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Releasing Young Hardwood Crop Trees—Use of a Chain Saw Costs Less Than Herbicides

Gary W. Miller



The Author

Gary W. Miller, economist, received a B.S.F. and M.S.F. in forest resources management from West Virginia University and attended the University of Pittsburgh. Since 1981, he has conducted research in timber management with the USDA Forest Service, Northeastern Forest Experiment Station, Timber and Watershed Laboratory, Parsons, West Virginia.

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Abstract

A crown-touching release of 12-year-old black cherry and yellow-poplar crop trees on a good site required removing an average of 14 trees for every crop tree. An average of 80 crop trees per acre was left free-to-grow with an average growing space of 4.7 feet on all sides of the crown. Basal spraying cost \$0.80 per crop tree, stem injecting cost \$0.61 per crop tree, and chain saw felling cost \$0.42 per crop tree. Cost indicators for each release method and suggestions for cost savings are provided.

Introduction

Forest managers contemplating crop-tree release need to consider at least three factors that determine the effectiveness and efficiency of release treatments: First, the criteria for recognizing potentially responsive hardwood stands and individual crop trees within those stands; second, the degree of release needed to increase growth of selected trees; and third, the application of release—applying the desired treatment at the lowest possible cost.

In support of the first factor, recent research indicates that Appalachian hardwood crop trees had a significant d.b.h. growth response to release when the seedling and sprout origin codominant trees in the stand were at least 25 feet tall (Lamson 1983, Smith and Lamson 1983). Apparently, until the stand is about 25 feet tall, codominant trees have not competed for crown position long enough to permit natural selection of superior trees. In shorter stands, crown classes are not stable, often resulting in crown-class regression and inconsistent growth responses following release (Trimble 1973, 1974, Smith 1979).

The degree of release is also important. Positive results were obtained when seedling origin crop trees were released by cutting all competing trees touching or within a vertical projection of the crop-tree crown—a crown-touching release (Smith and Lamson 1983). Sprout origin crop trees had a significant d.b.h. growth response when released to a free-to-grow position by cutting all but one or two stems per clump (Lamson 1983). Bole releases, where stems within a specified distance of the crop-tree bole are eliminated, do not always provide a complete crown release for some species. It is important, therefore, to concentrate on the crop-tree crown when applying the release treatment.

This paper summarizes cost information for release. The costs of mechanical and chemical treatments for releasing crop trees in a 12-year-old Appalachian hardwood stand are compared. The cost information reported here was recorded during a crown-touching release of crop trees measuring 30 to 35 feet tall.

Study Methods

Two options exist for eliminating unwanted trees when releasing young hardwoods. Competing trees can be chemically treated by either stem injection or basal spraying with an appropriate herbicide, or they can be cut mechanically. In this study, crop trees

were released by injecting, basal spraying, and chain saw felling unwanted stems to define the least-cost method of release.

Cost data were collected in a 12-year-old Appalachian hardwood stand that contained about 2,700 stems per acre, totalling 77 square feet of basal area per acre in trees 1.0-inch d.b.h. and larger (Fig. 1). More than 80 percent of the trees were less than 3.0-inches d.b.h. Most of the dominant and codominant stems were seedling-origin black cherry, *Prunus serotina* Ehrh., and yellow-poplar, *Liriodendron tulipifera* L. Some red oak, *Quercus rubra* L., sprout clumps were also present.



Figure 1.—Crop trees were severely crowded before release.

We selected 80 crop trees per acre based on the following criteria:

- Species—black cherry or yellow-poplar
- Crown class—dominant or codominant
- Origin—seedling preferred
- Stem form—straight stem, few forks
- Vigor—full, healthy crowns, no dead tops

In some instances, other species or sprout origin trees were selected as crop trees because they were the best available tree at the desired location. Cut trees were mostly black cherry, sweet birch, *Betula lenta* L., and red oak sprout clumps.

After crop trees were selected in each study area, all trees (1.0-inch d.b.h. and larger) whose crowns touched or were within a vertical projection of the crop-tree crown were marked with orange paint. An experienced worker then injected all marked trees. To make a direct cost comparison, the same worker went back into the plot and basal sprayed all the marked trees. Finally, the worker felled the marked trees with a chain saw.

During each of the three treatments, an observer recorded the time required to complete the operation, the number of trees treated, and the number of injections required during the injection treatment. The amount of herbicide mix needed to complete each operation was recorded, as were delays associated with each treatment such as fill-ups and rest breaks.

Basal spraying, stem injection, and chain saw felling were compared on two separate plots within the same stand. The first area measured 0.25 acres, the second 0.43 acres. Additional cost data on chain saw felling were collected on two 1-acre plots installed to study the long-term effects of the crown-touching release. A ¼-acre measurement plot within each 1-acre treatment area provided data on individual trees.

Results

Releasing 80 crop trees per acre required removing 1,082 stems per acre, or 14 per crop tree. Following treatment, crop trees were left free-to-grow with an average growing space of 4.7 feet on all sides of the crown. A comparison of basal spraying, stem injection, and chain saw felling indicated that felling eliminated unwanted stems at the lowest cost—about \$0.42 per crop tree. Moreover, felling revealed 60 additional competing trees per acre that were not apparent during the basal spraying and injection treatments.

Basal Spraying

An experienced worker using a backpack sprayer treated 309 stems per hour with a 4-percent mixture of 2,4-D ester in oil. The treatment required 3.5 man-hours per acre and 18 gallons of chemical mixture per acre (Table 1). The total treatment cost was \$64.00 per acre or \$0.80 per crop tree.

Stem Injection

The workers injected an average of 204 trees per hour in the study

plots. This treatment required 5.3 man-hours per acre and 1 gallon of chemical solution per acre. The cost of the chemical, a 20 percent solution of glyphosate found to be effective in killing most hardwoods (Wendel and Kochenderfer 1982), was \$17.00 per gallon (Table 1). Labor and chemicals combined resulted in a total treatment cost of \$48.80 per acre or \$0.61 per crop tree.

Chain Saw Felling

The workers felled approximately 260 stems per hour. This method of release required 4.1 man-hours per acre and 3.2 machine hours per acre. The total cost, including labor and the fixed and operating costs of a Pro Mac 800¹ chain saw, was \$33.60 per acre or about \$0.42 per crop tree.

¹The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture or the Forest Service of any product or service to the exclusion of others that may be suitable.

Table 1.—Average time, volume of chemical, and cost per crop tree to apply a crown-touching release in 12-year-old Appalachian hardwood stands

Treatment	Labor ^a		Machine ^b		Chemical		Total cost
	Time	Cost	Time	Cost	Volume	Cost	
	Minutes	Dollars	Minutes	Dollars	Gallons	Dollars	Dollars
Basal spraying	2.6	0.28	—	—	0.23	0.52 ^c	0.80
Stem injection	4.0	.44	—	—	.01	.17 ^d	.61
Chain saw felling	3.1	.34	2.4	0.08	—	—	.42

^aLabor cost: \$5.00 + 31 percent fringe benefits = \$6.55 per hour.

^bMachine cost: \$2.12 per productive hour for chain saw, negligible for other treatments.

^cChemical cost: 4 percent mixture of 2,4-D ester in oil = \$2.26 per gallon.

^dChemical cost: 20 percent solution of glyphosate = \$17.00 per gallon.

Discussion

The total cost of labor was highest for stem injection. While unwanted stems in the felling and basal spraying operations could be treated from one side, injection required the workers to walk around trees to properly space the injections. The added walking and difficulty of movement through the dense young stand combined to reduce productivity for injection.

Treatment costs can be reduced by selecting fewer crop trees per acre and by eliminating fewer trees per crop tree (Table 2). More than 60 percent of the trees eliminated in accordance with the crown-touching release guidelines were overtopped before treatment. In this study, if overtopped trees had been ignored, the release would have required eliminating only about six trees per crop tree. Chain saw felling, however, would still have been the least-cost method.

What about sprouts from cut stumps? Stump sprouts in clearcuts can attain a height of about 35 feet in 10 years (Wendel 1975, Lamson 1976). Crop trees selected in this study averaged 34 feet at the time of treatment. Assuming released crop trees grow about 2 feet per year (Smith and Lamson 1983, Lamson and Smith 1978), in 10 years the crop trees will be more than 50 feet tall. With crown closure among crop trees inhibiting the height growth of stump sprouts, crop trees should maintain a distinct height advantage over stump sprouts in stands similar to the study area.

Another advantage to chain saw felling is that it assures that all unwanted trees are eliminated. As trees are felled in favor of a selected crop tree, the operator can recognize competing trees at a glance. Because the herbicide treatments leave competitors standing, trees can be missed or left alive, leaving crop trees only partially released. This problem is magnified during the growing season when trees are in full leaf. With chain saw felling, the operator simply continues cutting until light encircles the crop-tree crown, regardless of the season.

Table 2.—Cost of selecting^a and releasing various numbers of crop trees using three methods of release

Crop trees per acre	Basal spraying	Stem injection	Chain saw felling
	----- Dollars/Acre -----		
50	46.97	37.47	27.97
60	56.36	44.96	33.56
70	65.76	52.46	39.16
80	75.15	59.95	44.75

^aSelecting crop trees in young hardwood stands required about 1 hour for every 47 crop trees selected (Smith and Lamson 1983).

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Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.



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Miller, Gary W. **Releasing young hardwood crop trees—use of a chain saw costs less than herbicides.** Res. Pap. NE-550. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1984. 5 p.

A crown-touching release of 12-year-old black cherry and yellow-poplar crop trees on a good site required removing an average of 14 trees for every crop tree. An average of 80 crop trees per acre was left free-to-grow with an average growing space of 4.7 feet on all sides of the crown. Basal spraying cost \$0.80 per crop tree, stem injecting cost \$0.61 per crop tree, and chain saw felling cost \$0.42 per crop tree. Recommendations on release methods and suggestions for cost savings are provided.

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