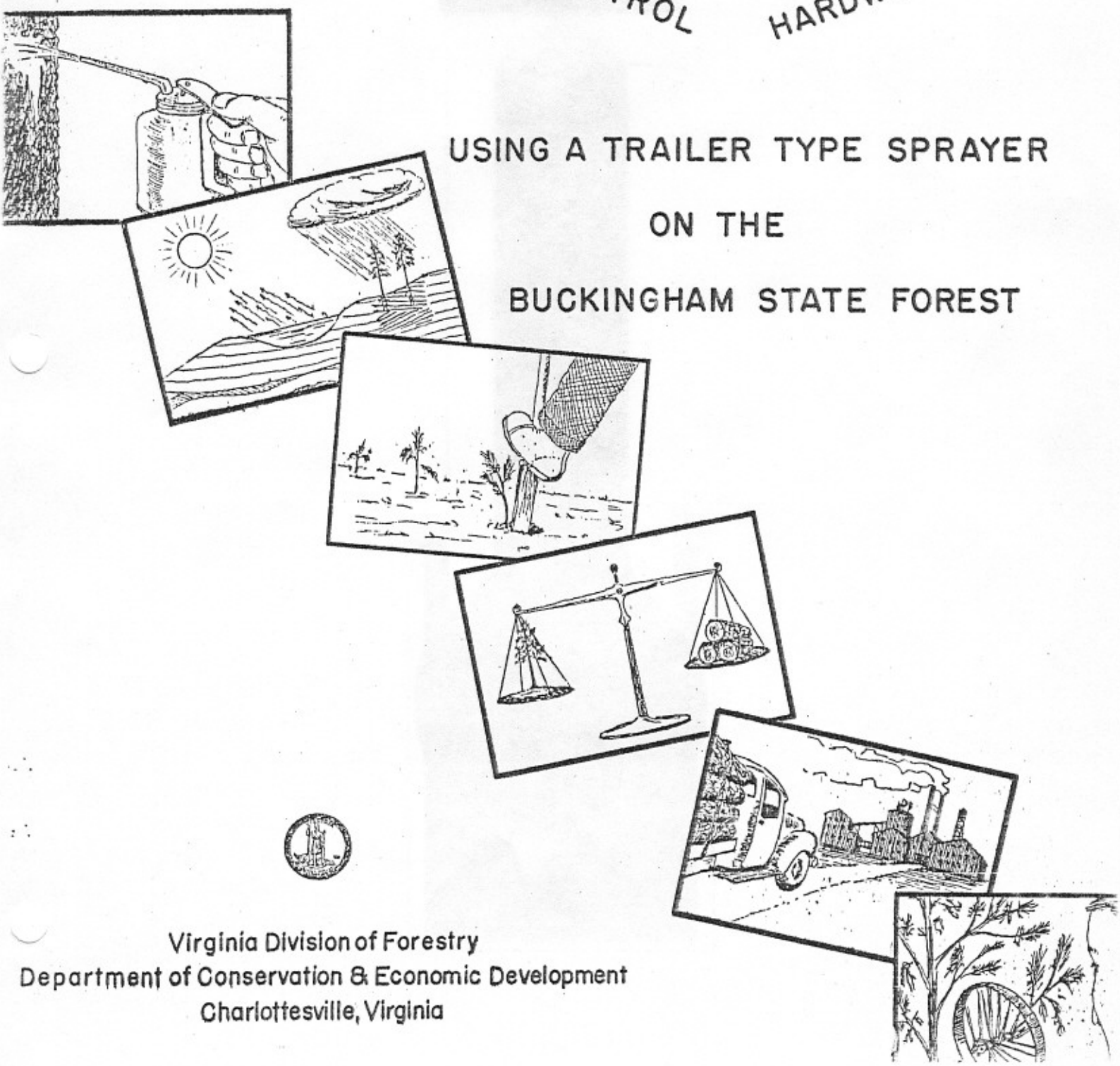


Virginia Division of Forestry
Department of Conservation & Economic Development
Charlottesville, Virginia

Foliage Spraying to Control Hardwoods
Using a Trailer-type Sprayer on the Buckingham State Forest

Summary

Foliage spray tests to control brush-type hardwoods up to 25 feet in height were installed on the Buckingham State Forest during the early summer of 1959 and 1960. A trailer-type spray rig pulled by a TD-9 tractor was used to apply the spray.

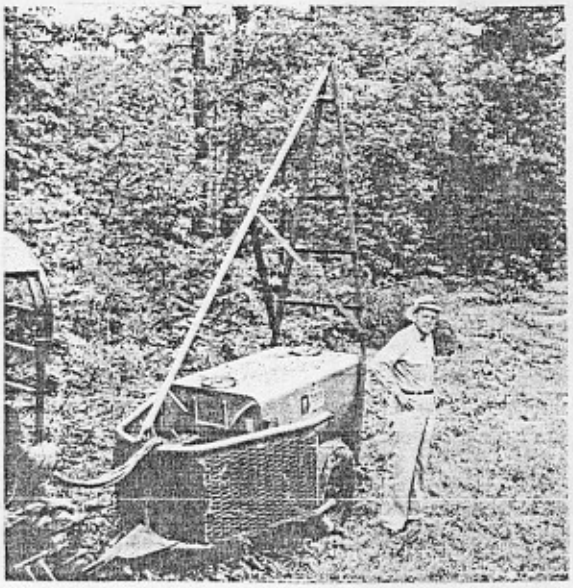
Different spray treatments including various combinations of acid (2,4,5-T) and fuel oil, and acid alone were tested. Water was used as the carrier in all treatments.

It was found that satisfactory hardwood control could be obtained using spray mixtures as low as 1½ pounds acid plus ½ gallon fuel oil per acre. Chestnut oak sprout growth and red maple proved the most difficult hardwood species to kill. Spray concentrations of up to 2 pounds acid plus 1 gallon fuel oil per acre damaged pines present at time of spraying only slightly.

Introduction

During the summers of 1959 and 1960 a trailer-type sprayer was used on the Buckingham State Forest to establish a series of foliage spray test plots using chemicals. The purpose of the test plots was two-fold: 1) to test the effectiveness of a trailer-type sprayer as a hardwood control unit and 2) to test different spray treatments for effectiveness on various hardwood species.

The Sprayer Used



A front and side view of the spray-rig used.

The sprayer in operation.

A Hudson (Peerless) Sprayer was used throughout the tests and is a special sprayer for brush and woods use.

Some facts concerning the sprayer are:

1. Tank - capacity, 250 gallons. Stainless steel with stainless steel agitator and fittings with large openings for filling. There are also baffle plates fitted inside and drain plugs attached.

2. Pump - Briggs and Stratton, 4 cycle engine powered (8HP). A 10 gallon per minute capacity pump capable of producing up to 800 pounds pressure. Inert to spray materials.

3. The unit is mounted on a heavy duty trailer with 7.60 - 15 implement tires and adequate protection, armor, etc., afforded the unit.

4. Heavy A - frame type boom for the three broad spray heads, braced well and hoses protected against destruction by brush. The spray heads are approximately 12 feet from ground level.

5. Spray Coverage - A swath 40 feet wide and up to 25 feet in height. Without interception, the swath is at least 10 feet wider.

Any crawler-type tractor may be used to pull the spray unit. For the Buckingham State Forest test a TD-9 tractor was used. Cover conditions will dictate the tractor size needed.

A "nurse" tank unit of some sort is called for when using the Hudson Sprayer. Large amounts of water are needed and must be readily accessible if the operation is to be an efficient one. For the Buckingham tests a stake-body truck was used which had mounted on it a steel tank which held 450 gallons of water. This truck and tank served as the supply unit for the tractor and trailer-sprayer unit.

Description of Area Sprayed

Typical cut-over Piedmont timberland conditions prevailed which provided for a variety of stand conditions.

Generally, a two-story hardwood crown canopy level existed with the lower crown canopy predominating. A considerable portion of the lower crown canopy level was comprised of stump sprouts.

Tree species present include chestnut oak, hickory, other oaks, dogwood, red maple, and black gum.

Spray Formulations Used

Water was used as a carrier and the following spray formulations were tested (on a per acre basis):

1. 3.4 pounds acid (Esterone) + 1.7 gallons fuel oil + water
2. 2 pounds acid (Weedone) + 1 gallon fuel oil + water
3. 2 pounds acid (Weedone) + ½ gallon fuel oil + water
4. 1½ pounds acid (Weedone) + 1 gallon fuel oil + water
5. 1½ pounds acid (Weedone) + ½ gallon fuel oil + water
6. 1 pound acid (Weedone) + 1 gallon fuel oil + water
7. 1 pound acid (Weedone) + ½ gallon fuel oil + water
8. 2 pounds acid (Forron) + water
9. 1 pound acid (Forron) + water

On the average approximately 85 gallons of spray mixture per acre were used. A typical breakdown of spray components using 2 pounds acid and 1 gallon of fuel oil per acre follows:

0.5 gallon 2,4,5-T (4 pound acid equivalent)
1.0 gallon fuel oil
83.5 gallons water

85.0 gallons, total

Because of rough terrain it became necessary to use approximately 85 gallons of spray mixture per acre due to slower travel time.

Chemicals Used

Dow Chemical Company's Esterone 245 OS (contains 4 pounds 2,4,5-T acid equivalent per gallon of propylene glycol butyl ether esters) and Forron 245 (contains 2 pounds of 2,4,5-T acid equivalent per gallon of propylene glycol butyl ether esters plus special penetrants and wetting agents).

AmChem's Weedone 2,4,5-T (contains 4 pounds 2,4,5-T acid equivalent per gallon of butoxy ethanol ester).

All the chemicals listed above are classified as low volatile esters.

Time of Spraying

The area sprayed using Esterone was sprayed on July 14 and 15, 1959.

The remaining spraying work took place in 1960 between June 13 and July 5.

It is generally conceded, for maximum effectiveness using 2,4,5-T esters to control hardwoods, that the leaves should be fully expanded and developed and that the trees should be actively growing. The hardwood leaves were fully developed when sprayed during the 1959-60 spray tests on the Buckingham State Forest and moisture conditions were such that growth should have been active.

Effectiveness of the Various Spray Treatments Used

Two items, 1) percent defoliation and 2) amount of resprouting are ordinarily used to evaluate the effectiveness of hardwood control measures. Resprouting in the 1959 and 1960 spraying tests on the Buckingham proved insignificant so percent defoliation alone was used as the main criterion to determine spray effectiveness one year following treatment.

Spray treatments were intensively sampled using plots and because the effective spray height reached no higher than 25 feet no hardwood trees over 25 feet in height were considered in the evaluation of treatments. The degree of spray damage to the hardwoods listed in the tables below refers only to trees 25 feet in height or less. "Severe damage" refers to those trees which are 50 percent or more defoliated. The various spray treatments and results are summarized in the following table:

Percent Severe Damage

Spray Treatment	Species[1] CO	WO	RO	G	M	H	O	Pine Damage[2]
3.4# acid + 1.7 gal. oil (Esterone)	--[3]	81.0[4]	79.3	89.2	47.0	50.0	100.0	14.0
2# acid + 1 gal. oil (Weedone)	52.1	66.7	82.6	93.8	50.0	66.6	50.0	0
2# acid + ½ gal. oil (Weedone)	--	--	94.1	89.5	33.3	100.0	--	0
1½# acid + 1 gal. oil (Weedone)	85.7	100.0	90.0	100.0	100.0	100.0	--	5.0
1½# acid + ½ gal. oil (Weedone)	100.0	87.5	90.0	100.0	66.7	60.0	--	0
1# acid + 1 gal. oil (Weedone)	22.7	75.0	84.6	100.0	--	60.0	75.0	0
1# acid + ½ gal. oil (Weedone)	44.4	36.8	56.5	93.1	100.0	80.0	100.0	0
2# Forron	66.7	91.7	73.8	94.6	60.0	71.4	--	0
1# Forron	59.5	80.0	63.3	85.4	--	100.0	66.7	3.0

1/ Species are as follows: CO-chestnut oak, WO-white oak and post oak, RO-red oak, G-black gum, M-red maple, H-hickory, and O-dogwood, persimmon, yellow poplar, ash, and sourwood.

2/ Pines present included shortleaf, loblolly, and Virginia. All pines tabulated were less than 25 feet in height so were within effective spray pattern. These pines were advance reproduction of natural shortleaf and Virginia pine and planted loblolly pine up to 8 years of age.

3/ -- indicates too few trees available for inclusion in data.

4/ Chestnut and white oak grouped in 1959; however, majority of these trees were chestnut oak.

Typical "Before" spraying photo. Note amount of hardwood undergrowth present.

Typical "After" photo of sprayed area. 2 pounds acid (Forron) per acre applied. Note how "open" the stand appears. Photo taken one year following spraying.

Hardwoods killed by spraying 2 pounds acid (Forron) per acre. This height hardwood growth was effectively covered and controlled.

Planted loblolly pine unaffected by spraying 2 pounds acid (Forron) per acre. Photo taken one year following spraying.

Spray Effectiveness Discussed

Generally, all spray treatments using at least 1½ pounds acid + ½ gallon fuel oil per acre gave satisfactory control of hardwood trees up to 25 feet in height for a release of pine reproduction.

Only slight hardwood control differences are discernible comparing 1 pound acid vs. 2 pounds acid of Forron per acre. Both treatments appear effective in release of pine reproduction.

Some of the heavier spray concentrations ie. (3.4 pounds acid + 1.7 gallons fuel oil) gave enough hardwood control so that pine seedlings could be planted on the area and a satisfactory stocking of free to grow pine seedlings obtained. This was borne out on the Esterone treated area which was hand planted in the spring of 1960 at which time approximately 1,000 loblolly pine seedlings per acre were planted. Stocking following the first growing season was 606 $\pm$ 105* loblolly pine seedlings free to grow.

Chestnut oak and red maple proved to be the most difficult species to control. It is thought that chestnut oak offered so much difficulty to control because a large percentage of the chestnut oak was of stump-sprout origin and that in these sprouts an insufficient amount of 2,4,5-T was translocated to an extensive root system due to the relatively small top or crown surface offered. No such explanation is available for red maple.

Easier to control species include red and white oaks, and black gum. Fair control of hickory was obtained.

The Trailer Spray-Rig Discussed

A trailer spray-rig such as the one used in these tests has its place in hardwood control. This trailer-sprayer provides another means of using and applying chemicals for hardwood control purposes.

The spray-rig here described in this report does not have universal usage irrespective of the hardwoods present to be controlled. Size of the hardwoods present is important. The sprayer has definite physical limits with respect to spray swath and height of spray coverage. The sprayer will not spray higher than 25 feet so if control of hardwoods more than 25 feet high is desired other control measures must be used. This should not necessarily limit the use of such a sprayer to just those hardwood stands under 25 feet in height. For example, many hardwood stands have a dense stand of hardwood trees less than 25 feet in height with only a comparative light overstory of larger trees. In a stand such as this an economical operation might consist of controlling the smaller hardwoods using the sprayer and controlling the larger overstory hardwoods using hand methods.

Large volumes of water are needed, and should be nearby, if the spray operation is to be efficient.

* 5 percent level of probability (19 out of 20 times)

The spray unit used was durable and easy to transport.

Drift is not as serious a problem since the spray mixture comes out as a spray and not broken down into a mist. Therefore, more working time should be available and spray coverage more uniform.

The costs involved using this sprayer appear reasonable.

Costs Mentioned

Costs for spraying a 37 acre area using the Hudson Peerless sprayer are included. These costs are based on a spray application of 3.4 pounds acid plus 1.7 gallons of fuel oil per acre and include "flagging" costs. "Flagging" or marking lines for the tractor and spray unit to follow are usually necessary if adequate spray coverage is to be obtained.

The itemized costs for the 37 acres are:

Spraying to control hardwoods under 25 feet in height:

Tractor Cost (TD-9) $12.00 / hr. @ 11 hrs. ----------	$132.00
Other Labor 2 men @ 11 hrs. @ $1.00 / hr. ----------	22.00
Chemical (Esterone 2,4,5 OS - 4 lbs. acid equivalent) 31.25 gal. @ $8.73 / gal. ----------	272.81
Fuel Oil 62.5 gal. @ $0.15 / gal. ----------	9.37
Total----------	$436.18
Cost per acre (37 acres treated):1/ $436.18 / 37 ----------	11.792/

1/ Truck time was not charged because it was not known what rate should be used for this cost. However, the man's time operating the truck was included in the above costs.

2/ By reducing the amount of chemical sprayed per acre to 2 pounds acid plus 1 gallon fuel oil the cost per acre averages approximately $8.68 per acre.

Hand Release for Hardwoods over 25 feet in height:[1/]

Labor	
Foreman, 38 hours @ $1.45	$ 55.10
Other, 144 hours @ $1.00	144.00
Material	
2,4,5-T (4 pound acid equivalent) 1 gallon @ $7.85	7.85
Kerosene, 35 gallons @ $0.15	5.25
Total	$212.20
Cost per acre (37 acres) $212.20 / 37	$5.73
Total cost per acre to control hardwoods: $8.68[2/] plus $5.73	$14.41

1/ Axe frill method using 2,4,5-T mixed with kerosene.

2/ Adjusted cost of $8.68 per acre used because it was demonstrated on other similar areas that satisfactory control was obtained using 2 pounds acid plus 1 gallon oil per acre.

August 1961

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