FOREST RESEARCH REPORT

NOVA SCOTIA DEPARTMENT OF LANDS AND FORESTS
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THE EFFECT OF TAPPING ON THE DIAMETER GROWTH OF SUGAR MAPLE TREES LESS THAN 25 CM IN DIAMETER

INTRODUCTION

Production of maple syrup in Nova Scotia is a steadily growing industry. In fact, the number of taps and total production of maple syrup has more than doubled since 1978. As of 1989 the gross sales of maple syrup products has grown to 778,000 dollars and the number of taps to 250,000 (MacIsaac, 1989). Because of the importance of this industry, the Dept. of Lands & Forests and the Dept. of Agriculture & Marketing have been working with producers to maintain the growth and health of this industry. One area of concern has been the effect of tapping[1] on the growth of small diameter sugar maple trees (*Acer saccharum* Marsh.). Coons (1975) stated that tapping trees less than 25 cm in diameter is considered harmful to the health of the tree. Others who discourage this practice include Lancaster *et al.* (1974) and Walters and Yawney (1982). To address the concerns of Nova Scotia's maple syrup producers in this regard, a trial was undertaken to examine whether tapping sugar maple trees less than 25 cm in diameter affects their diameter growth.

1 Drilling holes in the trunk of a tree for the purpose of obtaining sap.

SITE DESCRIPTION

The trial was established at 3 privately-owned woodlots within Cumberland County, namely Westbrook, Sugarloaf Mountain and Fenwick. Appendix I describes the stand and site characteristics for each experimental location. The Westbrook and Sugarloaf Mt. locations contained soils that were classified as well-drained gravelly sandy loams, whereas at Fenwick the soil was an imperfectly to well-drained sandy loam. Also in contrast, the Fenwick stand was smaller in average diameter with individual trees ranging from 5-30 cm in diameter at breast

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height (DBH) and was not thinned (90% stocked), while the other sites were larger in diameter and thinned (10-50 cm DBH and 80% stocked at Westbrook; 10-40 cm DBH and 70% stocked at Sugarloaf Mt.). Each of the stands were predominantly sugar maple and situated on gently sloping sites derived from glacial till.

METHODS

At each location, 20 pairs of sugar maple trees varying in diameter from 14-22 cm were selected from a nearly homogeneous area approximately 1 ha in size. Care was taken to ensure that members of each pair were within 15 m of each other, located on similar sites and were similar in diameter, crown characteristics and height. At each location, a number from 1 to 20 was assigned to both the tapped and control trees and a letter (T for tapped or C for control) painted on the tree.

The diameter of each sample tree was recorded by measuring the tree at breast height (1.3 m above ground level) with a diameter tape. This position was then marked by painting a band around the tree to ensure that future measurements would be taken at the same place on the tree.

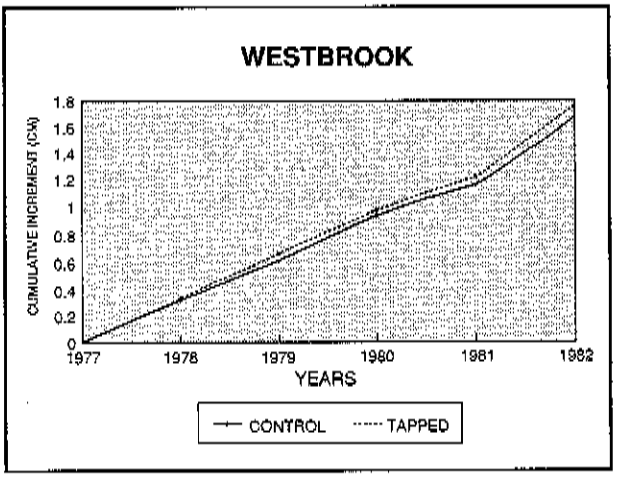
The trees were tapped in March of 5 consecutive years (1977-1982). To minimize disturbance to the breast height area, the trees were tapped in a different place each year at least 15 cm above or below the painted line. Spiles were then placed in the holes and connected to plastic pipelines where the sap flowed to holding tanks.

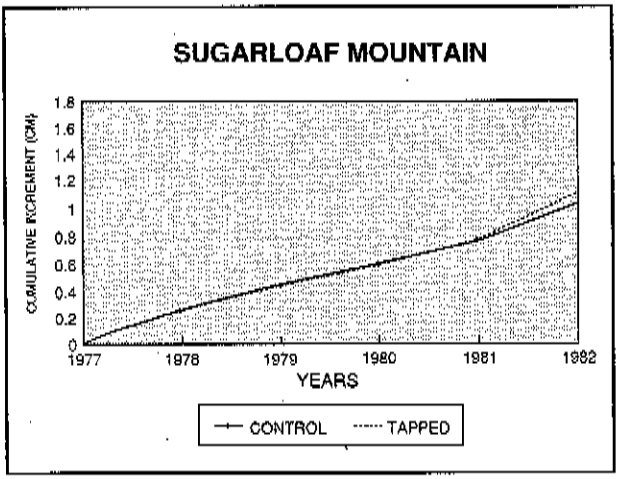
A paired t-test was performed to test for significant differences in diameter growth between control and tapped trees at each location (see Table 1 for results).

RESULTS

The average cumulative diameter growth for control and tapped trees are shown separately for each location in Figure 1 and Table 1. Diameters of individual trees by location and year are summarized in Appendix II.

For all sites, the diameter growth of tapped trees was no less than that of the control trees. At two of the locations, Westbrook and Sugarloaf Mountain, both control and tapped trees demonstrated almost identical diameter growth during the first 4 years of measurement. Even after 5 years, the difference in average diameter growth between control and tapped trees was only 0.1 cm at both sites. At Fenwick the differences were more pronounced, although again, the tapped trees grew more quickly than the control trees (0.4 cm). There is no apparent explanation for the increased diameter growth of tapped trees at Fenwick. Although diameter growth was not negatively affected in this study, some damage was visually detected on the tapped trees. A minority (<25%) of trees had cracks emanating from the tap-hole while others had areas of exposed cambium.





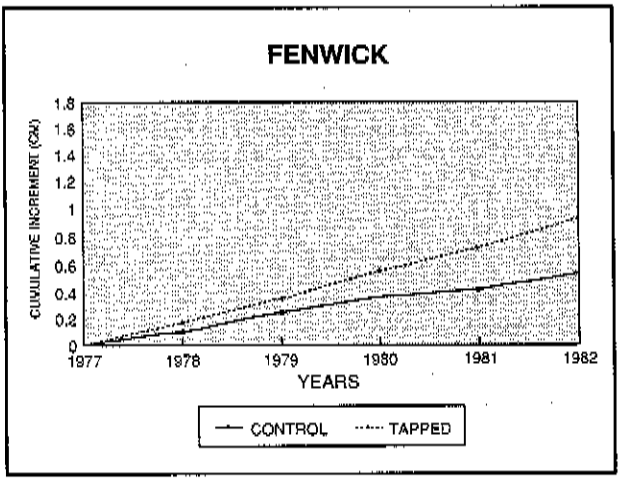


Figure 1. Average diameter growth (cm) for control and tapped trees between 1977 and 1982 at 3 locations.

Table 1. Comparison of average diameter growth between control and tapped trees at Westbrook, Sugarloaf Mt. and Fenwick.

	Average Diameter (cm)						
	Control			Tapped			
Location	1977	1982	Growth	1977	1982	Growth	Average difference[1] in diameter growth (cm)
Westbrook	17.6	19.1	1.5	17.6	19.3	1.7	0.1 *
Sugarloaf Mt.	17.6	18.6	1.0	17.6	18.7	1.1	0.1 *
Fenwick	17.5	18.1	0.6	17.6	18.5	0.9	0.4 *

1 Average difference may not equal the difference between average diameter growth between control versus tapped trees due to rounding.

* A paired t-test showed no significant difference (p=0.05) in the diameter growth between control and tapped trees.

CONCLUSIONS

The results of this test showed that yearly tapping of sugar maple trees 14-22 cm in diameter (DBH) over a 5-year period did not negatively influence the short-term diameter growth of these trees. Although no growth reduction was evident, some stem splitting and loss of bark was observed as a result of tapping. Future studies on the long-term consequences of these injuries on tree health and growth should be undertaken.

LITERATURE CITED

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APPENDIX I

Stand and Site Characteristics of the Experiment Locations as Recorded in 1978

Site	Stocking[1] (%)	Sugar Maple Content[2] (%)	Diameter Range (cm)	Thinning (year)	Drainage	Soil[3]	Parent[4] Material	Aspect[5]	Slope (%)
Westbrook	80	90	10-50	1976	Well	GSL	GT	NW	6-10
Sugarloaf Mt.	70	90	10-40	1977	Well	GSL	GT	NE	6-8
Fenwick	90	90	5-30	No	Imperfect-Well	SL	GT	SE	6-8

1) ocular estimate of crown cover
2) based on stem count
3) GSL - gravelly sandy loam
   SL - sandy loam
4) GT - glacial till origin
5) NW - northwest
   NE - northeast
   SE - southeast

APPENDIX II

Comparison of Diameter Growth Between Control and Tapped Trees Over a 5-Year Period at Westbrook, Sugarloaf Mt. and Fenwick

WESTBROOK

Pair No.	Diameter at breast height (cm)						Difference in Diameter Growth (cm) (+/-)
	Control			Tapped			
	1977	1982	Growth	1977	1982	Growth	
1	19.0	20.4	1.4	19.4	21.6	2.2	- 0.8
2	18.1	19.3	1.2	18.6	20.2	1.6	- 0.4
3	17.9	19.1	1.2	17.8	19.4	1.6	- 0.4
4	15.6	15.7	0.1	15.3	15.7	0.4	- 0.3
5	16.9	18.6	1.7	16.9	18.6	1.7	0.0
6	19.7	21.4	1.7	19.5	20.8	1.3	+ 0.4
7	18.8	20.8	2.0	19.4	20.9	1.5	+ 0.5
8	17.6	19.3	1.7	18.4	19.8	1.4	+ 0.3
9	16.5	18.4	1.9	16.9	19.0	2.1	- 0.2
10	14.8	16.1	1.3	14.5	16.1	1.6	- 0.3
11	20.5	23.7	3.2	20.7	22.6	1.9	+ 1.3
12	16.5	18.2	1.7	16.8	18.2	1.4	+ 0.3
13	15.5	17.2	1.7	15.3	16.4	1.1	+ 0.6
14	18.8	20.1	1.3	18.7	20.8	2.1	- 0.8
15	14.4	14.9	0.5	14.6	16.9	2.3	- 1.8
16	20.4	22.0	1.6	20.1	22.4	2.3	- 0.7
17	19.1	21.7	2.6	18.8	21.4	2.6	0.0
18	16.8	17.5	0.7	16.3	17.7	1.4	- 0.7
19	14.5	15.6	1.1	14.3	15.1	0.8	+ 0.3
20	21.3	22.9	1.6	20.1	21.6	1.5	+ 0.1
Average	17.6	19.1	1.5	17.6	19.3	1.7	- 0.1 *

* Average difference may not equal the difference between average diameter growth between control versus tapped trees due to rounding.

Appendix II (cont.)

SUGARLOAF MT.

Pair No.	Diameter at breast height (cm)						Difference in Diameter Growth (cm) (+/-)
	Control			Tapped			
	1977	1982	Growth	1977	1982	Growth	
1	21.9	22.1	0.2	21.5	22.3	0.8	- 0.6
2	18.0	19.4	1.4	18.2	19.2	1.0	+ 0.4
3	19.8	20.4	0.6	19.8	21.5	1.7	- 1.1
4	18.1	18.9	0.8	17.9	18.5	0.6	+ 0.2
5	14.6	14.9	0.3	13.9	14.0	0.1	+ 0.2
6	17.2	17.6	0.4	17.3	18.0	0.7	- 0.3
7	16.2	16.3	0.1	16.0	17.0	1.0	- 0.9
8	20.3	20.6	0.3	20.9	21.1	0.2	+ 0.1
9	18.6	20.2	1.6	18.7	19.7	1.0	+ 0.6
10	16.9	17.8	0.9	16.6	18.1	1.5	- 0.6
11	18.4	19.3	0.9	18.1	19.4	1.3	- 0.4
12	16.1	16.7	0.6	15.8	16.6	0.8	- 0.2
13	19.8	20.8	1.0	20.4	21.1	0.7	+ 0.3
14	19.3	19.9	0.6	19.2	19.9	0.7	- 0.1
15	16.3	17.8	1.5	17.0	18.1	1.1	+ 0.4
16	14.7	15.6	0.9	15.3	17.2	1.9	- 1.0
17	16.5	18.5	2.0	16.7	19.8	3.1	- 1.1
18	17.3	19.3	2.0	17.4	18.3	0.9	+ 1.1
19	14.0	17.0	3.0	14.1	15.1	1.0	+ 2.0
Average	17.6	18.6	1.0	17.6	18.7	1.1	- 0.1 *

* Average difference may not equal the difference between average diameter growth between control versus tapped trees due to rounding.

Appendix II (cont.)

FENWICK

Pair No.	Diameter at breast height (cm)						Difference in Diameter Growth (cm) (+/-)
	Control			Tapped			
	1977	1982	Growth	1977	1982	Growth	
1	16.8	17.3	0.5	16.9	19.0	2.1	- 1.6
2	15.2	15.5	0.3	14.9	15.9	1.0	- 0.7
3	16.1	16.3	0.2	16.4	17.2	0.8	- 0.6
4	17.0	17.4	0.4	16.8	17.1	0.3	+ 0.1
5	14.9	15.0	0.1	15.1	16.0	0.9	- 0.8
6	17.9	18.1	0.2	18.6	19.1	0.5	- 0.3
7	15.9	16.3	0.4	15.5	15.6	0.1	+ 0.3
8	20.7	20.7	0.0	20.2	20.7	0.5	- 0.5
9	16.8	16.8	0.0	17.1	18.1	1.0	- 1.0
10	19.7	20.1	0.4	19.8	20.1	0.3	+ 0.1
11	16.3	16.6	0.3	16.5	17.1	0.6	- 0.3
12	17.4	17.9	0.5	18.4	19.4	1.0	- 0.5
13	18.1	18.7	0.6	17.7	19.1	1.4	- 0.8
14	21.2	21.4	0.2	21.3	22.1	0.8	- 0.2
15	15.1	15.3	0.2	14.2	16.2	2.0	- 1.8
16	20.4	21.7	1.3	19.7	19.9	0.2	+ 1.1
17	21.1	22.5	1.4	21.1	22.8	1.7	- 0.3
18	16.9	18.4	1.5	18.0	19.9	1.9	- 0.4
19	15.5	17.5	2.0	15.6	16.8	1.2	+ 0.8
Average	17.5	18.1	0.6	17.6	18.5	1.0	- 0.4 *

* Average difference may not equal the difference between average diameter growth between control versus tapped trees due to rounding.

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