PROCEEDINGS

of

FORTY-SIXTH

INTERNATIONAL SHADE TREE CONFERENCE

August 8 - 13, 1970

ROCHESTER, NEW YORK

CONTROL OF SUCKER GROWTH ON UTILITY PRUNED TREES

M. R. Gardner

Assistant District Forester–Vegetation Control
Head Office Forestry Department
Hydro Electric Power Commission of Ontario

Introduction

Funding for nonessential maintenance work is, in a public utility, very often on a tenuous basis when the money market is depressed by slow conditions in the economy, or by deliberate government policy of economic manipulation, aimed at curbing inflation. In the large utilities where increasing capital is required for construction to maintain the current doubling of generation capacity every 7 years, budget restrictions may require the delay of work for which there is no apparent or immediate return. Maintenance programs must, by necessity, be efficient and effective over as long a period or cycle as possible. Any avenue which will moderate rapidly increasing labor and equipment costs must be evaluated.

Where such avenues apply to arboricultural practice, and tree trimming specifically, in a single utility covering some 250,000 square miles and serving some 2,350,000 customers, a relatively small reduction in time spent pruning individual trees will realize substantial savings on the whole system. In Ontario Hydro alone, excluding municipal mileage, this system as of the year ending 1969 consisted of some 20,037 miles of transmission lines and 51,320 miles of rural distribution lines (1). The personnel of the Ontario Hydro Forestry Department pruned and removed some 756,907 trees during 1969 spending some 731,842 man-hours so doing; giving an average man-hour per tree of 0.97 (7). Potential savings over the system through the use of a fortified tree wound dressing to prevent suckering of pruned trees was outlined in a previous paper (6). It was felt that 0.2 man-hours could be saved per tree on fast-growing species for each cycle. This would represent a substantial saving in money and man-hours expended for this aspect of system maintenance. Specific savings by various utilities are rarely published. Possible savings have been mentioned by Cran (4) and Phillips (9).

Research into growth regulating chemicals of both the fortified tree wound dressing and the foliar spray type has been undertaken by Ontario Hydro. Some of this work has already been published (5, 6). It is intended that an extensive report with specific results and recommendations will be completed at the beginning of 1971, along with an assessment of foliar treatments for new "improved appearance" transmission lines where substantial amounts of vegetation are to be left for aesthetic purposes. It is intended here to present only the provisional analysis of the more suitable tree wound dressings.

Materials and Methods

In a previous paper (6) the author presented the hypothesis that accelerated occlusion of large cambial wounds where limbs have been removed, may naturally reduce the auxin stimulation of adventitious and dormant buds. Thus, evaluation of suitable growth regulation materials has encompassed two main criteria: a) the ability to suppress adventitious and dormant bud break and, b) the relationship between such suppression and the rate of callus formation. A third parameter of appearance after treatment of both the immediate wound area and surrounding foliage was also employed on a subjective basis in the overall evaluation. A number of the experiments did not produce significant numbers of suckers in the first season and are not reported here. However, three experiments produced meaningful results.

They were conducted on black willow, *Salix nigra* Marsh, yellow willow, *S. babylonica* L., and False Chinese elm, *Ulmus pumila* L.

Individuals of these species with a height ranging from 25 to 60 feet had one large limb removed with a power saw from an Asplundh lift. These treatments would normally be at a point two-thirds of the way up the tree. In the larger trees it was possible to accomplish more than one cut on widely separated limbs from the aerial bucket. Treatment was made immediately after cutting and specific care taken to cover the surrounding cambial tissue, especially below the cut where there is a higher frequency of bud development. Where any existing suckers were noted in the immediate vicinity of the cut, these were removed by cutting. Each cut was tagged with a metal or plastic tag. Wherever possible, a drop-crotch pruning method was used as has been standard practice throughout Ontario Hydro. The size of limb would vary from two inches minimum to ten inches maximum. A minimum of five replications of each treatment were made and the results treated statistically. Treatment dates were: experiment 1, July 2, 1969; experiment 2, June 24, 1969; and experiment 3, May 26, 1969. Evaluation dates were: experiment 1, September 24, 1969, experiment 2, September 22, 1969, and experiment 3, September 22, 1969. Average daytime temperature at time of treatment for experiment 1 was 76°F and experiments 2 and 3, 59°F.

The chemicals used in this study are detailed in Table 1. Briefly the known active components are the ethyl ester of naphthalene acetic acid, the chlorethyl ester of ethrel, the morphactin, methyl-2 chloro-9-hydroxy-fluorine-(9)-carboxylate and aphenolic modified tall oil, pentaerythritol ester. Various application methods and carriers were utilized. Treatments A, B, C, D, M, N, and O were heavy bituminous tree wound dressings applied with a brush. Treatments E, F, and PE were in asphalt aerosol cans. Treatments H to K were aerosol formulations with a solvent carrier. Treatment G was an invert emulsion, while treatment L was a spar varnish applied with a brush.

Evaluation of growth inhibition by subjective evaluation is not sufficient where the experimental methodology is required to differentiate between relatively small differences among a number of treatments. Gross changes may be readily discerned. However, a statistical evaluation is required for adequate discrimination of effects and subsequent recommendations, where a large scale research project has been undertaken.

Measurements were made of the number of suckers and their average length, whether above or below the cut, and at what distance. These measurements were made by one observer and were in inches. The rate of occlusion was noted and the callus growth was recorded in tenths of inches. Observations were made as to condition of any suckers, cambium health, and leaf epinasty or chlorosis on surrounding limbs. Paint condition since time of treatment was recorded. Each of these experiments will be reevaluated in September of 1970.

The author experienced some difficulty in arriving at a reliable method of dealing with sucker growth for comparison purposes. That chemical which gives the minimum woody growth is taken to be the most effective. This is done by multiplying the number of suckers with the average length of the suckers and dividing the product by the number of treatments. Table 3 includes the statistical analysis by Punhani (10) of callus growth for each of the treatments. In carrying out the analysis of these experiments, a completely randomized design was used. In order to achieve uniformity and homogenity, some data were rejected and some missing values were filled in by taking the average of the available replications for a treatment in which the missing value was found. The statistical treatment for the analysis of variance for completely randomized design is explained in Cochran (3).

Table 1. Details of commercial materials used.

Research Designation	Trade Name	Chemical Name	Manufacturer
A	Amchem 69-26	Naphthalene acetic acid ethyl ester	Amchem
B	Amchem 69-27	Not available	Amchem
C	Amchem 69-28	1% 2 Chloroethyl-ester of Ethrel	Amchem
D	Amchem 69-29	1% 2 Chloroethyl-ester of Ethrel + 1% EtNAA	Amchem
E	Maintain CF 125	1/4% methyl-2-chloro-9-hydroxy-fluorine-(9)-carboxylate in asphalt	U.S. Borax
F	Asplundh Spray	1% naphthalene acetic acid	Asplundh
G	Maintain CF 125	1/4% in an invert emulsion	U.S. Borax
H	Maintain CF 125	1/4% in a solvent carrier	U.S. Borax
I	Maintain CF 125	1% in a solvent carrier	U.S. Borax
J	CF 125	1/2% in a solvent carrier	U.S. Borax
K	CF 125	1/8% in a solvent carrier	U.S. Borax
L	Spar varnish	Phenolic modified tall oil pentaerythritol ester	CIL Paint Division
M	Sturgeons - Hydro research material	1% naphthalene acetic acid in heavy asphalt	
N	Sturgeons H-11	Asphalt	Sturgeons Company
O	Sturgeons - Hydro research material	1% methyl-2-chloro-9-hydroxy-fluorine-(9)-carboxylate	
P	Untreated Control		
PE	Amchem Spray Tre-Hold	1% naphthalene acetic acid	Amchem

Results and Discussion

In examining the information for sucker control (Table 2), it can readily be seen that many treatments exerted some measure of retardation in comparison with the untreated controls, while some treatments appeared to accelerate sucker formation. The controls appear at a uniform order in each experiment. If an arbitrary cutoff is made at the point where the treatment means are 25% of the total growth of the controls for each experiment the following is the case: Treatment F appears in all experiments. Treatments B, E, I, K, L, M, N and O appear in two experiments and treatments G and H are excluded or they appear in only one experiment. PE, used in only one experiment, is retained as it is a similar formulation to F. Therefore, in descending order of retardation determined by relative standing in each experiment, we have F (and PE) then B, I, K, M, N, O, L, and E. It should be remembered that these results are valid for one season only and increased growth in the second year may negate any initial advantages. Further, the author has previously noted that aerosol application may give an initial quick response while a slower release from a heavy tree wound dressing may give more prolonged control.

In examining the data for occlusion (Table 3), it may be seen that a number of materials (L, E, D, N) promoted growth of callus tissue in comparison with the

Table 2. The average linear growth in inches of suckers formed following treatment of branch pruning wounds.

Tree Species	Treatment[1]																
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	PE	None
Experiment I																	
Salix babylonica & Ulmus pumila	±	4	56	114	17	0	140	40		29	40	13	0	15	6	0	88
Experiment II																	
Salix nigra	132	4	29	46	29	21	20	23	1	31	13	36	29	50	6	*	96
Experiment III																	
Salix nigra	77	30	90	74	19	6	191	60	11	48	7	7	8	0	110	*	87

Treatments in relative order of control

Experiment I																	
Salix babylonica & Ulmus pumila	F	PE	M	B	O	L	N	E	J	H	K	C	None	D	G	A	I
Experiment II and III																	
Salix nigra	I	K	F	B	M	L	E	N	J	H	O	D	C	None	A	G	

[1] Refer to Table 1
* Not used
± Insufficient data

Table 3. The average width in inches of callus formed following treatment of branch pruning wounds.

Experiment I

Salix babylonica & Ulmus pumila

Treatment	H	J	K	C	B	O	G	PE	None	E	N	L	M	D
Mean Growth	0	0	0	.03	.04	.07	.13	.15	.17	.21	.25	.35	±	±
Significance[1]														

Experiment II

Salix nigra

Treatment	A	H	I	K	C	F	N	J	B	G	O	M	None	D	E	L
Mean Growth	0	0	0	0	.05	.05	.06	.10	.13	.18	.18	.20	.21	.23	.23	.30
Significance[1]																

Experiment III

Salix nigra

Treatment	I	J	O	H	B	O	M	G	K	N	F	None	D	E	A	L
Mean Growth	0	.15	.15	.20	.25	.25	.25	.30	.30	.30	.35	.37	.45	.45	.50	.60

[1] Treatments that do not differ significantly at the 5% level are underlined by a bar.

±Insufficient data

control. Treatment L appeared in each of the experiments and produced the maximum callus. Treatment E appeared in each of the experiments but was slightly more variable. Treatments D appeared in two experiments and N in one. All other treatments retarded growth in some measure in comparison with natural healing.

Scrutiny of the data pertaining to sucker inhibition in relation to the data for callus formation shows that the majority of the chemicals retarding growth also decreased the formation of callus tissue. Some compromise can be obtained between the results to provide a number of suitable materials compatible with natural tree physiology. Treatment F (and PE), naphthalene acetic acid at a 1% concentration, applied with an aerosol can, tends to slightly inhibit wound healing. In two cases this inhibition is not significantly different from the rate for untreated wounds. Sucker control was highly uniform throughout the experiments. Treatment B, Amchem 69-27 although slightly more variable gave acceptable results. Treatment E, 1/4% morphactin in asphalt applied with an aerosol, gave good callus formation while at the same time very adequate sucker control. Treatments I and K are not acceptable since they caused considerable dieback on some individuals as noted by no callus formation. It would appear that the solvent carrier used is highly phytotoxic of itself and may in whole or in combination with the active chemical, have been responsible for the cambium dieback. The phenolic modified tall oil, although not a recognized growth manipulator, gave encouraging results. Cathey (2) has noted that fatty acids can be utilized as chemical pruning agents. Tall oil, a basic constituent in material L is produced as a by-product of the kraft or sulphate paper process. Composition is given as 50-60% fatty acids, 34-40% rosin acids, and unsaponifiable matter 5-10% (8). Treatment M, 1% naphthalene acetic acid in a heavy tree wound dressing, is presently marketed as a commercial formulation. The benefit of this carrier may be shown in the second year evaluations. Treatment N is the current tree wound dressing used by Ontario Hydro and is seen to reduce the ability of wounds to heal rapidly. Treatment O, 1% morphactin, although similar to N and H in callus retardation, may also support the possibility of slower active chemical release and thus longer control.

Further research has been undertaken in other species and comparable results appear to be the case for poplar, ash, and maple. However, these data are not yet available to be reported in this paper.

Literature Cited

1. Anonymous. 1969. Ontario Hydro 1969. Ontario Hydro Public Relations Division. p. 29-30
2. Cathey, H. M. 1969. Chemical growth regulators for plants. Northeastern Weed Control Conference, New York, 1970. p. 235
3. Cochran, W. G., et al. 1957. Experimental designs. John Wiley and Sons, Inc., New York.
4. Cran, H. J. 1970. E.E.I. tree growth control research project RP24, summary of field results. Public Utility Arborist Association.
5. Effer, W. R. 1969. Woody growth retardation–screening of chemicals for cut surface application. Northeastern Weed Control Conference, New York, 1970.
6. Gardner, M. R. 1969. The chemical inhibition of woody plant growth. Northeastern Weed Control Conference, New York, 1970.
7. Hunter, G. 1969. Forestry production and cost records for year ending 1969. Section A, Total volume trees, man-hours, costs. Ontario Hydro Forestry Department Report.
8. Merck. 1968. The Merck encyclopaedia of chemicals and drugs. Section 1. Monogram of chemicals. p. 1011
9. Phillips, C. 1968. Tree spray and growth control. Proceedings Western Chapter International Shade Tree Conference.
10. Punhani, A. L. 1970. Statistical analysis of retardation growth experiments in 1969. Ontario Hydro Research Division Report 70-151-1.

■ ■ ■