

CANADA  
DEPARTMENT OF FORESTRY  
Forest Research Branch

PLANTATION RESEARCH IN ONTARIO

by

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## INTRODUCTION

In recognition of the importance of forest plantations in Ontario and the need for a new plantation research program, due to changes in the staff of the Ontario District Office of the Department of Forestry, a meeting was held in this office on December 12th, 1961, to review the work done in plantation research and to discuss the needs and the direction of future research in this field.

This report, based on discussions at the meeting and comments received from members of the organizations engaged in forest research in Ontario, gives a short description of active and recently completed projects to show the present trend in plantation research in Ontario, and makes recommendations for future research.

Nursery aspects, such as the development of suitable planting stock, are not included.

ACTIVE PROJECTS OR WORK RECENTLY COMPLETED

1. Department of Forestry - Petawawa Forest Experiment Station

A. Plantation Establishment

1. Two new planting methods, as proposed by Prof. Hosie, are being studied in co-operation with various companies. The Forest Experiment Station has carried out one of the replications of this experiment. No differences in growth rate are apparent to date, but it is possible that height differences may show up after a 5-year period. The experiment will be terminated in 1962.
2. Pellet fertilizing trials were carried out as replicates of a co-operative study initiated by the PPRIC. Nitrogen-phosphorous pellets were placed in planting holes with white spruce seedlings. The experiment has been observed for three years, but there are no indications that this treatment has had a beneficial effect. The experiment will be terminated in 1962.

B. Plantation Development

1. Three spacing trials were set up in the 1940's in red pine plantations. The plantations are remeasured from time to time and a publication on the results is expected in the near future.
2. Crown studies were carried out in red pine plantations with the aim of estimating the amount of foliage in a red pine crown by a few external measurements. A publication will be available on this study in 1962.

3. The effect of spacing on crown development is being investigated.

C. Growth and Yield

1. A number of permanent sample plots were established in white pine and red spruce plantations and are remeasured regularly. So far, several site index curves have been developed from the remeasurement data and it is hoped eventually to develop yield tables for these species.
2. A study of sampling methods was carried out in plantations with the aim of finding the minimum number of height measurements required for a determination of average heights and for the construction of reliable height-diameter curves. It is hoped to develop a standard which will result in a substantial saving in measurement time.

D. Plantation Treatment

1. Various basal area thinning intensities are being studied in a 35-year old white spruce plantation. The plantation will be remeasured every 10 years and thinned back to the prescribed basal area. This is a long-term experiment, and no results are expected in the near future.
2. Red pine plantations, in blocks of 10 acres, are thinned on a 10-year cycle to a prescribed basal area. But since the plantations are rather non-uniform, no replications could be carried out and the results will be limited.

3. A red pine debudding experiment has been in progress for the last 20 years. The 20 year results have been assessed and a publication will soon be available.
4. Close planting of white pine at a spacing of 2 x 2 feet was studied as an attempt to defeat the white pine weevil. In this dense stand a large enough number of straight stems are available for a final crop, but the increment has suffered so badly that a pre-commercial thinning was carried out this year, favouring the 200 most promising trees per acre. The density of the stand will be severely reduced during the next 5 years.

2. Department of Forestry - Ontario District Office

A. Plantation Establishment

1. Two direct seeding experiments are now in progress at the Goulais Experiment Area. The first experiment involves three seeding techniques replicated for three years, while the second tests three seedbeds: freshly scarified ground, year-old scarified and undisturbed ground. White, red and jack pine and white spruce seed were used in both experiments.
2. Two direct seeding tests with white and red pine, designed to permit qualitative comparisons of different seedbeds, were undertaken in cut-over, old-growth white pine stands near Timagami.
3. In 1961 an underplanting experiment was established in the Goulais Experiment Area to test the relative efficiency of two species (white pine and white spruce) and three types of stock (2-0, 3-0, and 2-2). The planting was done on scarified strips in two conditions, partially cut tolerant hardwoods and lightly stocked aspen.

B. Plantation Treatment

1. A third thinning was carried out in a 50-year-old red pine plantation near Rockland. Two permanent sample plots were established in 1938, one plot was thinned and pruned, while the other received no treatments. The plots have been remeasured every 5 years and have been thinned at



6.

10 year intervals. The results of thinning and pruning, and the economic aspects of these silvicultural treatments will be published in 1962.

2. The taper curves and volume tables of Technical Note No. 90<sup>1</sup> are being extended to include the 65 to 75 foot height classes for red pine trees grown in plantations.

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<sup>1</sup>Stiell, W.M., 1960. Taper Curves and Volume Tables for Plantation Red Pine. For. Res. Div. Tech. Note No. 90

3. Department of Forestry - Forest Pathology

1. White pine blister rust has been studied in plantations since 1949.
2. Fomes annosus was first studied in red pine plantations at St. Williams in 1955.
3. A study of the following diseases has been initiated:
  - a. Armillaria mellea
  - b. Bark stain associated with pruned red pine
  - c. Canker of white spruce
  - d. Jones disease.
4. The failure of northern forest plantations using planting stock from southern Ontario nurseries was investigated in 1957 in co-operation with the Ontario Department of Lands and Forests. The study showed that serious losses could be prevented by winter storage of planting stock near the planting sites.
5. The action of fungicides on white pine blister rust are being studied. While the results from Western Canada seem promising, no conclusive success has yet been achieved in Eastern Canada or the Eastern U.S.
6. A study of pathological considerations in the breeding of poplar and pine trees is being carried out in co-operation with the Ontario Department of Lands and Forests.

4. Department of Forestry - Forest Entomology

1. A study of the white pine weevil has shown that the weevil may be controlled either by direct attack through spraying and clipping of infected leaders, or by growing white pine saplings in partial shade and thereby reducing weevil incidence. Both approaches have their limitations; while spraying and clipping is expensive, growing white pine under an overstorey slows the growth and release may also prove costly.
2. A study of the pine shootmoth has been carried out for the last six years, covering population numbers by years and an appraisal of the mortality factors that operate against the insects. Parasites have been introduced from Europe but the results, to date, have not been satisfactory.
3. Studies of the European pine sawfly have mainly centered around the introduction of parasites and an evaluation of these parasites in controlling the sawfly. A total generation mortality of 97% was found to be inadequate to prevent population increases during the next generation. Tests are being carried out with fumigation of nursery stock.
4. A long term experiment was started two years ago in the Kirkwood forest. The purpose of this experiment is to study insect attacks during the life span of plantations. Several important leads have been discovered already and this experiment is expected to yield some important results and help in the understanding of the relationships between age of plantations and various insect attacks.

5. Ontario Department of Lands and Forests - Research Branch

A. Plantation Establishment:

1. An underplanting study was conducted in 1956 in the Lake Huron District for the purpose of converting a decadent Scots and jack pine plantation to more suitable species. Both hardwood and conifer species are being tested.
2. An underplanting study, using red and white pine, was conducted on a thirty-acre tract of dense second growth hardwoods. The development of the seedlings is being recorded. This study was done in conjunction with chemical release.
3. Basswood was underplanted in a low quality hard maple stand to determine whether this species is suitable for stand conversion purposes. Naturally occurring basswood indicate that the species is suitable for this site.
4. Several common, commercial hardwood species were planted in 1950 in an open field to determine the suitability of such tree species under this condition. Their survival and growth is being recorded at five-year intervals.
5. Experiments are being established for planting hardwood and conifer species on wet sites in Southern Ontario.
6. The planting of seedlings of major species at various depths has been studied during the last 10 years. Data on root development and survival have been recorded. Planting in the open and underplanting have also been studied in these experiments.

10.

7. The survival of seedlings and transplants has been studied in regard to age of seedling at time of planting, season of planting and condition of the planting site.
8. A study of planting grades for white spruce has been conducted for a number of years and some specifications recommended.
9. Planting success on shallow soils has been investigated in several forest districts. Some of the planting was carried out under specially established cover crops.
10. The ecotypical variation in black spruce is being studied in co-operation with Dr. Heimburger. This study is at present restricted to the nursery level but will require study in the field later.
11. Comparisons of methods of short-time storage of nursery stock at the planting site have been made and resulted in recommendations to field staff.
12. Studies have been made on the moisture balance of planting stock with respect to differences between nursery and planting site, and with respect to handling of the stock.

B. Plantation Development

1. In the research area of East Gwillambury, experiments were established in 1948 dealing with spacing and pruning trials in red and white pine and white spruce. The pruning has been continuous in red pine, with the removal of a branch whorl from time to time. The influence of pruning on the diameter increment of the stems is checked by dendrometer

tapes. Effects of pruning on height growth, as well as spacing effects on different tree species, are also being investigated.

2. Fertilizing trials in plantations have been carried out at different times during the life of the plantations. Some plantations were fertilized at time of planting, while others were fertilized when they reached a semi-stagnant stage. Special equipment was developed for spreading fertilizers in specified quantities.
3. Frost killing and damage in plantations were studied and equipment was developed to measure the degree of damage done by frost.
4. The planting check of white spruce has been studied, but so far little progress has been made as to identification of its cause or means to prevent its onset.

C. Growth and Yield

1. A number of permanent sample plots were established in southern Ontario during the last 15 years and the re-measurements have yielded much information that may be useful in showing the effect of thinning on branch development and crown growth. Much detailed information has been collected in these plots.

D. Plantation Treatment

1. Tolerance of white spruce, white pine and Scots pine to herbicides was studied in conjunction with weed eradication

12. in plantations. Results indicate that white spruce is more tolerant to 2,4-D and 2,4,5-T than white and Scots pine.

2. Several chemicals were tested for chemical debarking of red pine. Results are available.

6. University of Toronto - Faculty of Forestry

1. Studies of Fomes annosus root rot have been carried out in pine plantations and a number of reports and papers have been published on this subject.
2. The root morphology of trees in plantations has been studied in co-operation with the Department of Lands and Forests.
3. Studies on mineral nutrition of plantation trees were undertaken.
4. In the University Forest an attempt is made to convert low-grade tolerant hardwood stands on shallow soils to mixed forests by clear-cutting and planting.



University of Toronto - Faculty of Forestry  
University of Toronto - Faculty of Forestry

- 1. Studies of *Pinus strobus* root rot have been carried out in pine plantations and a number of reports and papers have been published on this subject.
- 2. The root morphology of trees in plantations has been studied in co-operation with the Department of Forestry and Forest Products.
- 3. Studies on mineral nutrition of plantation trees were undertaken.
- 4. In the University Forest an attempt is made to convert low-grade tolerant hardwood stands on shallow soils to mixed forests by clear-cutting and planting.

FUTURE RESEARCH PROBLEMSA. Plantation Establishment

1. An intensive study of the requirements of different species in relation to soil types and moisture regimes, and their tolerance to exposure and weed competition could lead to the planting of species best suited to particular sites.
2. Little information is yet available on the most suitable size and age of planting stock of various species for plantation establishment on sites of different soil, soil moisture, degree of exposure, protection or competition from brush and weeds.
3. The planting of areas with a heavy sod cover or a compact soil layer has had only limited success. Experiments dealing with various intensities of site preparation might improve success and prove to be cheaper than repeated refill planting.
4. The successful planting of wet sites is a problem in some areas. Planting on ridges after deep ploughing or planting on mounds may improve the survival and experiments with different equipment may reduce planting costs.
5. The problem of white spruce "check" has been studied but the cause is still unknown.
6. Very little information is available on hardwood planting in Ontario. Studies are needed to investigate the following aspects of hardwood plantation establishment.

- a. Site evaluation for planting of different species.
- b. Species suitability for planting under different degrees of exposure and competition.
- c. Age and size of planting stock best suited for various site conditions.
- d. Site preparation required for successful establishment.

B. Plantation Development

1. The tending of young coniferous and hardwood plantations could often improve the survival and growth in plantations which suffer from severe grass or brush competition. Various methods of mechanical and chemical release might be studied and their costs compared with those of refill planting.

C. Growth and Yield

1. Information on the yield of plantations is almost completely lacking. All available tables are based on the growth of natural stands and are, in their present form, not applicable to plantations. A basic need therefore exists for a full rotation research project on growth and yield of plantations in Ontario. This is a long range project and should be based on a series of permanent sample plots covering various age classes on a range of forest sites. The plot treatments should conform with the management aim directed to the production of quality sawlogs, quality poles and maximum production of pulpwood timber.

An evaluation of all available sample plot data, collected by all agencies engaged in research in Ontario, might be the first step in this study and could determine the extent of information already available and useable in a future yield table.

2. The yield of sawlogs, poles and pulpwood from a plantation of certain age is largely dependent on the time and intensity of thinning operations. Through a study of various thinning intensities, a table could be produced showing the desirable spacing for the production of various materials.

D. Economics of Forest Plantations

1. An economic study relating land, planting, thinning, protection and supervision costs to yield value would be very valuable in the determination of land values, especially for land of marginal productivity.
2. The cost of and returns from forest plantations in comparison with alternate land uses might be investigated for determination of best land use.
3. A study of plantation size investigating the minimum as well as the most economical size of forest plantations in regard to factors of establishment, administration, protection and eventual utilization would lead to the establishment of economical planting units.
4. The construction of an economic yield table showing the expected returns through management for different products

would be very useful. A study of the economics of thinning and pruning could then be used as a guide to future management decisions.

5. The determination of financial maturity in plantations would probably lead to shorter rotations than those based on the culmination of mean annual increment. A study of the relative values of various products could supply the basis for determination of economic rotation age.

#### APPENDIX 1

##### ORGANIZATIONS AT MEETING

The following organizations and personnel representing them, were present at the meeting:

##### Ontario Department of Lands and Forests

Timber Branch	J. Morawski
Research Branch	C. H. Larsson Dr. R. E. Mullin

##### Department of Forestry

Forest Entomology	W. A. Reeks C. Kirby
Forest Pathology	Dr. L. T. White
Petawawa Forest Experiment Station	W. M. Stiell
Ontario District Office	G. H. D. Bedell K. W. Horton F. W. von Althen
Forest Products Laboratory	J. D. Irwin