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NATIONAL RESEARCH COUNCIL OF CANADA

PROCEEDINGS

OF THE

FIFTH MEETING

OF THE

SUBCOMMITTEE ON FOREST TREE BREEDING

OTTAWA

8 APRIL, 1941

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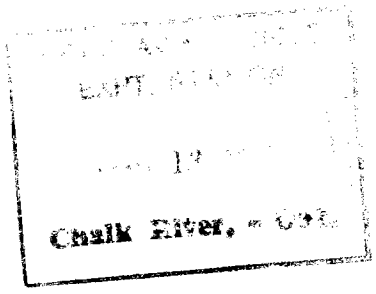

OTTAWA

8 APRIL, 1941

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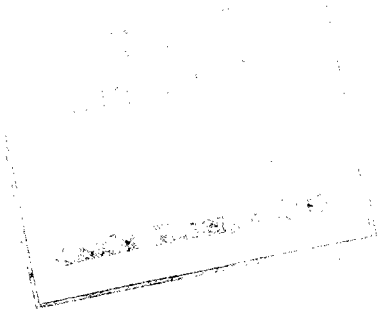


NATIONAL RESEARCH COUNCIL

P R O C E E D I N G S

of the

Fifth Meeting

of the

SUBCOMMITTEE ON FOREST TREE BREEDING

Held at the National Research Laboratories, Ottawa,
8 April, 1941.

Present:

Members: Mr. W. M. Robertson (Acting Chairman)
Dr. N. H. Grace
Dr. C. Heimburger
Dr. J. G. Malloch
Mr. M. B. Morison
Mr. C. G. Riley
Dr. H. A. Senn
Dr. L. P. V. Johnson (Secretary)

Visitors:

Mr. J. L. Farrar
Mr. A. J. Skolko
Dr. J. M. Swaine

- -

59. Minutes — The minutes of the fourth meeting of the Subcommittee on Forest Tree Breeding were read and approved without change.

60. Report on project organization — Dr. Johnson reported on the recommendations of the Special Committee on Project Organization (Minute 53, Fourth Meeting) which met on 11 December, 1940. The Special Committee decided that the Project Outline previously recommended (see Appendix A, Proceedings of Second Meeting) should be modified to take the form set forth in Appendix B of these

Proceedings. Further recommendations of the Special Committee respecting outlines of and annual reports on individual experiments are represented by the instructions given in Appendix A of these Proceedings.

61. Report on breeding and related work

Dr. Johnson summarized his activities during the winter months, which included work on control of damping-off in the greenhouse, and studies on the relation of growth rate to wood quality in Populus hybrids. Reports on these may be found (V-Z-1 and III-A-1) in Appendix C of these Proceedings.

Dr. Johnson stated that interspecific hybridization in Populus, carried out in the greenhouse during the winter had been very successful. It was considered that the favorable results were in a large degree due to the environmental conditions provided for the detached branches. Branches were collected in January and early February, set in jars of water (frequently flushed out), and placed in a greenhouse control room having a daily temperature variation of from 50° F. at midnight to 70° F. at noon. The room was kept very humid by keeping saturated peat on floor and benches.

62. Report on vegetative propagation at Petawawa

Mr. Farrar in outlining the propagation experiments at Petawawa stated that the results of completed experiments are to be found in reprints already distributed. (A list of these reprints is given in Appendix E). He also stated that current and prospective experiments are covered by the outlines given in Appendix C.

In a brief summary of his work during the past year, Mr. Farrar said that the vegetative propagation of Norway spruce has advanced to the point where the methods worked out could be satisfactorily applied to practical propagation. He believed that the same could be said, with some reservations, of the work on white spruce and white pine. On the other hand, vegetative propagation work on basswood, poplar and birch was considered to be still very much in the experimental stage.

63. Vegetative propagation general

Dr. Grace discussed several fundamental questions relating to the work on vegetative propagation. One of the more interesting of these problems has to do with the factors underlying the highly beneficial effects of Alfred peat on rooting. This peat, which is of sedge origin, is far superior to other peats tried in the vegetative propagation work. A special study is being made of the factors involved. Other questions brought up by Dr. Grace were: the greater efficiency of outdoor beds as compared to greenhouse beds in producing rooted cuttings; and, the matter of growth form (branch-like or tree-like) of rooted conifer cuttings. These problems are also receiving special study.

64. Report on pathology

Mr. Riley, after referring the meeting to the report given in Appendix D went on to summarize some of the more important results of the pathological work during the summer of 1940. Observations were continued on the diseases occurring naturally on the breeding material at Petawawa. Artificial inoculations were made but the results were not entirely satisfactory. It was felt that the inoculation technique could be perfected and the work continued. The pathogene causing the leaf rust of poplar was definitely established as being Melampsora medusae Thum.-- the aecial stage of which occurs on larch. It was proposed to investigate whether or not this pathogene could complete its life cycle on the poplar.

65. Petawawa nursery materials

Dr. Heimburger outlined the work on plant introduction and strain testing carried on at Petawawa. The results of this work are given in Appendix C.

Dr Heimburger also summarized his work on vegetative propagation in Populus. He stressed the need for experiments on methods of heeling-in, a point upon which Dr. Senn was in complete agreement.

66. Woody species at Dominion Arboretum

Dr. Senn reported that the Dominion Arboretum, Ottawa, had during the past two years obtained some 10,000 additional woody plants, involving 1665 species and varieties. Details are given in Appendix F.

67. Summer meeting

It was decided to hold a Summer meeting of the Subcommittee at the Petawawa Forest Experiment Station. It was further agreed that the meeting should be held concurrently with the Summer meeting of the Dominion Forest Service.

Memorandum to:

I am enclosing instructions, decided upon at recent conferences, for outlining the experiments coming under the Subcommittee on Forest Tree Breeding. It will be noted that headings having to do with classification number, title, etc., are to be standardized, while headings concerned in the actual writing-up of the experiment are to be decided upon by the research worker himself. The parenthesized statements following the headings are given to provide an example of a completed form.

It is hoped that all research workers will be able to submit outlines and annual reports of all important experiments to the secretary before the Spring meeting, which will be held early in April.

L. P. V. Johnson,

Secretary,
Subcommittee on Forest
Tree Breeding.

(Form to be followed in writing up outlines of experiments)

CLASSIFICATION NUMBER: (IV-A-1)

CLASSIFICATION SUBJECT: (Vegetative propagation: stem cuttings)

TITLE OF EXPERIMENT: (Response of Norway spruce cuttings to Alfred peat)

SCHEDULE: (Commenced May, 1940, finished ----)

CONDUCTED BY: (J.L.Farrar and N.H.Grace)

(The above headings are to be standardized. After "Classification Number" give: The Roman number of the main division, as IV for Vegetative propagation; the letter of the subheading, as A for Stem Cuttings; and, the Arabic number of the experiment, as 1 for "Response of Norway spruce cuttings to Alfred peat." Numbers of experiments will run consecutively under each subheading. After "Classification Subject" name the main division and subheading concerned.)

(It is suggested that the experiments be written-up under a system of additional headings similar to the following:

OBJECTIVES

METHODS

EQUIPMENT AND MATERIALS

RESULTS - to be filled in at completion of experiment since annual reports will take care of results during course of experiment.)

APPENDIX "B"

Classification of Investigations, Sub-committee on Forest Tree Breeding

1. General Outline

I.	Breeding	- Dr. Johnson and Dr. Heimburger
II.	Genetics and Cytology	- Dr. Johnson and Dr. Peto
III.	Wood Technology	- Dr. Johnson
IV.	Vegetative Propagation	- Dr. Grace, Mr. Farrar.
V.	Pathology	- Mr. Riley
VI.	Entomology	- Dr. Atwood
G.	General	-

2. Main Divisions and Subheadings

I. Breeding
- A. Selection and breeding general
- B. Hybridization
- C. Production of polyploid forms
- D. Nursery tests
- E. Disease garden tests
- F. Plantation tests
- G. Reforestation and afforestation
- Z. General

II. Genetics and Cytology
- A. Inheritance studies
- B. Cytology of induced polyploids
- Z. General

III. Wood Technology
- A. Histological studies
- B. Physical tests
- C. Chemical analyses
- D. Pulp and paper tests
- E. Experimental manufacture
- Z. General

IV. Vegetative Propagation
- A. Stem cuttings
- B. Root cuttings
- C. Grafting
- D. Layering
- E. Development of vegetatively propagated material
- Z. General

V. Pathology
   A. Poplar
   B. White pine
   Z. General

VI. Entomology
   (no subheadings

3. Outlines of Experiments

Outlines of experiments coming under the above subheadings are given in Appendix C.

APPENDIX "C"

Report on Breeding and Related Work

CLASSIFICATION NUMBER: I-A-1 (I-E-a-1*)

CLASSIFICATION SUBJECT: Breeding: selection and breeding general.

TITLE OF PROJECT: Strain testing and selection of spruce.

SCHEDULE: Commenced spring 1935.

CONDUCTED BY: C. Heimburger and Entomologists.

OBJECTIVES

Testing of strains of native and exotic species of Picea to study the biotypes found within these. Selection of superior biotypes for purposes of intensive silviculture in eastern Ontario and elsewhere, and for breeding purposes.

METHODS

Raising of plants in the nurseries from seeds and cuttings of known origin. Testing of the material obtained for growth rate and growth form, for adaptation to existing climate and soil conditions, susceptibility to diseases, and injuries by insects. Selection of superior populations and clones for further tests in plantations established for this purpose.

EQUIPMENT AND MATERIALS

Nursery tools and other equipment for raising of material, for preparation of planting sites, establishment and maintenance of test plantations. Needs anticipated one year in advance and submitted to the Superintendent, Petawawa F.E.S.

RESULTS

Found in seed lot transplant and plantation records of the Petawawa Forest Experiment Station and in annual reports on nursery work there. Data on clones are kept on index cards.

Summary of Previous Work:

(* Classification numbers given in parentheses are those of the Dominion Forest Service or Department of Agriculture which also apply to these projects or experiments.)

(a) SOWINGS

Spring 1935

Seed Lot	
2	Picea ajanensis, Rafn, Denmark, cancelled.
3	" excelsa, Jutland, planted in P.S.P. 152, spring 1936, good.
4	" glauca, Coalspur, Alta., transplanted spring 1936, 1939 slow in growth.
5	" " Petawawa, cancelled.
7	" pungens Kosteri, C.E.F., cancelled.

Fall 1935

8	Picea glauca, Petawawa, transplanted spring 1938, plantation 41, spring 1940, good.
9	" excelsa, Terraak, Norway, cancelled, because of slow growth.

Fall 1936

13	Picea excelsa, Riga, Latvia, transplanted spring 1939, good.
14	" " Norway, transplanted spring 1939, very variable, culled.
15	" " " " " " " "
16	" " " " " " " "
17	" " " " " " " "

Fall 1937

28	Picea pungens Kosteri, C.E.F., germination very poor, cancelled.
29	" Engelmannii, Blue River, B.C., transplanted spring 1939, slow growth
30	" glauca, Bruce County, Ont., transplanted spring 1939, good.
31	" " , Aleza Lake, B.C., transplanted spring 1939, fair, slow growth.
32	" " , Lake Edward, F.E.S., transplanted spring 1939, good.
33	" Hondoensis, Vienna, transplanted spring 1939, slow growth.
34	" obovata, Vienna, transplanted spring 1939, excellent.
35	" excelsa, Norway, transplanted spring 1939. uneven, some very good
36	" Glehnii, Vienna, transplanted spring 1939, slow growth.
37	" excelsa, Minsk, USSR, poor germination, cancelled.
38	" " Norway, no germination, cancelled.
39	" " " " " "
40	" " " " " "
41	" " Laurentide plantations, transplanted spring 1939, good.

Fall 1937, continued

42 Picea excelsa, Petawawa, no germination, cancelled.
43 " glauca Fort William, Ont., transplanted spring 1939, slow growth.
44 " " Nipawin, Sask., transplanted spring 1939, slow growth.
45 " " Harlan Forest, Sask., transplanted spring 1939, slow growth.
46 " " Grandview, Man., transplanted spring 1939 and 1940.
47 " " Nipawin, Sask., transplanted spring 1939, slow growth.
48 " mariana, Fort William, Ont., transplanted spring 1940, very good.
52 " " Petawawa swamps, transplanted spring 1940, good.
53 " glauca, Terrace, B.C., transplanted spring 1939, slow growth.
54 " " Lesser Slave Lake, Alta., transplanted spring 1939, slow growth.

Spring 1938

56 Picea Schrenckiana, USSR, transplanted spring 1939, slow growth.
58 " obovata, Denmark, no germination, cancelled.
59 " mariana, Notakim Depot, Que., very poor germination, cancelled.
60 " " Petawawa swamps, transplanted spring 1939, good.

Fall 1938

81 Picea glauca, Kananaskis, F.E.S., slow growth.
82 " sitchensis x glauca F_2 and x sitchensis, many not hardy, some very good.
83 " glauca, Les Eboulements, Que., fair.
84 " excelsa, Laurentide plantations, not uniform but very good.
85 " glauca, Valcartier, F.E.S., rather slow growth.
86 " excelsa, Latvia, very good.
87 " glauca, Denmark, rather slow growth.
93 " " seed tree 1, Petawawa, good.
94 " " " " 2, " "
95 " " " " 3, " "

Spring 1939

107 Picea asperata, Nancy, France, very good.
109 " mariana, Notakim Depot, Que., slow growth.
146 " obovata, Harbin, very good.

Fall 1939

188 Picea jezoensis, Harbin, good.
189 " sitchensis, Kitimat, B.C., fairly good.
190 " " Courtenay, B.C., " "
191 " Engelmannii, Salmon Arm, B.C., good, slow growth.
192 " excelsa, Finland, good.
193 " " Yugoslavia, good.
194 " " Roumania, excellent.
195 " " France, fair.
196 " " Poland, excellent.
197 " " Finland, good.
198 " " Switzerland, good.
199 " " Sweden , fairly good.
200 " " Germany, good.
203 " " Germany, very good.
204 " " Norway, good.
205 " " Roumania, good.
206 " " Roumania, fairly good.
207 " " USSR, fair.
208 " rubra Berthierville, Que., poor.
209 " glauca, Notakim Depot, Que., good.
210 " excelsa, Petawawa, good.

Spring 1940

217 Picea koraiensis, Keijo, good.

Fall 1940

226 Picea yezoensis, Keijo.
227 " glauca, Petawawa.
228 " rubra, Berthierville, Que.
229 " glauca, Angus, Ont.

(b) VEGETATIVE PROPAGATION

Spring 1937 cuttings

Picea excelsa SN-15, Petawawa, F.E.S. 162, transplanted spring 1940
" pungens #1, Petawawa, F.E.S. 97, transplanted spring 1940.

Fall 1939 cuttings

Picea excelsa SN-15, Petawawa F.E.S. 188, cuttings.
" " SN-17, " " 136, "
" " SN-18, " " 123, "
" " SN-19, " " 152, "
" " SN-20, " " 147, "
" " SN-21, " " 145, "
" " SN-22, " " 148, "
" " SN-23, " " 135, "
" pungens #1, " " 128, "

Fall 1940 cuttings

Picea excelsa	SN-17, Petawawa, F.E.S.	513	cuttings.
"	" SN-19, "	440	"
"	glauca, Albertiana #7006, C.E.F.	27	"
"	omorika #4024, C.E.F.	37,	cuttings
"	" #6192, "	32,	"
"	pungens Kosteri #2, C.E.F.	17	cuttings.
"	" " #3, "	19	"
"	sitchensis, St. Williams, Ont.,	26	"

(c) OBSERVATIONS TO DATE

Picea excelsa of central European origin planted in eastern Canada is not fully winter-hardy.

Some striking individual differences in susceptibility to white pine weevil (Pissodes Strobi Peck) can be observed in plantations. These differences may be inherent with some biotypes. Strains from different altitudes and latitudes in Norway generally show slower growth and shorter growth periods with increasing altitude and latitude of place of origin. All the strains tested so far are much more heterogeneous in this respect than strains from different altitudes in the Alps described previously by Cieslar and Engler. Most of the strains from Norway show several abnormalities in their growth form when grown at Petawawa. This is not the case with P. excelsa and P. obovata from Latvia and from Siberia, which are quite homogeneous in their growth form and growth rates. In Picea glauca, Engelmannii and related forms, the size of the 1-year seedlings appears to depend a great deal on the size of the seeds; later this is obscured by inherent growth factors, as well as by soil differences. Eastern strains have smaller seeds than the western strains, as a rule, but the latter show a slower growth in the nurseries after their first year. The expression of dominance among seedlings in seed beds is far greater than in Picea excelsa and is much favoured by good soil. It is greater in the eastern strains, showing more rapid seedling development than in western strains. Some of the latter are not ready for setting out in plantations until they are 5 years old. After their second year in the seed beds, seedlings of some eastern strains of P. glauca are larger than seedlings of P. excelsa of the same age. The marked differences in several morphological characters found in mature material in the Rocky Mountains have so far not been reflected in the seedlings grown from it at Petawawa. The existence of upland ecotypes of P. mariana in western Ontario and northern Quebec, distinct from the more commonly occurring swamp ecotypes, is rendered highly probable by recent tests in the nurseries. The former are more drought-resistant and show much better transplantability in mineral soils. Several strains from rich swamps at Petawawa compare very favourably with the best strains of P. glauca and P. excelsa in their growth rate after their second year. P. rubra has so far yielded rather slow growing material.

CLASSIFICATION NUMBER: I-A-2 (I-E-a-2)

CLASSIFICATION SUBJECT: Breeding: selection and breeding general.

TITLE OF PROJECT: Strain testing and selection of hard pines.

SCHEDULE: Commenced spring 1935.

CONDUCTED BY: C.Heimburger

OBJECTIVES

Testing of strains of native and exotic species of Pinus of the sections Lariciones and Insignes (Australes) to study the biotypes found within these. Selection of superior biotypes for purposes of intensive silviculture on poor soils in eastern Ontario and elsewhere, not suitable for growing more valuable species and for breeding purposes.

METHODS

Raising of plants in the nurseries from seeds and cuttings of known origin. Testing of the material obtained for growth rate and growth form, for adaptation to existing climate and the special site conditions, susceptibility to disease and injuries by insects. Selection of superior populations and clones for further tests in plantations established for this purpose.

EQUIPMENT AND MATERIALS

Nursery tools and other equipment for raising of material; for preparation of planting sites, establishment and maintenance of test plantations. Needs anticipated for one year in advance and submitted to Superintendent of Petawawa F.E.S.

RESULTS

Found in seed lot, transplant and plantation records of the Petawawa F.E.S. and in annual reports on nursery work there. Data on clones are kept on index cards.

Summary of Previous Work:

(a) SOWINGS

Spring 1935

1 Pinus silvestris, Karelia, transplanted spring 1936, out in plantation 39, spring 1938, good form.

Fall 1936

12 Pinus silvestris, Norway, poor germination, cancelled.
18 " " " transplanted spring 1938, out in plantation 42 spring 1940.
19 " " " transplanted spring 1938, out in plantation 42 spring 1940.
20 " " Riga, Latvia, transplanted spring 1938, out in plantation 42 spring 1940, good form.
21 " Banksiana, Fort William, Ont., transplanted spring 1938, out in plantation 42, spring 1940.
22 " silvestris, Norway, transplanted spring 1938, out in plantation 42 spring 1940.
23 " " Norway, transplanted spring 1938, out in plantation 42 spring 1940.

Fall 1937

49 Pinus contorta var. latifolia, Terrace, B.C., transplanted spring 1939, good.
50 " silvestria, Minsk, USSR, transplanted spring 1939, good.
51 " " Czechoslovakia, transplanted spring 1939, good.

Spring 1938

152 Pinus silvestris, Ladoga, transplanted spring 1939, good.
153 " " Bugnet, " " 1939, "
65 " " Leningrad, " " 1939, "

Fall 1938

73 Pinus contorta, Lower Fraser Valley, transplanted spring 1940, good.
74 " silvestris x montana F_3, Denmark, transplanted spring 1940, variable.
77 " " , Griva, Latvia, transplanted spring 1940, good.

Fall 1939

162 Pinus silvestris, Norfolk County, Ont.
163 " " Scotland.
164 " " Griva, Latvia, (same as No. 77).
165 " " Latvia
166 " " USSR
167 " " Hungary
168 " " Poland
169 " " USSR
170 " " East Prussia
171 " " Roumania
172 " " Scotland
173 " " Lapland
174 " " Sweden
175 " " France

Fall 1939 continued.

176 Pinus silvestris, Finland
177 " " Sweden
178 " " Pyrennees
179 " " S.W. Germany
180 " " Norway
181 " " "
182 " " "
184 " resinosa Petawawa
185 " silvestris Norway
186 " Banksiana, Orange Road, Petawawa
201 " densiflora, Harbin
202 " leucosperma, "

Spring 1940

215 Pinus contorta var. latifolia, Salmon Arm, B.C.
216 " " " " Kitwanga, B.C.
218 " " " " Prince George, B.C.

Fall 1940

235 Pinus ponderosa, Falkland, B.C.
238 " Banksiana, Racehorse, Petawawa
239 " contorta, Comox, B.C.
240 " Banksiana, Notakim Depot, Que.
241 " contorta, Fraser River Delta, B.C.
242 " Banksiana, Highview, Petawawa.
243 " contorta var. latifolia, Kananaskis, F.E.S.
244 " nigra, Hungary.
245 " densiflora, Korea.
246 " Banksiana, Massey, Ont.

(b) VEGETATIVE PROPAGATION

Fall 1940 cuttings

Pinus austriaca No. 319, C.E.F.,17 cuttings.
" contorta var. latifolia No. 1625 C.E.F.,24 cuttings.
" montana var. Mughus No. 1024 C.E.F.,18 cuttings.
" " " uncimata No. 5887 C.E.F.,20 cuttings.
" ponderosa No. 702, C.E.F.,10 cuttings.
" rigida No. 7015 C.E.F.,19 cuttings.
" (Thunbergiana) No. 1774, C.E.F.,10 cuttings.

(c) OBSERVATIONS TO DATE

The usually cultivated strain of P. silvestris in eastern Canada has the well-known poor growth form, although it is quite winter-hardy, resistant to disease and maintains a fairly rapid growth rate even when planted on rather poor sites.

Strains from eastern Finland and from Latvia have so far shown much superior growth form but slightly inferior growth rate. Strains from Norway are very heterogeneous, material from high altitudes as a rule being slower growing and more branchy than strains from lower elevations. The latter are slightly inferior in growth form as compared with strains from eastern Europe, but grow faster. The material obtained recently from various other parts of Europe has shown marked differences in susceptibility of the seedlings to damping-off according to place of origin. Some strains from northern Europe and from high altitudes in the mountains of central Europe appear more resistant than the rest. Strains from central Sweden and East Prussia suffered more than other strains. Strains of P. Banksiana and P. contorta and its var. latifolia has so far not shown any marked fifferences beyond the expected slower growth and shorter growth period of northern and high-altitude strains as compared with strains of more southern origin and lower elevations.

CLASSIFICATION NUMBER: I-A-3 (I-E-a-3)

CLASSIFICATION SUBJECT: Breeding: selection and breeding general.

TITLE OF PROJECT: Strain testing and selection of soft pines.

SCHEDULE: Commenced spring 1935.

CONDUCTED BY: C.Heimburger, C.Riley, L.P.V.Johnson and Entomologists.

OBJECTIVES

Testing of strains of native and exotic species of Pinus of the sections Strobi, Cembrae (Balfourianae, Gerardianae) to study the biotypes found within these. Selection of superior biotypes for purposes of intensive silviculture in eastern Ontario and elsewhere, and for breeding purposes.

METHODS

Raising of plants in the nurseries from seeds and cuttings of known origin. Testing of the material obtained for growth rate and growth form, for adaptation to existing climate and soil conditions, susceptibility to diseases, and injuries by insects. Selection of superior populations and clones for further tests in plantations established for this purpose.

EQUIPMENT AND MATERIALS

Nursery tools and other equipment for raising of material, for preparation of planting sites, establishment and maintenance of test plantations. Disease garden for testing susceptibility to blister-rust. Needs anticipated one year in advance and submitted to Superintendent at Petawawa F.E.S. and to N.R.C.

RESULTS

Found in seed lot, transplant, and plantation records of the Petawawa F.E.S. and in annual reports on nursery work there. Data on clones kept on index cards. Records on blister-rust and weevil resistance not organized yet.

Summary of Previous Work:

(a) SOWINGS

Spring 1935

Seed Lot

6 Pinus Peuce, Duluth, transplanted spring 1937 and 1939, good, slow growth.

Spring 1937

25 Pinus Armandi, Nancy, France, transplanted spring 1938, all frozen dead by 1940, cancelled.
26 " " China, transplanted spring 1938, hardy, but slow growth.

Spring 1938

55 Pinus excelsa, Punjab, transplanted spring 1939, 2/3 frozen by 1940.
61 " koraiensis, USSR, transplanted spring 1939, hardy, slow growth.
63 " " Japan, transplanted spring 1939, very good.
64 " parviflora, Japan, " " " some frozen by 1940.

Fall 1938

68 Pinus Peuce, C.E.F., transplanted spring 1940, excellent growth.
69 " Cembra, USSR, mouse damage, cancelled.
70 " flexilis, Nordegg, Alta., mouse damage, cancelled.
71 " Peuce, Macedonia, no germination, cancelled.
72 " Strobus, Racehorse, Petawawa, transplanted spring 1940, good.
75 " " Corry Lake, Petawawa, transplanted spring 1940, good.
89 " " C.E.F., transplanted spring 1940, good.
90 " " K25, " " 1940, "
91 " " K17, " " 1940, "
92 " " K7, " " 1940, "

Spring 1939

110 Pinus Strobus, Notakim Depot, Que., good.
111 " " K16, good.
112 " " K5, "
113 " " B349, "
114 " " B417, "
115 " " B478, "
116 " " Pl 2, "
117 " " Pl 3, transplanted spring 1940, good.
118 " " Pl 8, " " " "
119 " " H 18, " " " "
120 " " H 19, " " " "
121 " " H 20, " " " "
122 " " H 21, " " " "
123 " " H 396, " " " "
124 " " W 1, " " " poor
125 " " W 2, " " " "
126 " " W 3, " " " "
127 " " W 4, " " " rather poor.
128 " " Pe S.C.I., " " " " "
129 " " W 5, " " " " "
130 " " W 6, " " " " "

Spring 1939 continued

131 Pinus Strobus W 7, transplanted spring 1940, poor.
132 " " Pe 404, " " " "
133 " " Pe 405, " " " "
134 " " D 800, " " " "
135 " " D 801, " " " rather poor.
136 " " D802, " " " fair.
137 " " D 803, " " " "
138 " " D 808, " " " poor.
139 " " Maskinonge, Que., transplanted spring 1940, good.
140 " " Pe CLAN, transplanted spring 1940, quite good.
141 " " Pe CLAS, " " " " " "
142 " koraiensis, Harbin, transplanted spring 1940, died since, cancelled.
143 " Strobus, PW 16, poor germination, cancelled.
144 " monticola, Salmon Arm, B.C., transplanted spring 1940, fair.
145 " " Abbotsford, B.C., poor germination, cancelled.

Fall 1939

187 Pinus monticola, Departure Bay, B.C., quite good.

Fall 1940

225 Pinus Strobus, Notakim Depot, Que.
231 " koraiensis, C.E.F.
232 " " Keijo.
233 " Cembra, Switzerland.
234 " flexilis, Field, B.C.

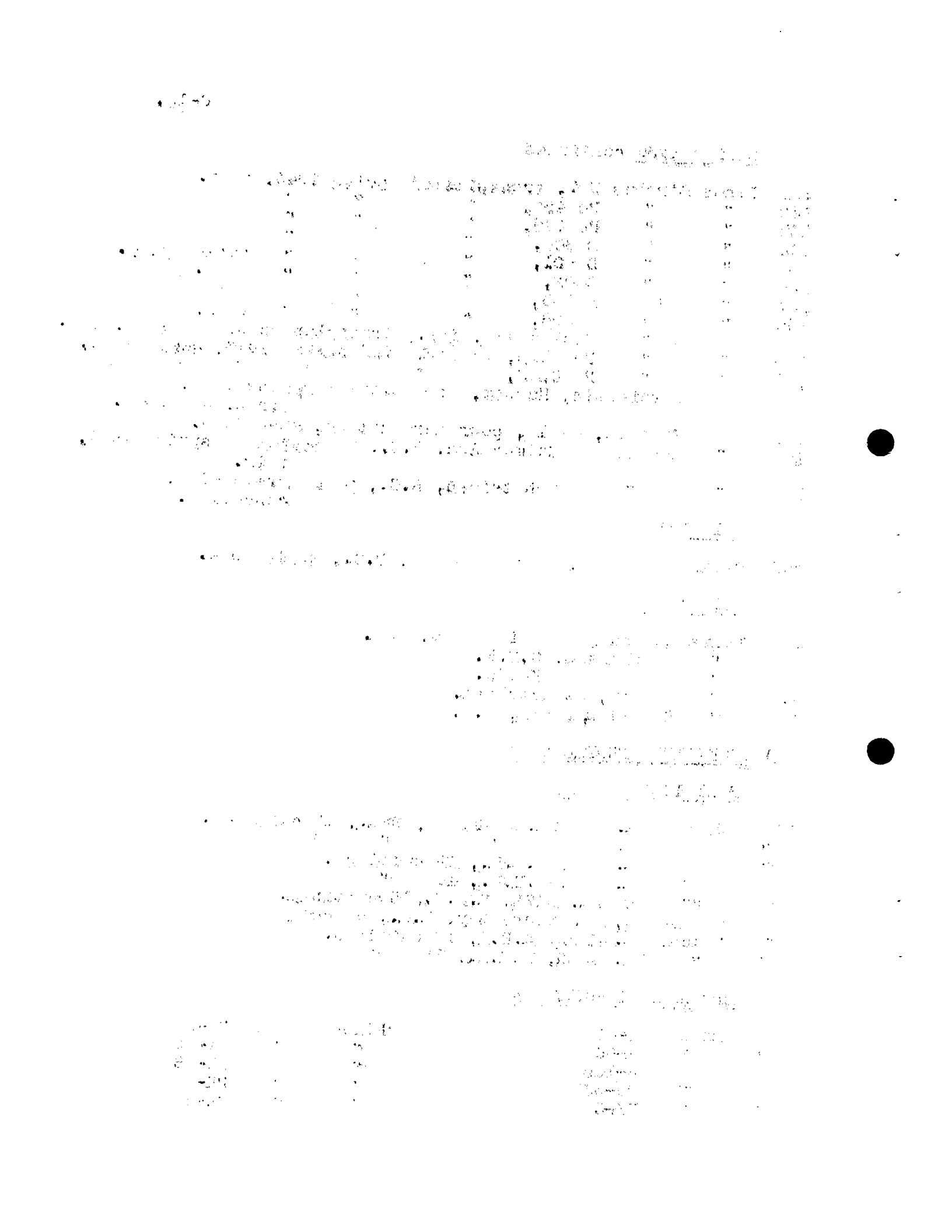
(b) VEGETATIVE PROPAGATION

Fall 1940 cuttings

Pinus Cembra No. 20, St. Williams, Ont., 12 cuttings.
" " No. 21, " " 13 "
" " No. 325, C.E.F., 19 cuttings.
" " No. 571, C.E.F., 16 "
" koraiensis No. 3172, C.E.F., 15 cuttings.
" monticola, Departure Bay, B.C., 60 cuttings.
" Peuce, No. 4158, C.E.F, 19 cuttings.
" " No. 5400, C.E.F., 15 "

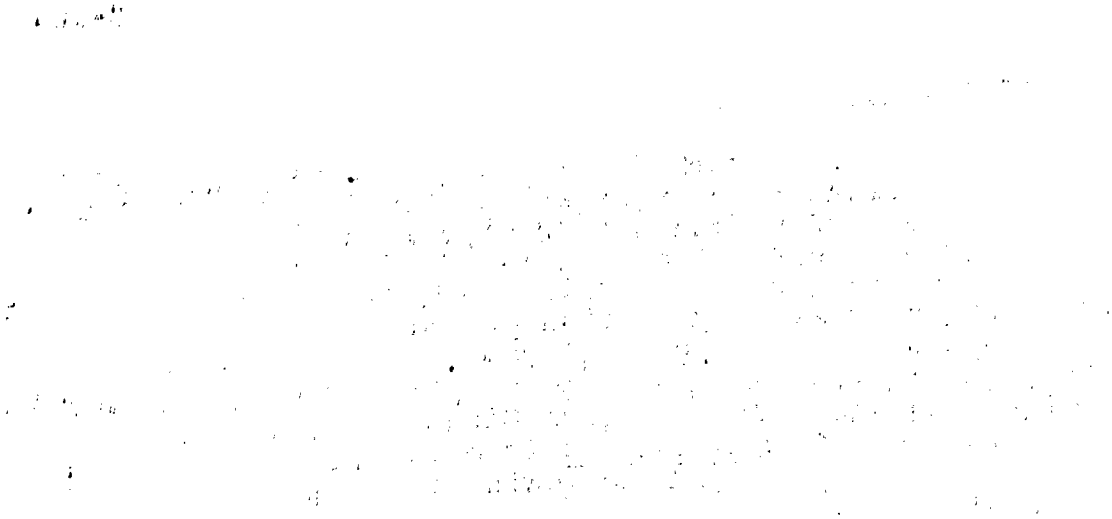
Spring 1941 cuttings

Pinus Strobus B-70
" " B-96
" " B-100
" " Pe-53
" " PK-3
Pinus Strobus PK-25
" " PK-55
" " PK-58
" " PK-60
" " PK-63



(c) OBSERVATIONS TO DATE

Seeds of various strains of P. Strobus sown in the spring without previous stratification and other pre-treatment showed marked differences in degree and rapidity of germination depending upon their origin. Seeds from New England seem not to require as much stratification for rapid and complete germination as seeds from the Lake Champlain region and from Petawawa. Japanese seeds of Pinus koraiensis were found to be better adapted to spring sowing than seeds from eastern Siberia and Manchoukuo. The strain of Pinus monticola from the interior of B.C. is better adapted to spring sowing than the strain from the west coast.



CLASSIFICATION NUMBER: I-A-4 (I-E-a-4)

CLASSIFICATION SUBJECT: Breeding: selection and breeding general.

TITLE OF PROJECT: Strain testing and selection of Douglas fir.

SCHEDULE: Commenced fall 1936.

CONDUCTED BY: C.Heimburger and Pathologists.

OBJECTIVES

Testing of strains of species of Pseudotsuga to study the biotypes found within these. Selection of superior biotypes for purposes of intensive silviculture in eastern Ontario and elsewhere, and for breeding purposes.

METHODS

Raising of plants in the nurseries from seeds and cuttings of known origin. Testing of the material obtained for growth rate and growth form, for adaptation to existing climate and soil conditions, susceptibility to diseases and injuries by insects. Selection of superior populations and clones for further tests in plantations established for this purpose.

EQUIPMENT AND MATERIALS

Nursery tools and other equipment for raising of material, for preparation of planting sites, establishment of tests plantations. Needs anticipated for one year in advance and submitted to the Superintendent of the Petawawa F.E.S.

RESULTS

Found in seed lot, transplant, and plantation records of the Petawawa F.E.S. and in annual reports on nursery work there. Data on clones kept on index cards.

Summary of Previous Work:

(a) SOWINGS

Fall 1936

Seed Lot

11 Pseudotsuga taxifolia var. caesia, Shuswap Lake, B.C., transplanted spring 1938 and 1940, 30% of plants good in 1940.

Fall 1938

66 Pseudotsuga taxifolia var. caesia, Larch Hills, B.C., transplant spring 1940, 80% good.
67 " " " glauca, Kananaskis, F.E.S., hardy, but slow growth.

Fall 1940

219 Pseudotsuga taxifolia var. caesia, Salmon Arm, B.C.
221 " " " glauca, Mt. Indefatigable, Alta.
223 " " " caesia, Prince George, B.C.

(b) VEGETATIVE PROPAGATION

Fall 1940 cuttings

Pseudotsuga taxifolia var. glauca No. 1097, C.E.F., 22 cuttings.

(c) OBSERVATIONS TO DATE

Pseudotsuga taxifolia var. glauca is fully hardy in eastern Ontario but grows very slowly. Strains from the coast of B.C. are very rapid growing but freeze out as seedlings. Material from the Interior of British Columbia belonging chiefly to the var. caesia seems to combine fairly rapid growth with sufficient winter-hardiness and thus may be suitable for growing in eastern Canada. As in the case of Picea excelsa from Norway these strains are very heterogenous. While material from high altitudes is rather uniform in growth form and growth rate, seeds from lower elevations yield a wide variety of types differing markedly in growth rate and several morphological characters. A rather wide variation is also found in respect to winter-hardiness. This is being utilized for the selection of the most useful biotypes.

CLASSIFICATION NUMBER: I-A-5 (I-E-a-5).

CLASSIFICATION SUBJECT: Breeding: selection and breeding general.

TITLE OF PROJECT: Strain testing and selection of larch.

SCHEDULE: Commenced fall 1936.

CONDUCTED BY: C.Heimburger

OBJECTIVES

Testing of strains of native and exotic species of Larix to study the biotypes found within these. Selection of superior biotypes for purposes of intensive silviculture in eastern Ontario and elsewhere and for breeding purposes.

METHODS

Raising of plants in the nurseries from seeds and cuttings of known origin. Testing of the material obtained for growth rate and growth form, for adaptation to existing climate and soil conditions, susceptibility to diseases and injuries by insects. Selection of superior populations and clones for further tests in plantations established for this purpose.

EQUIPMENT AND MATERIALS

Nursery tools and other equipment for raising of material, for preparation of planting sites, establishment and maintenance of test plantations. Needs anticipated one year in advance and submitted to Superintendent of Petawawa F.E.S. Most test plantations need fencing or other means to control damage by porcupines.

RESULTS

Found in seed lot, transplant and plantation records of the Petawawa F.E.S. and in annual reports on nursery work there. Data on clones will be kept on index cards.

Summary of Previous Work:

(a) SOWINGS

Fall 1936

Seed Lot

10 Larix sibirica, Ural Mts., transplanted spring 1939, 2 distinct size classes.

Fall 1937

27 Larix eurolepis F_2, Petawawa, poor germination, cancelled.

Fall 1938

76 Larix eurolepis F_2, Petawawa, very great variation in size and hardiness.
78 " laricina, Oak Point, N.B., no germination, cancelled.
79 " " " " " " " "
80 " " " " " " " "
88 " eurolepis F_2, Petawawa, very great variation in size and hardiness.

Fall 1940

220 Larix occidentalis, Salmon Arm, B.C.
222 " koreana, Keijo.
222 " leptolepis, Keijo.

(b) OBSERVATIONS TO DATE

Larix sibirica from Ural Mountains segregates into two distinct size classes after its first year in the seed bed. There are at least two different climatic strains represented by seed lot received. Larix eurolepis is quite variable, as expected.

CLASSIFICATION NUMBER: I-A-6 (I-E-a-6).

CLASSIFICATION SUBJECT: Breeding: selection and breeding general.

TITLE OF PROJECT: Strain testing and selection of birch.

SCHEDULE: COmmenced fall 1938.

CONDUCTED BY: C.Heimburger.

OBJECTIVES

Testing of strains of native and exotic species of Betula to study the biotypes found within these. Selection of superior biotypes for purposes of intensive silviculture in eastern Ontario and elsewhere, and for breeding purposes.

METHODS

Raising of plants in the nurseries from seeds and cuttings of known origin. Testing of the material obtained for growth rate and growth form, for adaptation to existing climate and soil conditions, susceptibility to diseases and injuries by insects. Selection of superior populations and clones for further tests in plantations established for this purpose.

EQUIPMENT AND MATERIALS

Nursery tools and other equipment for raising of material, for preparation of planting sites, establishment and maintenance of test plantations. Needs anticipated one year in advance and submitted to Superintendent of the Petawawa F.E.S.

RESULTS

Found in seed lot, transplant and plantation records of the Petawawa F.E.S. and in annual reports on nursery work there. Data on clones will be kept on index cards.

Summary of Previous Work:

(a) SOWINGS

Fall 1938

Seed Lot

96 Betula lutea, Lake Edward F.E.S. seed beds much better than drills, good.

106 " " Valcartier F.E.S, drill sowing, perished.

Fall 1939

156 Betula davurica, Harbin, very good.
157 " lutea, Valcartier F.E.S, very good.
160 " ovalifolia, Harbin, drill sowing, perished.
161 " platyphylla, Harbin, good.
133 " lutea, Petawawa F.E.S., good.

Fall 1940

347 Betula japonica, Keijo.
348 " Schmidtii, Keijo.
349 " Maximowiczii, Keijo.

(b) OBSERVATIONS TO DATE

Sowing in protected seed beds is far superior to sowing in open drills. An experiment in fall transplanting of Yellow Birch seedlings started fall 1940.

CLASSIFICATION NUMBER: I-A-7 (I-E-a-7).

CLASSIFICATION SUBJECT: Breeding; selection and breeding general.

TITLE OF PROJECT: Strain testing and selection of poplars.

SCHEDULE: Commenced summer 1938.

CONDUCTED BY: C.Heimburger, L.P.V.Johnson and C.G.Riley.

OBJECTIVES

Testing of strains of native and exotic species of Populus to study the biotypes found within these. Selection of superior biotypes for purposes of intensive silviculture in eastern Ontario and elsewhere and for breeding purposes.

METHODS

Raising of plants in the nurseries from seeds and cuttings of known origin. Testing of material obtained for growth rate and growth form, for adaptation to existing climate and soil conditions, susceptibility to disease and injuries by insects. Selection of superior populations and clones for further tests in plantations established for this purpose.

EQUIPMENT AND MATERIALS

Nursery tools and other equipment for raising of material, for preparation of planting sites, establishment and maintenance of test plantations. Needs anticipated one year in advance and submitted to Superintendent of the Petawawa F.E.S.

RESULTS

Found in annual reports on nursery work at the Petawawa F.E.S., data on populations and clones kept on index cards.

Summary of Previous Work

(a) SOWINGS

Summer 1938

Populus alba x grandidentata, Petawawa, 18 good plants, set out in plantation 41, spring 1940.
" " x " F_2, Aylmer Road, cloned fall 1939, 6 retained, 13 discarded, fall 1940.
" tremuloides var. aurea, Edmonton, 1 seedling left, fall 1940, slow growth, heavily rusted.

Summer 1938 continued

Populus canescens x alba, C.E.F., 2 seedling discarded, fall 1940.
" " x tremuloides, C.E.F., 1 retained, 5 discarded, fall 1940.
" " x grandidentata, C.E.F., 2 discarded, fall 1940.
" termula, East Prussia, 1 left, fall 1940.

Summer 1939

Populus tremula villosa, Germany, several at hand fall 1940, not yet cloned.
" Rasumowskyana x tacamahacca, Petawawa, several at hand fall 1940, not cloned.

(b) VEGETATIVE PROPAGATION

Spring 1934 cuttings

Carolina 2, St. Williams, Ont., out in plantation, spring 1935, used for experiments in propagation in nursery since then.
Andover, Oxford Hybrid, not winter-hardy, discarded 1938.
Androscoggin, Oxford Hybrid, not winter-hardy, discarded spring 1935.
Berolinensis 2, C.E.F., out in plantation, spring 1937, discarded from nursery, 1939.
Frye, Oxford Hybrid, not winter-hardy, discarded spring 1936.
Geneva, Oxford Hybrid, in plantation 41, spring 1940, still being grown.
Maine, Oxford Hybrid, in plantation 41, spring 1940, still being grown.
Oxford, Oxford Hybrid, not winter-hardy, discarded spring 1935.
Rochester, Oxford Hybrid, not winter-hardy, grown for arboretum only.
Roxbury, Oxford Hybrid, not winter-hardy, grown for arboretum only.
Rumford, Oxford Hybrid, discarded spring 1938.
Strathglass, Oxford Hybrid, in plantation 41, spring 1940, still being grown.

Fall 1934 cuttings

Populus tremula 1, Latvia, root cuttings, grown for arboretum only.

Spring 1935 cuttings

Populus Northwest, Indian Head, Sask., hardy, but heavily rusted, grown for arboretum and disease garden.
" Saskatchewan, " " " " " "

Spring 1936 cuttings

Populus canescens 1, Denmark, poor propagability, grown for arboretum only.
" Raverdeau, Berthierville, Que., in plantation 41, spring 1940, still being grown.
" Calgary 1, hardy but heavily rusted, grown for arboretum only.
" " 2, poor propagability, discarded 1937.
" " 3, no rooting, cancelled.
" trichocarpa 1, Victoria, B.C., poor rooting, not hardy, discarded 1937.
" " 2, " " good rooting, not hardy, being grown at St. Williams since 1938.
" " 3, " " good rooting, not hardy, poor growth form, discarded 1937.

Fall 1936 cuttings

Populus Manitoba, Duck Mts., no rooting, discarded.
" Jackii 1, Gatineau River, Que., still being grown.
" canescens 2, Woodstock, N.B., grown for arboretum only.
" " 6, Buckingham, Que., discarded 1939, of no direct use.
" alba x grandidentata 2, Masson, Que., grown for further testing.
" " x " 3, " " poor propagability, discarded 1940.
" " x " 4, " " " "
" " x " 5, " " " 1939.
" " x " 6, Gatineau River, poor propagability, discarded 1938.
" " x " 7, Rideau Canal, Ottawa, poor propagability, discarded 1940.
" " x " 8, Petawawa, poor propagability, discarded 1940.
" " x tremuloides 1, Masson, Que., poor propagability, discarded 1940.
" " x " 2, " " grown for arboretum only.
" Masson, Masson, Que., in plantation 41, spring 1940, still being grown.

Spring 1937 cuttings

Populus Calgary 4, hardy but heavily rusted, grown for arboretum only.
" " 5, no rooting, cancelled.
" " 6, hardy but heavily rusted, grown for arboretum only.
" " 7, no rooting, cancelled.
" " 8, poor propagability, cancelled 1938.
" " 9, no rooting, cancelled.
" " 10, " " "
" " 11, " " "

Spring 1937 cuttings continued

Populus Calgary 12, no rooting, cancelled.
" " 13, " " "
" " 14, " " "
" " 15, " " "
" " 16, hardy but heavily rusted, grown for arboretum only.
" " 17, " " " " " " "
" " 18, no rooting, cancelled.
" " 19, " " "
" " 20, " " "
" " 21, " " "
" " 22, " " "
" " 23, quite promising, still being grown and tested.
" " 24, no rooting, cancelled.
" " 25, " " "
" trichocarpa 4, Revelstoke, B.C., no rooting, cancelled.
" " 5, " " quite promising, still being propagated.
" " 6, " " " " "
" " 7, " " no rooting, cancelled.
" " 8, " " " " "
" " 9, " " " " "
" " 10, C.E.F., no rooting, cancelled.
" vernirubens, Dublin, Ireland, very promising, still being propagated.
" canescens 5, Gatineau River, Que., used for experiments in propagation, of no direct value.

Fall 1937 cuttings

Populus alba x grandidentata 12, Gatineau River, Que., poor propagability, discarded 1939.
" " x " 13, Masson, Que., poor propagability, discarded 1940.
" " x " 14, " " " "
" " x " 15, Aylmer Road, Que., still being propagated.
" " x " 16, " " " perished, spring 1938.
" " x " 17, " " " poor propagability, discarded 1939.
" " x " 18, " " perished, spring 1939
" " x " 19, " " poor propagability, discarded 1939.
" " x " 20, " " poor propagability, discarded 1940.
" " x " 21, Masson, Que., still being propag.
" " x " 22, " " " " "
" " x " 23, " " poor propagability, discarded 1940.
" " x " 24, " " still being propagated

Fall 1937 cuttings continued

Populus alba x grandidentata 25, Masson, Que., poor propagability, discarded 1940.
" " x " 26, " " " " 1939.
" " x " 27, " still being propagated.
" " x " 28, " " " "
" " x " 29, " poor propagability, discarded 1940.
" " x " 30, " " " 1939."
" " x " 31, Longueuil, Que., no rooting, cancelled.
" " x " 32, Aylmer Road, Que., still being propagated.
" " x tremuloides 3, Masson, no rooting, cancelled.
" " x " 4, " " " "
" " x " 5, " poor propagability, discarded 1940.
" " x " 6, " " " " "
" " x " 7, Aylmer Road, Que., no rooting, cancelled.
" " x " 8, Masson, poor propagability, discarded 1939.
" " x " 9, " no rooting, cancelled.
" canescens 3, Eastview, still being propagated, in a group of P. alba x grandidentata.
" " 4, Aylmer Road, Que., poor propagability and of no direct value, discarded 1939.

Spring 1938 cuttings

P. acuminata 1, Calgary, Alta., grown for arboretum only.
" Bassano, Brooks, Alta., grown for arboretum only.
" Brooks 4, Brooks, Alta., still being propagated.
" " 10, " " " " "
" alba 1, Gatineau Mills, Que., no rooting, cancelled.
" alba 2, C.E.F., " " "
" " 3, Masson, Que., poor propagability, discarded 1939.
" " 4, Aylmer Road, Que., poor " " 1940.
" " 7, Germany, no rooting, cancelled.
" " 8, C.E.F., " "
" " 9, C.E.F., " "
" " 10 " " "
" " x grandidentata 10, Ottawa, still being propagated.
" " x " 33, Aylmer Road, Que., poor propagability, discarded 1940.
" " x " 37, " " no rooting, cancelled.
" " x " 38, " " " " "
" " x " 63, " " " " "
" " x " 64, " " " " "
" " x " 65, " " poor propagability, discarded 1938.

Spring 1938 cuttings continues

P. alba x grandidentata 66, Aylmer Road, Que., poor propagability, discarded 1939.
" " x tremuloides 10, Ottawa, no rooting, cancelled.
" " x " 12, Aylmer Road, Que., no rooting, cancelled.
" " x " 14, " " " " " "
" " x " 15, " " " " " "
" " x " 16, " " " " " "
" canescens 7, West of C.E.F., poor propagability, discarded 1939.
" " 8, C.E.F., no rooting, cancelled.
" " 9, Germany, " " "
" " 10, C.E.F., still being propagated.
" grandidentata 1, Petawawa F.E.S, poor propagability, discarded 1940.
" " 2, Aylmer Road, Que., no rooting, cancelled.
" tremuloides 7, " " " " " "
" tremula 2, Lillö, Sweden, still being propagated, quite promising.

Fall 1938 cuttings

P. alba x grandidentata 91, Masson, Que., poor propagability, discarded 1939.
" " x " 92, " still being propagated.
" " x " 93, " no rooting, cancelled.
" " x " 94, " poor propagability, discarded 1939.
" " x " 95, " " " " "
" " x " 96, " " " " "
" " x " 97, " " " " 1940.
" " x " 98, " no rooting, cancelled.
" " x " 99, " " " "
" " x tremuloides 19, Masson, " " "
" Jackii 2, Cap de la Madeleine, Que., still being propagated.

Spring 1939 cuttings

P. angulata erecta, Oxford, England, still being propagated, quite good.
". cathayana 11, Harbin, no rooting, cancelled.
" " 13, " still being propagated, quite good.
" " 14, " not winter-hardy, discarded 1940.
" " 15, " still being propagated, quite good.
" " 16, " " " " " "
" " 17, " " " " " "
" " 18, " " " " " "
" " 19, " not winter-hardy, discarded 1940.
" " 20, " still being propagated, quite good.
" charkoviensis, USSR, no rooting, cancelled.
" deltoides 1, Gatineau River, Que., grown for arboretum only.
" " 2, " " " " " "
" " 3, St. Williams, Ont., " " " "
" " 4, " " " " " "

Spring 1939 cuttings

P. Gelrica, Oxford, England, still being propagated, one of the very best.
" generosa, " Paper Co., still being propagated, quite promising.
" koreana 1, Harbin, no rooting, cancelled.
" " 2, " " " "
" " 3, " poor propagability, discarded 1940.
" " 4, " no rooting, cancelled.
" " 5, " still being propagated.
" " 6, " " " "
" " 7, " no rooting, cancelled.
" " 8, " poor propagability, discarded 1940.
" " 9, " still being propagated.
" " 10, " poor propagability, discarded 1940.
" laurifolia 1, Sweden, no rooting, cancelled.
" " 2, USSR, grown for arboretum only.
" Moskoviensis, USSR, no rooting, cancelled.
" OP-5, Oxford Hybrid, not winter-hardy, grown for arboretum only
" OP-6, " " " " " " " " "
" OP-7, " " " " " " " " "
" OP-10, " " " " " " " " "
" OP-14, " " " " " " " " "
" OP-18, " " " " " " " " "
" OP-23, " " " " " " " " "
" OP-26, " " " " " " " " "
" OP-27, " " " " " " " " "
" OP-30, " " " " " " " " "
" OP-38, " " still being propagated, quite good.
" OP-41, " " not winter-hardy, grown for arboretum only
" OP-42, " " " " " " " " "
" OP-44, " " " " " " " " "
" OP-45, " " still being propagated, quite good.
" OP-46, " " not winter-hardy, grown for arboretum "
" OP-47, " " " " " " " " "
" OP-48, " " " " " " " " "
" OP-49, " " still being propagated, quite good.
" OP-50, " " not winter-hardy, grown for arboretum "
" OP-51, " " " " " " " " "
" OP-52, " " " " " " " " "
" OP-53, " " " " " " " " "
" OP-54, " " still being propagated, quite good.
" OP-55, " " not winter-hardy, grown for arboretum "
" Petrowskyana, USSR, no rooting, cancelled.
" tagamahacca 1, Sweden, no " "
" suaveolens 1, USSR, still being propagated.
" trichocarpa 12, Victoria, B.C., not winter-hardy, grown for arboretum only.

Spring 1939 cuttings continued

P. trichocarpa 13, Victoria, B.C., not winter-hardy, grown for arboretum only.
" " 14, " " " " " "
" " 15, " " " " " "
" " 16, " " " " " "
" " 17, " " " " " "
" " 18, " " " " " "
" " 19, " " " " " "
" " 20, " " " " " "
" " 21, " " " " " "
" " 22, " " " " " "
22-11, Oxford Hybrid, still being propagated, quite promising.
alba 13, Arnprior, Ont., poor propagability, discarded 1940.
" 14, Eastview, Ont., no rooting, cancelled.
" 15, Eastview, Ont., " " "
" 16, " " " " "
" 17, " " " " "
" 18, River Road, Ottawa, no rooting, cancelled.
" 19, Bowesville Road, Ottawa, no rooting, cancelled.
" 20, " " " " " "
" 21, Belmont, no rooting, cancelled.
" 22, " grown for arboretum only.
" 23, Arnprior, Ont., no rooting, cancelled.
" 24, Chalk River, Ont., no " "
" 25, Petawawa, " " "
" 26, " grown for arboretum only.
" 27, Pembroke, Ont., no rooting, cancelled.
" 28, Hurdman's Farm, no rooting, "
" 30, Germany, " " "
" 31, Brno, Moravia, " " "
" 32, " " " " "
" 33, " " " " "
" x grandidentata 67, Masson, Que., still being propagated.
" x " 69, " " no rooting, cancelled.
" x " 71, " " " " "
" x " 72, " " " " "
" x " 73, " " still being propagated.
" x " 74, " " no rooting, cancelled.
" x " 75, " " " " "
" x " 76, " " " " "
" x " 77, " " " " "
" x " 78, " " " " "
" x " 79, " " " " "
" x " 80, " " " " "
" x " 81, " " still being propagated.
" x " 83, " " no rooting, cancelled.
" x " 84, " " " " "
" x " 85, " " " " "
" x " 87, " " " " "
" x " 88, " " " " "
" x " 89, " " " " "

Spring 1939 cuttings continued

P. alba x grandidentata 90, Masson, Que., no rooting, cancelled.
" " x " 101, " " " " "
" " x " 102, " " " " "
" " x " 103, " " " " "
" " x tremuloides 18, " " " " "
" " x " 20, " " " " "
" canescens 11, Oxford, England, no rooting, cancelled.
" " 12, " " " " "
" tremula 3, Scotland, no rooting, cancelled (propagation by root cuttings failed)

Fall 1939 cuttings

P. deltoides x tremuloides 1, Uplands Airfield, no rooting, can.
" " x " 2, Eastview, Ont., " " "
" " x " 3, Masson, Que., grown for arboretum only.
" tacamahacca 2, Petawawa, poor propagability, discarded 1940.
" " 3, " grown for arboretum only.
" tristis 1, Dropmore, Man., grown for " "
" alba 11, C.E.F., no rooting, cancelled.
" " 12, Gatineau River, Que., no rooting, cancelled.
" " 34, Eastview, Ont., " " "
" " 35, Pakenham, Ont., " " "
" " x grandidentata 68, Masson, Que., no rooting, cancelled.
" " x " 70, " " " " "
" " x " 82, " " " " "
" " x " 86, " " " " "
" " x " 104, " " " " "
" " x " 105, " " " " "
" " x " 107, Farrelton, Que., still being propagated.
" " x tremuloides 17, Masson, Que., no rooting, cancelled.
" canescens 13, Bowesvell Road, Ottawa, no rooting, cancelled.
" tremuloides 9, Notakim Depot, Que., no rooting, cancelled.
" " 10, Pensive Depot, Que., poor propagability, discarded 1940.

Spring 1940 cuttings

P. Berolinensis 1, C.E.F., grown for arboretum only.
" candicans, Valcartier, grown for arboretum only.
" cathayana 1, Harbin, still being propagated.
" deltoides 5, St. Williams, Ont., grown for arboretum only.
" " 7, C.E.F., grown for arboretum only.
" Eugenei 1, C.E.F., weak plants, discarded 1940.
" Eugenei 2, C.E.F., grown for arboretum only.
" nigra 1, C.E.F., grown for arboretum only
" nigra 2, Cap de la Madeleine, Que., grown for arboretum only.
" pyramidalis 1, C.E.F., grown for arboretum only.
" nigra rotundifolia 1, C.E.F., grown for arboretum only.
" Simonii 1, C.E.F., grown for arboretum only.
" trichocarpa 11, Lake Tahoe, Calif., grown for arboretum only.
" tristis 2, C.E.F., grown for arboretum only.

Spring 1940 cuttings continued

P. alba	29,	Richmond, Ont.,	grown for arboretum only.					
" "	36,	Hull, Que.,	good rooting,	grown for arboretum.				
" " x grandidentata	34,	Aylmer Road, Que.,	no rooting	cancel.				
" " x "	42,	" "	"	"	"	"		
" " x "	43,	" "	"	"	"	"		
" " x "	47,	Masson, Que.,	still being propagated.					
" " x "	48,	" "	no rooting,	cancelled.				
" " x "	49,	" "	"	"	"			
" " x "	50,	" "	"	"	"			
" " x "	51,	" "	"	"	"			
" " x "	52,	" "	"	"	"			
" " x "	53,	" "	"	"	"			
" " x "	56,	" "	"	"	"			
" " x "	57,	" "	"	"	"			
" " x "	59,	" "	still being propagated.					
" " x "	60,	" "	"	"	"			
" " x "	61,	" "	no rooting,	cancelled.				
" " x "	62,	" "	"	"	"			
" " x tremuloides	13,	" "	"	"	"			

Fall 1940 cuttings

P. Jackii	3,	Dow's Lake, Ottawa.						
" "	4,	McGregor Lake.						
" "	5,	" "						
" "	6,	" "						
" "	7,	" "						
" "	8,	" "						
" laurifolia	3,	C.E.F.						
" alba	37,	Bank St. and C.N.R.,	Ottawa.					
" "	38,	Ironsides, Que.						
" " x grandidentata	108,	Elgin St. & Driveway,	Ottawa.					
" " x "	109,	Bank St. & C.N.R.,	Ottawa.					
" " x "	110,	Dow's Lake,	Ottawa.					
" " x "	111,	Rockcliffe,	Ont.					
" " x "	112,	near Champlain Bridge,	Ottawa.					
" canescens	14,	Aylmer, Que.						

Spring 1941 cuttings

Will include a number of P. Maximoviczii from Harbin, a collection of mostly Asiatic poplars from the Montreal Botanical Garden, a P. Jackii from Montreal and a few additional P. alba x grandidentata clones from Ottawa and vicinity.

(c) OBSERVATIONS TO DATE

Material of P. tremula obtained so far is fully hardy, quite rust-resistant, but slower growing than the native aspens. P. tremula var. villosa appears to be more drought-resistant than the normal glabrous form. P. tremula gigas from Sweden, a triploid form, compares very favourably with the native aspens. P. trichocarpa from Revelstoke, B.C. contains several valuable biotypes that may be of importance to intensive silviculture. P. trichocarpa from the coast of B.C. is not winter-hardy but may be of value in further breeding projects as it is quite rust-resistant and roots well from cuttings. P. trichocarpa and related forms from Calgary, Alta., grows rather slowly and is heavily rusted, since of no direct value, except of possible use in further breeding projects to obtain forms suitable for the prairies. By far the most of the Oxford Hybrids are not winter-hardy and very branchy and hence of no direct value. A few of these are hardy, have clean stems and may be of direct value. Most of this material is being retained for breeding purposes. Several Asiatic species such as P. cathayana, P. koreana, P. suaveolens, seems to be promising for direct use as well as for further breeding projects. None of the P. alba and P. alba x aspen hybrids found in nature have shown good propagability from stem cuttings. Their propagability from root cuttings is now being tested. The good rooting of P. alba 36, found in 1940, may offer possibilities of obtaining good-rooting new hybrids, if further tests confirm the findings of 1940. Several of the more recent cottonwood hybrids from western Europe seem to be quite promising and are being propagated for further tests. Recently, material has been forwarded to S. Africa, Australia and Chile for special uses there. A number of clones have also been sent to the Kananaskis F.E.S. to test their adaptation to the climatic conditions there as a preliminary step to the testing the material in the prairies.

CLASSIFICATION NUMBER: I-A-8 (I-E-b-1)

CLASSIFICATION SUBJECT: Breeding: selection and breeding general.

TITLE OF PROJECT: Breeding of poplars.

CONDUCTED BY: C.Heimburger, L.P.V.Johnson and G.C.Riley.

OBJECTIVES

The production of hardy and disease-resistant new forms of Populus of rapid growth for the production of wood of high quality for industrial purposes and of value for shelterbelts in the prairies.

METHODS

Hybridization of parental forms having known valuable characters and recombination of these characters in the hybrids. Selection for propagability, growth rate and growth form, for adaptation to existing climate and soil conditions, resistance to disease and injuries by insects, among the seedlings obtained. Selection of superior clones in this respect for further tests in plantations established for this purpose.

EQUIPMENT AND MATERIALS

Greenhouse and other facilities to effect the crosses. Nursery tools and other material for the raising of the seedlings, the testing of the seedlings for propagability and other characters, and their vegetative propagation. Equipment for the preparation of planting sites, the establishment and maintenance of test plantations. Needs as regards nursery and plantation facilities anticipated one year in advance and submitted to the Superintendent of the Petawawa F.E.S. greenhouse facilities and the N.R.C.

RESULTS

Found in annual reports on nursery work at the Petawawa F.E.S. Data on populations and clones kept on index cards. Results of some of the previous work published in 1936: C.Heimburger, Report on Poplar Hybridization, 1936; Forestry Chronicle 12:285-290, in 1938; F.H.Peto, Cytology of Poplar Species and Natural Hybrids, Canadian Journal of Research C 16: 445-455 and in 1940; C. Heimburger, Report on Poplar Hybridization II, 1937 and 1938, Forestry Chronicle 16:149-160.

Summary of Previous Work

1936 Crosses

P. tremuloides x grandidentata, of the 10 seedlings obtained, 7 have been discarded because of poor propagability from root cuttings. Two clones are being grown for arboretum purposes only

and one clone has so far shown good propagability and disease resistance to warrant its propagation on a larger scale.

P. canescens x grandidentata, of the 36 seedlings obtained, 26 have been discarded because of poor propagability from root cuttings and susceptibility to disease. Ten clones are still being propagated from root cuttings for further tests. Of these, 6 clones have shown a fairly good propagability from stem cuttings also.

1937 Crosses

P. canescens x alba var. Bolleana, only one seedling from this cross was retained and is now being grown for arboretum purposes, as it has no direct value.

1938 Crosses

P. acuminata x Eugenei, of the 11 straight-growing seedlings obtained, 6 have been discarded because of poor propagability. The remaining 5 seedlings are being propagated for further tests.

P. Berolinensis x Northwest, of the 26 normal seedlings at hand in the fall of 1939, 11 have been discarded because of poor propagability or poor growth rate. The remaining 15 seedlings are being propagated for further tests.

P. tremuloides x adenopoda, of the 7 seedlings at hand in 1939, 4 have been discarded because of poor propagability from root cuttings. The remaining 3 seedlings are being propagated for further tests.

P. (alba x grandidentata) x Eugenei, 3 seedlings from this cross are still at hand. They cannot be propagated from stem cuttings and are being kept for further tests with root cuttings.

P. (alba x grandidentata) x tremuloides var. aurea, of the 57 seedlings at hand in 1939, 6 have been discarded in 1940 because of slow growth. None of the remaining seedlings can be propagated from stem cuttings. The material is being retained for further tests with root cuttings.

P. (alba x grandidentata) x canescens, the single seedlings of this cross obtained in 1939 was tested for propagability from root cuttings, and was not found satisfactory in this respect. It was, therefore, discarded.

P. canescens x tremuloides var. aurea, of the 1538 seedlings of this cross at hand in 1938, 74 perished in the winter of 1938-39, 47 perished in the winter of 1939-40, 524 were more

or less frozen back in the winter of 1939-40 and were discarded with the exception of two seedlings that were free from rust during the previous summer. During the summer of 1940 it was observed that 264 of the remaining seedlings had "curly leaf", 317 had very slow growth and 229 were pendulous or semi-pendulous in their growth form. These were all discarded. The remaining selected seedlings are being retained for further propagation and tests.

CLASSIFICATION NUMBER: I-A-9 (I-E-a-x)

CLASSIFICATION SUBJECT: Breeding; selection and breeding general.

TITLE OF PROJECT: Strain testing and selection of miscellaneous species.

CONDUCTED BY: C.Heimburger and L.P.V.Johnson.

OBJECTIVES

Testing of strains of native and exotic species of Tilia, Fraxinus, Quercus, Acer, Phellodendron, Abies, Alnus, Tsuga, Ulmus and other forest tree genera of value to forestry in Canada, to study the biotypes found within these. Selection of superior biotypes for purposes of intensive silviculture in eastern Ontario and elsewhere and for breeding purposes.

METHODS

Raising of plants in the nurseries from seeds and cuttings of known origin. Testing of the material obtained for growth rate and growth form, for adaptation to existing climate and soil conditions, susceptibility to disease and injuries by insects. Selection of superior populations and clones for further tests in plantations established for this purpose.

EQUIPMENT AND MATERIALS

Nursery tools and other equipment for raising of material, for preparation of planting sites, establishment and maintenance of test plantations. Needs anticipated one year in advance and submitted to superintendent of Petawawa F.E.S.

RESULTS

Found in seed lot, transplant and plantation records of the Petawawa F.E.S. and in annual reports on nursery work there. Data on clones are kept on index cards. To be subdivided into separate projects as needed.

Summary of Previous Work

(a) SOWINGS

Spring 1938

Seed Lot

57 Abies Nordmanniana, USSR, transplanted spring 1939, poor survival.

62 " " Denmark, transplanted spring 1939, poor survival.

Spring 1938

148 Fraxinus excelsior, USSR, poor germination, good survival.
149 " americana, Angus, Ont., poor germination, good "
150 " manshurica, Japan, good germination, fair "

Fall 1938

97 Ribes Cynosbati, King Mountain, good, transplanted spring 1940.
99 Quercus borealis, Highview, good.
100 " " Indian Point, good.
101 " " seed tree 1, Petawawa, good.
102 " " " " 2, " "
103 " " " " 3, " "
104 " " " " 4, " "
105 " " Hillsboro, N.H., no germination, cancelled.
147 Acer saccharum, Petawawa, poor germination, cancelled.
151 Fraxinus americana, Petawawa, good.
98 Tilia amurensis, Japan, good germination, perished, cancelled.

Spring 1939

108 Tsuga Mertensiana, Seymour Range, B.C., good, but very slow growth.
154 Tilia amurensis, Harbin, good germination, perished, cancelled.

Fall 1939

155 Acer macrophyllum, Cisco, B.C., no germination, cancelled.
158 Phellodendron amurense, Harbin, good.
159 " " USSR, good.
211 Fraxinus manshurica, USSR.
212 Tilia manshurica, USSR.

Spring 1940

213 Quercus serrata, Keijo, good germination, poor survival.
214 " acutissima, Keijo, good germination, poor survival.

Fall 1940

230 Abies grandis, Courtenay, B.C.
236 Fraxinus manshurica, Harbin.
237 " " Keijo.
250 Acer glabrum, Kananaskis F.E.S.

(b) VEGETATIVE PROPAGATION

Fall 1940 cuttings

Cupressus Leylandii (C. macrocarpa x Chamaecyparis nootkatensis F_1)

(c) OBSERVATIONS TO DATE

Seeds of Tilia show very poor survival when sown in open drills but give good results in protected seed beds. Ribes Cynosbati can be raised by sowing ripe berries directly after harvesting in seed beds. Quercus borealis gives good results by sowing in open drills soon after harvesting in the fall. Various experiments with seeds of Tilia americana carried out to study technique of raising Tilia from seed cuttings and by layering.

CLASSIFICATION NUMBER: I-B-1

CLASSIFICATION SUBJECT: **Breeding; hybridization.**

TITLE OF PROJECT: **Interspecific hybridization in forest-tree genera.**

SCHEDULE: **Commenced March, 1938.**

CONDUCTED BY: **L.P.V.Johnson and C. Heimburger.**

OBJECTIVE

To develop inherently superior types of forest trees capable of producing high quality products over a wide range of environment and in the shortest possible time.

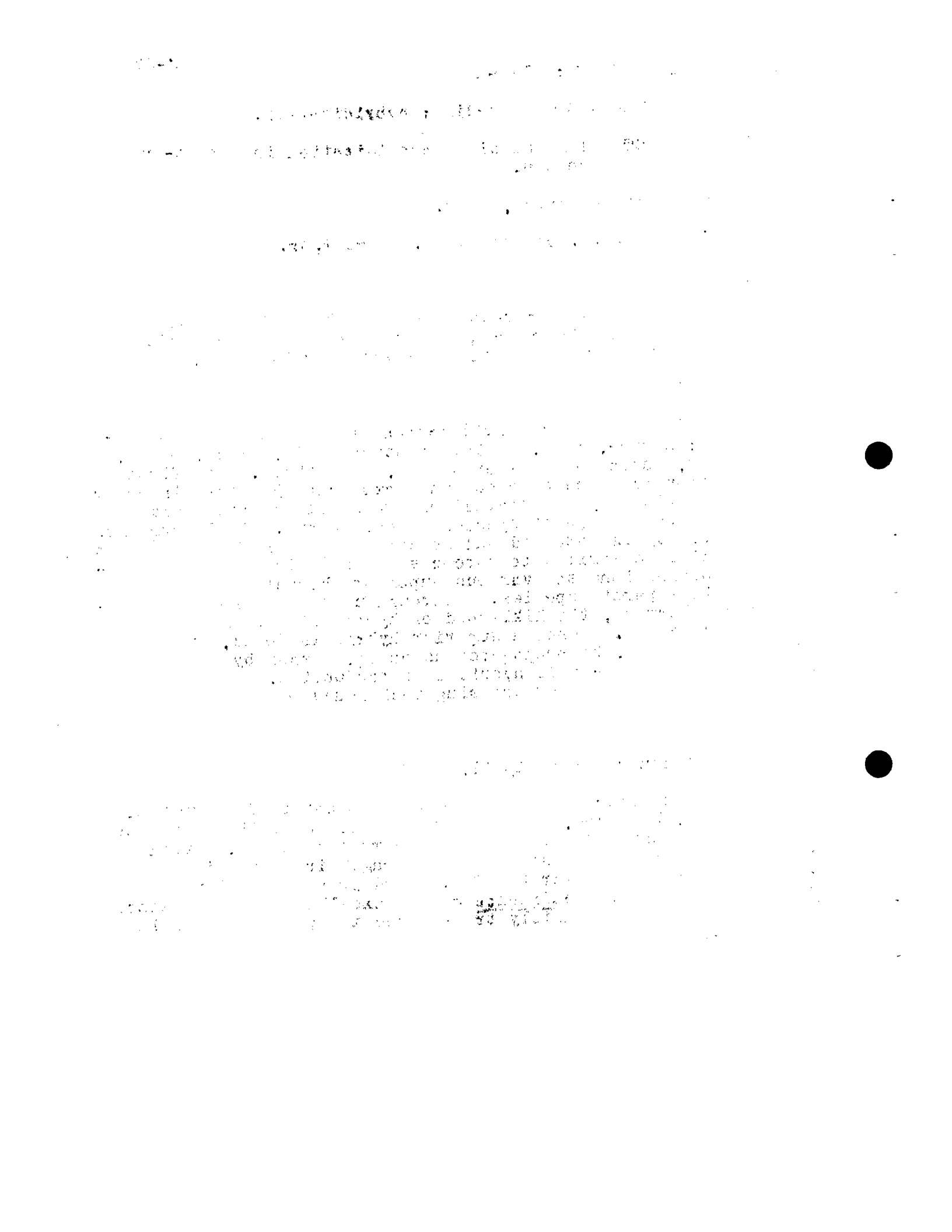
MATERIALS AND METHODS

Interspecific hybridization will include the following genera: spruce, pine, poplar, basswood, elm, birch, maple, walnut, oak, larch, ash, alder willow, and others. At first hybridization is to be of a somewhat exploratory nature in order that information may be obtained on crossability within and between various groups of species in each genus. As information on crossability is obtained and as crossing technique is perfected, crossing will be limited to attempts to unite in the most advantageous combinations the various superior characteristics now resident in separate species. Throughout all crosses, exploratory and otherwise, the liklihood of hybrid vigour will in itself justify the cross. Once a superior hybrid is found, it will, wherever possible, be propagated as an F_1, either by vegetative methods or by large-scale hybrid seed production.
(see I-B-2 for crossing technique).

RESULTS

(Brought up to April, 1941)

Interspecific hybrids have been obtained in spruce, pine, poplar, basswood, elm and birch. Tests of these hybrids have not been carried far enough to warrant a report. Hybrid vigour, however, may be said to be strongly indicated in certain spruce and poplar hybrids. And in a cross between Populus alba and P. grandidentata, the excellent rooting capacity of the former was definitely transmitted to hybrid as a dominant character.



CLASSIFICATION NUMBER: I-B-2

CLASSIFICATION SUBJECT: **Breeding: hybridization.**

TITLE OF EXPERIMENT: **The development of crossing technique for forest-tree genera.**

SCHEDULE: Commenced March, 1938.

CONDUCTED BY: L. P. V. Johnson

OBJECTIVE:

To find efficient and convenient methods of making interspecific crosses in forest-tree genera (see I-B-1).

MATERIALS AND METHODS

The development of superior crossing techniques involves: tests of various pollen-proof protective coverings for female flowers; methods of collecting, storing, transporting and applying pollen (see I-B-3); culture of detached flower branches (used in greenhouse crossing); methods of emasculation; studies on self sterility (see I-Z-1); investigations on large-scale crossing, etc.

RESULTS

It is expected to publish results of this work at the end of the 1941 crossing season. Reprints will be forwarded for filing with this outline.

CLASSIFICATION NUMBER: I-B-3

CLASSIFICATION SUBJECT: Breeding: hybridization

TITLE OF EXPERIMENT: Studies on the storage and artificial germination of forest-tree pollen.

SCHEDULE: Commenced March, 1938.

CONDUCTED BY; L. P. V. Johnson

OBJECTIVE

To find efficient and convenient methods of storing the various kinds of pollen used in the hybridization work on forest trees; and, to find suitable methods for making germination tests of fresh and stored pollen.

MATERIALS AND METHODS

Pollen collected from various species of spruce, pine, poplar, basswood, elm, birch, maple, oak, larch, ash, etc. is stored in desiccators under various conditions of humidity, light and temperature. Germination tests are made on various media, such as agar, silica gel and distilled water, which contain various concentrations of a nutrient, such as sucrose, sterile yeast extract, vitamin B_1, etc.

RESULTS

It is too early to state results from this work. However, it may be said that light and high temperatures are deleterious to pollen in storage, and that low relative humidity (5 to 20%) appears to be most favorable to pollen stored at room temperatures, while humidity of about 35% appears to be most favorable to pollen stored at temperatures just above freezing. It has been demonstrated that pine pollen will germinate very well on agar or distilled water without nutrient, while in poplar pollen germination is favored by relatively high concentrations of nutrient, for example, 10% sucrose in 0.75% agar.

CLASSIFICATION NUMBER: I-C-1

CLASSIFICATION SUBJECT: Breeding: production of polyploid forms

TITLE OF EXPERIMENT: Production of amphidiploid forms of forest trees by the colchicine method.

SCHEDULE: Commenced December, 1938.

CONDUCTED BY: L. P. V. Johnson

OBJECTIVE

To investigate the possibility of producing new forms of forest trees through doubling the chromosome numbers in pure species by the colchicine method. In cultivated agricultural plants, polyploid species (such as tetraploids with four sets of chromosomes) are economically superior to diploid species (two sets of chromosomes). Since most of our important forest-tree species are diploid, it would appear that chromosome doubling holds good possibilities as a means of producing superior forms.

METHODS

Various methods of applying colchicine have been used: e.g., 0.5 and 1.0% in agar applied to cut growing tips in gelatin capsules (waterproofed with collodion for outdoors); immersion of entire roots of young trees in 0.05 and 0.1% solutions; bandaging of bruised stems with absorbent cotton saturated in 0.4% and covered with sheet rubber (dental rubber dam); germinating seeds on blotters saturated with 0.1, 0.2 and 0.4%, removing seedlings when characteristic swelling of root and shoot are noted; and, 0.2% colchicine in 0.75% agar applied in waterproofed capsules to shoots of newly emerged seedings growing in greenhouse flats - this permits stem treatment without root treatment.

MATERIALS

To date some thirty species of forest trees, including all important native forms, have been subjected to colchicine treatment.

RESULTS

(Brought up to April, 1941)

Nearly all species have reacted positively to treatment. The effect is commonly distortion of leaves, thickening of the stem and general stunting of the plant. In some cases, however, the affected plant is more vigourous, e.g., in maple and ponderosa pine. Seed treatment are the most convenient but have one serious drawback - the roots, which emerge from the seed before the stem, get an overdose by the time the stem is sufficiently affected.

This work is considered to be very promising, but much research must be done before definite conclusions can be drawn.

CLASSIFICATION NUMBER: I-Z-1

CLASSIFICATION SUBJECT: Breeding: general

TITLE OF EXPERIMENT: Studies on self sterility in forest trees.

SCHEDULE: Commenced May, 1938.

CONDUCTED BY: L.P.V. Johnson

OBJECTIVE

To ascertain the degree to which self sterility exists in the forest-tree species being used in hybridization work. In genera having perfect flowers, e.g., Ulmus, Tilia, a high degree of self sterility would obviate the necessity of emasculation in hybridization. In other genera, self sterility would simplify large-scale hybrid seed production.

MATERIALS AND METHODS

At the time of the regular interspecific cross pollinations, female flowers are bagged and provided with means of self pollination. As a check, pollen from another tree of the same species is substituted for self pollen in a number of bags on each tree. Genera involved (up to end of 1940) are Ulmus, Tilia, Picea, Pinus and Betula.

RESULTS

(Brought up to end of 1940)

A high degree of self sterility has been shown to exist in several species of Ulmus, namely, U. americana, U. Heyderi, U. pumila and U. effusa. No definite instance of self sterility has been noted in the other genera under study.

CLASSIFICATION NUMBER: I-Z-2

CLASSIFICATION SUBJECT: Breeding: general.

TITLE OF EXPERIMENT: Storage humidity in relation to longevity of seeds of poplar and elm.

SCHEDULE: Commenced May, 1938; finished April, 1941.

CONDUCTED BY: L. P. V. Johnson

OBJECTIVE

To investigate the effect of storage in a graduated humidity upon the germinability of poplar and elm seeds after various periods of storage. Since poplar seeds lose their vitality in a few weeks under ordinary conditions of storage, and since it is often desirable to retain seeds for much longer periods, it would be very useful to discover a method for prolonging longevity in storage. Elm seeds normally retain fair viability for several months, but there is a need for a method of storage that will maintain high vitality for periods up to one year.

MATERIALS AND METHODS

Seeds are stored in desiccators maintained at 2.5, 20, 35, 50 (and in the case of poplar, also 65 and 80) percent relative humidity. Germination tests of seeds from each condition of storage are made at regular intervals. Species used are: Populus grandidentata, P. tremuloides, Ulmus americana, U. effusa, and U. Pumila.

RESULTS

Storage in 20% relative humidity proved to be the best for both species of poplar, seeds retaining viability for as long as 555 days. Poplar seeds stored in open air failed to germinate after 42 days. Elm seeds proved to be much less sensitive to humidity and results of the experiment must be considered inconclusive.

CLASSIFICATION NUMBER: II-A-1

CLASSIFICATION SUBJECT: Genetics and cytology: inheritance studies

TITLE OF EXPERIMENT: Studies on genetic variability for sugar production in the sugar maple and the white birch.

SCHEDULE: Commenced March, 1941.

CONDUCTED BY: L. P. V. Johnson

OBJECTIVE

Primarily, to study the sap and sugar production of a series of comparable sugar maples with the view of obtaining definite information on genetic variability for this characteristic. This information is a prerequisite to any consideration of a breeding project in the sugar maple. The study as it concerns the white birch may be considered as being of an incidental and exploratory nature.

MATERIALS AND METHODS

A series of 36 sugar maples (25 at the Holy Ghost Sugar Bush, and 11 at the N.R.C. Annex) were selected for study. Each site is uniform, and trees are comparable with respect to age, size, exposure, and type and size of crown. The volume of sap produced by each tree is measured, and the sugar concentration of the sap at the beginning, middle and end of the sap season is determined polarimetrically. The study will be continued for at least three years. The work on white birch follows the lines of that on maple.

RESULTS

(Brought up to April, 1941)

There is wide variability in sap concentration and sap volume in both maple and birch. Further work must be done before any conclusions can be drawn regarding the genetic or environmental nature of these variations.

The sugar of maple sap proved to be sucrose (dextrorotatory); while that of birch appeared to be a mixture of fructose(levorotatory) and glucose (dextrorotatory), the products of decomposed (inverted) sucrose. Birch sap produces about one-third as much syrup per unit volume compared to maple sap, and does not appear to have any particular flavour to recommend it.

CLASSIFICATION NUMBER: III-A-1

CLASSIFICATION SUBJECT: Wood technology: histological studies

TITLE OF EXPERIMENT: The relation of growth rate to wood quality in Populus hybrids

SCHEDULE: Commenced September, 1939; finished April, 1941

CONDUCTED BY: L. P. V. Johnson

OBJECTIVE

To investigate in Populus the degree, if any, to which rapidity of growth (especially hybrid vigour) affects the quality of wood for pulping and other purposes. It is a demonstrated fact that growth rate affects the structure of the wood, e.g., spring wood and summer wood in annual rings. Since hybridity commonly introduces increased vigour of growth, the growing of hybrid trees must take into account the possibility of adverse wood characteristics arising from increased rate of growth.

MATERIALS AND METHODS

Trees under study, selected for variability in growth rate are as follows:

P. alba x P. grandidentata	24 trees
P. alba x P. tremuloides	8 "
P. alba	2 "
P. grandidentata	6 "
P. tremuloides	3 "
Total	43 trees

Each tree was measured for diameter and height, its age determined, and a 1/2-inch core removed from the butt at 18 inches from the ground. Specific gravity of each core was determined. Wood samples from the Spring, middle, and Summer regions of average-growth annual rings (and in certain trees of fast-growth and slow-growth annual rings) of each tree were mascerated and fibre dimensions determined microscopically. Correlation studies were made between all imporant combinations of the following variables:

1. average annual increment in height
2. " " " " diameter
3. " " " " volume
4. vigour index (product of 1 and 2)
5. average length of fibres
6. " width of "
7. specific gravity of wood
8. height-diameter ratio.

RESULTS

Results of this experiment are to be published very shortly. Reprints will be forwarded for filing with this outline.

CLASSIFICATION NUMBER: III-D-1

CLASSIFICATION SUBJECT: Wood technology: pulp and paper tests

TITLE OF EXPERIMENT: Comparative pulp and paper tests of hybrid and parental trees in Populus

SCHEDULE: Commenced September, 1939; finished April, 1941.

CONDUCTED BY: L.P.V. Johnson (in collaboration with the Forest Products Laboratory, Dominion Forest Service)

OBJECTIVE

To ascertain whether any marked differences in pulp and paper quality might be found in wood samples derived from a relatively slow-growing parental species and from an abnormally rapid-growing hybrid.

MATERIALS AND METHODS

An entire trunk (A x G-106) of a vigourous P. alba x P. grandidentata hybrid, and a similar trunk (G-2) of a slow-growing P. grandidentata tree were sent to the Pulp and Paper Division, Forest Products Laboratory, Montreal, for testing. The tree G-2 was 40 feet in height, 3.9 inches in diameter, and 18 years of age; while the tree A x G-106 was 34 feet in height, 5.0 inches in diameter, and only six years of age.

RESULTS

Results of this experiment are to be published very shortly. Reprints will be forwarded for filing with this outline.

CLASSIFICATION NUMBER: IV-A-1 (50:1)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Norway spruce, June collections

SCHEDULE: Commenced June, 1940

CONDUCTED BY: J. L. Farrar at P.F.E.S.

OBJECTIVES

(a) To compare two concentrations of Alfred peat in fine and coarse sand.
(b) To try dust treatments with indolylacetic acid.
(c) To continue the seasonal collections already begun.

MATERIALS AND METHODS

Cuttings are planted in beds, Type 4, covered with shades, Type 3, and watered daily. A collection is made of 1939 growth bearing 1 cm. of 1940 growth and a later collection of fully extended 1940 growth. The treatments given are: control, talc, 100, 1000 and 8000 p.p.m. indolylacetic acid in talc.

PROGRESS

To April, 1941.

The experiment has been completed and the results will appear in Nos. IX and X of the series "Vegetative Propagation of Conifers" in the Canadian Journal of Research.

CLASSIFICATION NUMBER: IV-A-3 (50:3)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Wire girdling

SCHEDULE: Commenced June, 1940

CONDUCTED BY: J. L. Farrar at P.F.E.S.

OBJECTIVES

To determine if girdling induces change in the propagability of twigs or their ability to produce flower buds.

MATERIALS AND METHODS

To influence propagability lower branches are girdled near the trunk in June. The twigs are collected and planted in October in beds, Type 4, with shades, Type 3, in an Alfred peat medium. The cuttings will be examined in September, 1941. Control cuttings are obtained from ungirdled branches on the same trees.

To influence flowering the main trunk is girdled where its diameter is between 1 and 2 inches. Flowering will be observed on these and neighbouring trees.

For girdling #20 brass wire for smaller branches, and haywire for larger branches is used. It is twisted until it begins to cut into the bark.

Norway spruce, white spruce, and red pine are the species used.

PROGRESS

To April, 1941.

The brass wire was not strong enough. By October many girdles were broken. Cuttings were collected and planted in October.

CLASSIFICATION NUMBER: IV-A-4 (50:4)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Norway spruce: hormone-treated upper cuttings in Alfred peat.

SCHEDULE: Commenced October, 1940

CONDUCTED BY: J. L. Farrar at P.F.E.S.

OBJECTIVES

To check beneficial results obtained in Experiment IV-A-38-G1 with indolylacetic acid and sugar, and the influence of medium on these effects.

MATERIALS AND METHODS

Cuttings are planted in beds, Type 4, covered with shades, Type 3, and watered daily. The cuttings are obtained from the upper half of 18 year old trees from twigs 3 to 6 inches long. The treatments are: control, talc, 1000, 2000, 4000 and 8000 p.p.m. indolylacetic acid in talc, and 4000 indolylacetic plus 10% cane sugar in talc. The media are coarse and fine sand and a mixture of the two used separately and mixed with Alfred peat in proportions by volume of 4:1, 4:2 and 4:4 (sand:peat).

PROGRESS

April 4, 1941

The cuttings were planted as scheduled in October, 1940.

CLASSIFICATION NUMBER: IV-A-5 (50:5)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT; Temperature and evaporation.

SCHEDULE: Commenced May, 1940

CONDUCTED BY: J. L. Farrar at P. F. E. S.

OBJECTIVES

To determine maximum and minimum weekly temperatures and the weekly evaporation, in beds, Type 4, covered with shades, Type 3.

MATERIALS AND METHODS

Maximum and minimum thermometers are put on the south side of two beds and read weekly. Two atmometers are put in each of the two beds and refilled weekly. They are rotated weekly to eliminate individual variation in atmometers.

PROGRESS:

To April, 1941.

The readings were taken from May to October.

CLASSIFICATION NUMBER: IV-A-6 (50:6)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Propagation of individual trees.

SCHEDULE:

CONDUCTED BY: C. C. Heimburger and J. L. Farrar at P. F. E. S.

OBJECTIVES

To determine the propagability of various coniferous clones under conditions found optimum for Norway spruce.

MATERIALS AND METHODS

The cuttings are collected in late September and October and planted in bed, Type 4, covered with shades, Type 3, in medium No. 7. (Bed 98). The cuttings include several spruces and pines from the Central Experimental Farm Arboretum and two pines and a spruce from the Ontario Forests Branch, St. Williams.

PROGRESS

To April, 1941.

The cuttings were planted in October, 1940.

CLASSIFICATION NUMBER: IV-A-7 (50:7)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Norway spruce: watering, shading, and depth of planting.

SCHEDULE: Commenced October, 1940

CONDUCTED BY: J. L. Farrar at P. F. E. S.

OBJECTIVES

To determine the optimum conditions for propagating Norway spruce cuttings outdoors.

MATERIALS AND METHODS

Cuttings are planted in beds, Type 4, They are obtained from the lower half of 18 year old trees from twigs 3 to 6 inches long. Planting is to a depth of 3, 4, and 5 cm. Shades are Type 3 and 4 all year, and Type 3 followed by Type 4. Three degrees of watering will be used.

PROGRESS

April, 1941.

The cuttings were planted in October, 1940. A means of regulating the watering schedule is being investigated. (IV-A-17 or 50:17)

CLASSIFICATION NUMBER: IV-A-8 (50:8)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Norway spruce: cuttings from different positions on the tree.

SCHEDULE: Commenced October, 1940

CONDUCTED BY: J. L. Farrar at P. F. E. S.

OBJECTIVES

To determine the propagability of cuttings from various levels on the tree and the interaction with hormone treatment.

MATERIALS AND METHODS

Cuttings are planted in beds, Type 4, covered with screens, Type 3 and watered daily. All are from one 18 year old tree, 15 feet high. Twigs used were all 3 to 6 inches long. Each whorl is kept separate and then grouped to give convenient numbers. (2,3,4), (5), (6), (7,8), (9, 10, 11). The treatments are: control, talc, and 4000 p.p.m. indolylacetic acid in talc.

PROGRESS

April, 1941.

The cuttings were planted in October, 1940.

CLASSIFICATION NUMBER: IV-A-9 (50:9)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Norway spruce: soil media

SCHEDULE: Commenced October, 1940

CONDUCTED BY: J. L. Farrar at P. F. E. S.

OBJECTIVES

To find a medium in which cuttings may be rooted and then maintained for a year or more.

MATERIALS AND METHODS

Cuttings are planted in beds, Type 4, covered with screens, Type 3, and watered as necessary. They are obtained from twigs 3 to 6 inches long off the lower part of 18 year old trees. The media are tabulated. The proportions are by volume.

No.	Soil	Sand	Alfred peat
36	0	2	1
37	1	1	1
38	2	0	1
39	1	2	0
40	1	0	0

PROGRESS

April, 1941.

The cuttings were planted in October, 1940.

CLASSIFICATION NUMBER: IV-A-10 (50:10)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: White pine: type of cuttings

SCHEDULE: Commence August, 1941.

CONDUCTED BY:

OBJECTIVES

To determine the propagability of various types of white pine cuttings.

MATERIALS AND METHODS

Cuttings are taken in the latter half of August and planted in beds, Type 4, covered with shades, Type 3, in medium No. 7 and watered daily. Cuttings are divided into two length classes and the longer ones used full length and shortened. Cuttings are taken from two age classes of trees and from the upper and lower parts of these trees.

CLASSIFICATION NUMBER: IV-A-11 (50:11)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: White pine: watering, shading, depth of planting.

SCHEDULE: Commence August, 1941

CONDUCTED BY:

OBJECTIVES

To determine the optimum conditions for propagating white pine outdoors.

MATERIALS AND METHODS

Similar to IV-A-7 with Norway spruce.

CLASSIFICATION NUMBER: IV-A-12 (50:12)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Propagation of various coniferous species.

SCHEDULE: Commenced October, 1940

CONDUCTED BY: C. C. Heimburger and J. L. Farrar at P.F.E.S.

OBJECTIVES

To determine the propagability of various coniferous species found at the P.F.E.S. and elsewhere under conditions optimum for Norway spruce.

MATERIALS AND METHODS

Similar to IV-A-6 with Norway spruce. Besides all conifers available at Petawawa there are two spruces from Rananaskis.

PROGRESS

April, 1941.

The cuttings have been planted in October, 1940.

CLASSIFICATION NUMBER: IV-A-13 (50:13)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Norway spruce: twelve-inch cuttings with hormone treatments.

SCHEDULE: Commenced October, 1940

CONDUCTED BY: J. L. Farrar at P.F.E.S.

OBJECTIVES

To determine effects of hormone treatments on medium-length and long cuttings.

MATERIALS AND METHODS

Cuttings are planted in beds, Type 4, covered with shades, Type 3, and watered daily. The bed has 20 inches of head room in place of the usual 7. The treatments are identical with those in Experiment IV-A-4 (50:4). The cuttings are 8 to 12 inches long, collected from the upper part of the trees. The medium is No. 4. The cuttings were planted 5 inches deep with a trowel.

PROGRESS

April 4, 1941.

The cuttings were planted in October, 1940.

CLASSIFICATION NUMBER: IV-A-14 (50:14)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Norway spruce: length of cuttings

SCHEDULE: Commenced October, 1940

CONDUCTED BY: J. L. Farrar at P. F. E. S.

OBJECTIVES

To determine the propagability of cuttings of various lengths.

MATERIALS AND METHODS

Cuttings are planted in beds, Type 4, covered with shades, Type 3, in medium No. 4, and watered daily. The bed has 20 inches of head room in place of the usual 7. The lengths are, in inches: 3 to 6, 8 - 12, and 12 - 16. The two longer classes were planted 3 inches deep with a trowel, and the short 2-1/2 inches with the Petawawa board.

PROGRESS

April 4, 1941.

The cuttings were planted in October, 1940.

CLASSIFICATION NUMBER: IV-A-15 (50:15)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Norway spruce: seasonal progress of rooting.

SCHEDULE: Commenced October, 1940

CONDUCTED BY: J. L. Farrar at P. F. E. S.

OBJECTIVES

To determine when roots originate, when they grow and the optimum season for transplanting.

MATERIALS AND METHODS

Cuttings are planted in a bed, Type 4, covered with shades, Type 3, in medium No. 7, and watered daily. The cuttings are 3 to 6 inches long from the lower part of the tree. Provision is made for lifting 4 groups of 10 cuttings at 15 periods. These may occur every two weeks throughout one season. Until 80% rooting is reached, the cuttings should be replanted and taken up 52 weeks later. When 80% rooting is achieved, all cuttings lifted should be transplanted to a bed in Nursery 1, with Type 4 shades.

PROGRESS

April, 1941.

The cuttings were planted in November, 1940.

CLASSIFICATION NUMBER: IV-A-16 (50:16)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Norway spruce: weekly collections

SCHEDULE: Commence May, 1941

CONDUCTED BY: J. L. Farrar at P. F. E. S.

OBJECTIVES

To determine the propagability throughout the summer season.

MATERIALS AND METHODS

Cuttings are planted in beds, Type 4, covered with shades, Type 3, in medium No. 7, and watered daily. The cuttings will be 3 to 6 inches long from the lower part of a random selection of trees in Plantation No. 8. Weekly collections (60 cuttings) will be made from May 1 to November 1. They will be removed 51 weeks later and transplanted to a shaded bed in Nursery No. 1.

CLASSIFICATION NUMBER: IV-A-17 (50:17)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Rapid determination of moisture in media

SCHEDULE: Commenced November, 1940

CONDUCTED BY: J. L. Farrar at P. F. E. S.

OBJECTIVES

To determine a rapid method of obtaining the moisture content of a medium without removing the medium from the bed. This will enable us to work out a watering schedule.

MATERIALS AND METHODS

(a) Electrical methods based on changes of resistance with change of moisture.
(b) Methods based on the tendency for soil to take up water against increasing pressure as it drips.
(c) Methods based on tendency of hygroscopic materials to maintain a moisture content in equilibrium with the surrounding media.
(d) Methods based on removing weighing and replacing a fixed amount of medium in a porous vessel.

Methods (a) and (b) require expensive apparatus. Method (c) depends on finding a suitable substance. Wood is suggested. Method (d) is the most direct and depends on finding a suitable vessel. Wire screen and porous clay is suggested.

PROGRESS

To April, 1941.

Methods (a) and (b) were rejected as being too complicated and expensive.

Pieces of cedar cut transversely were set in the media but they became water logged and stayed that way.

Porous clay vessels were not obtained.

Wire baskets were made and are being tried. The indications are that with certain precautions these can be used.

CLASSIFICATION NUMBER: IV-A-18 (50:18)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Norway spruce: tests with Alfred peat

SCHEDULE: Commenced December, 1940

CONDUCTED BY: N. H. Grace and J. L. Farrar at N.R.L.

OBJECTIVES

To determine the property of Alfred peat which is beneficial to propagation of spruce cuttings.

MATERIALS AND METHODS

Cuttings are in beds 7 and 8, Room 4091, tightly covered with cotton shades. The media are in gallon crocks 12 inches deep with bottom drainage. The cuttings are 3 to 6 inches long from Plantation 8 at P.F.E.S. Watering is done daily. Alfred peat was treated in various ways before being made up into a medium (peat:sand = 1:2) in an effort to destroy its beneficial properties; steam sterilized, dried at 100°C., extracted with 5% acetic acid, 1/2 of 1% sodium hydroxide, 95% methyl alcohol, and boiling water. Swedish peat was variously treated to make it as good as Alfred peat: watered weekly with 200 c.c. of: 2 p.p.m. vitamin B_1 solution, Hoagland's nutrient solution, and potassium acid phosphate and magnesium sulphate as in Hoagland's nutrient; chemicals of Hoagland's nutrient added once to give an extra 4% mineral content, 2% of calcium carbonate added, 10% Alfred peat added, methyl alcohol extract of Alfred peat added, Swedish peat finely ground. In addition there were controls of Alfred and Swedish peat mixed with sand, sand alone, and sand with a half-inch layer of Alfred peat on top of it. The reaction in all media is determined, and bacterial and fungal counts on those sterilized.

PROGRESS

April, 1940.

The media have been prepared and the cuttings planted in December. pH readings were taken in all replicates of all media. The watering with chemicals has been done.

CLASSIFICATION NUMBER: IV-A-19 (50:19)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Norway spruce: P dusts

SCHEDULE: Commenced December, 1940

CONDUCTED BY: N. H. Grace and J. L. Farrar at N.R.L.

OBJECTIVES

To complete the trials of these dusts by using a conifer and to see if a hormone chemical can be found which stimulates Norway spruce.

MATERIALS AND METHODS

Cuttings are in bed 4, Room 4093, in a medium similar to No. 7 of P.F.E.S. The bed is tightly covered with cotton shades and watered daily. The dusts are described on page 20, book 176 (176:20). They contain alpha-naphthyl acetic acid, alpha-naphthyl butyric acid, alpha-naphthyl hexylate and indolylacetic acid at concentrations of 500, 1000, 2000 and 4000 p.p.m. There is a talc treatment and a control. The cuttings are 3 to 6 inches long, from Plantation No. 8 at P.F.E.S., from the lower part of the trees.

PROGRESS

April, 1941.

The cuttings were planted in December, 1940.

CLASSIFICATION NUMBER: IV-A-20 (50:20)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Norway spruce: shading and lengths

SCHEDULE: Commenced December, 1940

CONDUCTED BY: N. H. Grace and J. L. Farrar at N.R.L.

OBJECTIVES

To determine the propagability of different lengths of cuttings under varying degrees of shade.

MATERIALS AND METHODS

Cuttings are in bed 4, Room 4093, in a medium similar to No. 7 of the P.F.E.S. The cuttings are from the lower part of the trees in Plantation No. 8 of the P.F.E.S. Watering is done daily. The head room is divided into 4-inch sections, divided by cello-glass. Some sections are left open, some covered with cheese-cloth, some with cotton and some with cello-glass. The cuttings are in three lengths: 1-1/2 to 3 inches, 3 to 6 inches, and 6 to 10 inches. Light values will be determined under each cover.

PROGRESS

To April, 1940.

The bed was prepared and the cuttings planted in December, 1940.

CLASSIFICATION NUMBER: IV-A-21 (5o:21)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: Norway spruce: J dusts

SCHEDULE: Commenced December, 1940

CONDUCTED BY: N. H. Grace and J. L. Farrar at N.R.L.

OBJECTIVES

To determine the action of these dusts on Norway spruce.

MATERIALS AND METHODS

Cuttings are in bed 1, Room 4099, in a medium similar to No. 7 of the P.F.E.S. The cuttings are from the lower part of the trees in Plantation No. 8 of the P.F.E.S. They are 1-1/2 to 3 inches long. Watering is done daily and the bed is tightly covered with cotton. The dusts are described in book 176:14. They contain nutrient, vitamin B_1 alone and combined with nicotinic acid and naphthyl butyric acid. There is an untreated group, groups treated with talc and with charcoal dust, and naphthyl butyric acid in charcoal.

PROGRESS

April, 1941.

The experiment is completed. The cuttings have been removed and detailed notes made. Rooting was very satisfactory and, the rooted cuttings are heeled-in.

CLASSIFICATION NUMBER: IV-A-22 (50:22)

CLASSIFICATION SUBJECT; Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: White pine: hormone treatments

SCHEDULE: Commenced January, 1941

CONDUCTED BY: J. L. Farrar and N. H. Grace at N.R.L.

OBJECTIVES

To test propagability of white pine in Alfred peat in greenhouse, to check Doran's results with hormone treatments, and to compare the dust and solution methods.

MATERIALS AND METHODS

Cuttings are in bed 5, Room 4093, in a medium similar to No. 7 at the P.F.E.S. The cuttings are from the lower part of a group of trees at Kingsmere from 10 to 30 feet tall. Only twigs 3 to 6 inches long were used for cuttings. The beds are covered tightly with cotton and watered daily. Treatment was with indolyl butyric acid in solutions for 24 hours at concentrations of 50, 100 and 200 p.p.m. and in talc at concentrations of 50, 1000 and 2000 p.p.m. There was an untreated control, a talc control and a water control.

PROGRESS

April, 1941.

The cuttings were planted in February, 1941.

CLASSIFICATION NUMBER: IV-A-23 (50:23)

CLASSIFICATION SUBJECT: Vegetative propagation: stem cuttings

TITLE OF EXPERIMENT: White pine: Riker's individuals.

SCHEDULE: Commenced January, 1941

CONDUCTED BY: C. C. Heimburger and J. L. Farrar at N.R.L.

OBJECTIVES

To obtain ramets of rust free clones known to Dr. Riker, Wisconsin.

MATERIALS AND METHODS

The cuttings are obtained by Dr. Riker and shipped here in moss. After a preliminary storage period in snow they are prepared and planted as in IV-A-22.

PROGRESS

To April, 1941.

The cuttings were planted February 17.

CLASSIFICATION NUMBER: IV-C-1 (52:1)

CLASSIFICATION SUBJECT: Vegetative propagation: grafting

TITLE OF EXPERIMENT: Work on coniferous transplants.

SCHEDULE: Commenced May, 1940

CONDUCTED BY: C. C. Heimburger and J. L. Farrar at P.F.E.S.

OBJECTIVES

To develop a technique of grafting twigs on transplants.

MATERIALS AND METHODS

Plants of white spruce and red pine 2 and 4 years old are potted in tin cans with holes for drainage. Grafting will be done in Spring 1941.

PROGRESS

April, 1941.

The plants were potted in May, 1940, most survived the summer of 1940.

CLASSIFICATION NUMBER: IV-E-1 (54:1)

CLASSIFICATION SUBJECT: Vegetative propagation: development of material

TITLE OF EXPERIMENT: Effect of rooting medium and new growth

SCHEDULE:

CONDUCTED BY:

OBJECTIVE

To follow the development of rooted cuttings with reference to presence of new growth and the medium in which the cuttings were rooted.

MATERIALS AND METHODS

The cuttings are well-rooted ones from Experiment IV-A-38-G1 (50:38-G1). Those propagated in sand are kept separate from those propagated in peat-sand, and those with new growth from those without it. They were planted in Nursery No. 1 in a bed covered with shades, Type 4.

PROGRESS

April, 1941.

The planting was done in May, 1940. In October, 1940, almost complete survival was noted. 1940 growth occurred on practically all cuttings, in some cases there were two flashes of growth.

CLASSIFICATION NUMBER: IV-E-2 (54:2)

CLASSIFICATION SUBJECT: Vegetative propagation: development of material

TITLE OF EXPERIMENT: Plants from Camp 4, Bed 1, in Nursery 1.

SCHEDULE:

CONDUCTED BY: C. C. Heimburger and J. L. Farrar at P.F.E.S.

OBJECTIVE

These are the oldest rocted cuttings available. A number of them are ramets of clone no.

MATERIALS AND METHODS

The clone was planted by C. C. Heimburger in May, 1937. The others were planted at the N.R.L. in January to March, 1938 and transplanted to P.F.E.S. in May, 1938. In May, 1940 they were all transplanted to Nursery 2, P.F.E.S. and planted without protection.

Observations and experiments will be made as conditions warrant.

CLASSIFICATION NUMBER: IV-E-3 (54:3)

CLASSIFICATION SUBJECT: Vegetative propagation: development of material

TITLE OF EXPERIMENT: Cuttings of season of 1938, P.F.E.S.

CONDUCTED BY: J. L. Farrar and C. C. Heimburger at P.F.E.S.

OBJECTIVES

There are no definite plans for these plants.

MATERIALS AND METHODS

These cuttings were planted during the season of 1938 and transplanted in May, 1939 to Nursery 1 and protected by shades, Type 4. When large enough they should be lined out in a nursery or planted in the field for observation.

CLASSIFICATION NUMBER: IV-E-4 (54:4)

CLASSIFICATION SUBJECT: Vegetative propagation: development of material

TITLE OF EXPERIMENT: Cuttings rooted in sphagnum peat 1938, P.F.E.S.

CONDUCTED BY: J. L. Farrar and C. C. Heimburger

OBJECTIVES

MATERIALS AND METHODS

This investigation covers all cuttings of white, Norway and black spruce, and white pine, that were planted in July and August, 1938, and propagated in a sphagnum peat mixture. They are all in Bed 6, P.F.E.S. They will be lined out in the nursery and classified by species, and according as the original cutting had a terminal bud.

CLASSIFICATION NUMBER: IV-E-5 (54:5)

CLASSIFICATION SUBJECT: Vegetative propagation: development of material

TITLE OF EXPERIMENT: Transplanting spring and fall with three degrees of shade

SCHEDULE: Commenced September, 1940

CONDUCTED BY: J. L. Farrar and C. C. Heimburger

OBJECTIVE

To determine the feasibility of lining out rooted cuttings in September.

MATERIALS AND METHODS

Cuttings were from Experiment IV-A-39-P1 and P7 propagated in Alfred peat medium. The roots are trimmed off 5 cm. long. Cuttings are planted in September and May. Shades Type 3 and 4 and no shade are used. Planting is done by the trowel-slit method in a bed in Nursery 1. Cuttings for spring planting are heeled-in protected by shades Type 3.

PROGRESS

April, 1941.

The fall planting was done and the cuttings for spring planting were heeled-in in groups with their labels.

CLASSIFICATION NUMBER: V-A-1 (V A)

CLASSIFICATION SUBJECT: Pathology: poplar

TITLE OF PROJECT: Resistance to diseases in poplar breeding materials.

SCHEDULE: Commenced 1936

CONDUCTED BY: C. G. Riley, J. E. Bier, A. J. Skolko

OBJECTIVES

(a) To acquire fundamental knowledge of diseases that may seriously threaten any given line of breeding stock.
(b) To determine the relative degree of susceptibility or resistance of such lines to these diseases.

MATERIALS AND METHODS

(1) Basic studies of the diseases involved.
(2) The natural incidence of disease is determined by means of periodic examinations - (a)in nurseries, (b) in test plantations where optimum conditions for infection are provided, (c) of prospective parental material elsewhere.
(3) Artificial inoculations are practiced under controlled conditions.

Materials as provided by the tree breeders in nurseries and test plantations.

RESULTS

See (a) Bier, J.E. Septoria canker of introduced and native hybrid poplars. Can. Jour. Res. 17: 195-204. 1939.
(b) Annual reports to this Subcommittee (Appendix D).

CLASSIFICATION NUMBER: V-B-1 (V B a)

CLASSIFICATION SUBJECT: Pathology: white pine: blister rust.

TITLE OF PROJECT: Resistance to blister rust in white pine breeding materials.

SCHEDULE: Commenced 1940

CONDUCTED BY: C. G. Riley and A. J. Skolko

OBJECTIVES.

(a) To acquire fundamental knowledge of the disease.

(b) To determine the degree of resistance or susceptibility to blister rust in breeding materials.

MATERIALS AND METHODS

(a) Basic studies of the disease. (b) The natural incidence of the disease is studied by means of periodic examinations in test plantations where optimum conditions for development of the disease are provided. (c) Artificial inoculations are practiced under controlled conditions.

Materials as provided by the tree breeders in nurseries and test plantations

CLASSIFICATION NUMBER: V-B-2 (V B a 1)

CLASSIFICATION SUBJECT: Pathology: white pine: blister rust: Pointe Platon.

TITLE OF PROJECT: Freedom from blister rust in Pointe Platon white pines.

SCHEDULE: Commenced 1940

CONDUCTED BY: C. G. Riley

OBJECTIVE

To discover white pine trees in which resistance against blister rust is indicated by freedom from this disease under conditions favouring its development; such trees, if discovered to serve as a source of experimental breeding material.

MATERIALS AND METHODS

At Pointe Platon, Quebec, on the Seigniory of Lotbiniere, is a small plantation of white pine that was planted in 1908, to serve as a windbreak. The planting stock was imported from Germany, and it is believed that this was also the occasion of one of the original importations of blister rust from Europe to America. Some of the trees have been attacked by the disease, while others appear to have remained free of it. A near-by bed of black currants provides abundant inoculum. Under these conditions the rust-free trees suggest possible resistance against the disease. The Seigneur, Mr. A. Joly de Lotbiniere, whose business address is Lecleroville, Co. Lotbiniere, P.Q., is anxious to co-operate with this Committee in making the best possible use of these pines.

Annual inspection of the trees is made during the aecial season. Rust-free trees are identified by metal number tags. Mr. de Lotbiniere has volunteered to plant black currants in a location calculated to increase the chances of infection in the pines.

RESULTS

See annual reports to the Subcommittee (Appendix D)

CLASSIFICATION NUMBER: V-Z-1

CLASSIFICATION SUBJECT: Pathology: general

TITLE OF EXPERIMENT: Studies on the control of damping-off of forest-tree seedlings in greenhouse and nursery.

SCHEDULE: Commenced November, 1939

CONDUCTED BY: L. P. V. Johnson

OBJECTIVE

To investigate the efficiency of various soil and seed treatments in controlling damping-off of forest tree seedlings in greenhouse and nursery. Since many species of forest trees are highly susceptible to damping-off, it is highly important that the exceedingly valuable hybrid material be given every protection against this menace.

MATERIALS AND METHODS

Red pine seedlings have proved to be the most suitable material for study and have been used in most of the work. White spruce and poplar seedlings have also been studied. In the greenhouse experiments, gallon-size, glazed crocks of equal tare weight and containing equal amounts of soil have been used. Constant soil moisture was maintained by weighing crocks at time of watering. Both soil and seed treatments were applied and the effects of temperature and humidity studied. Local garden soil as well as heavily-infected soil imported from the Provincial nursery at Orono have been used. Hygrothermographic records have been kept during all experiments. Determinations of pH have been made in all experiments. Seed treatments have included the following chemicals: red copper oxide, zinc oxide, copper carbonate, copper sulphate, Semesan and formalin. Soil treatments have included steam sterilization, cultures of Bacillus simplex and the following chemicals: mercuric chloride, sulphuric acid, formalin, red copper oxide, aluminum sulphate, Semesan, Cheshunt compound, and ethyl mercuric bromide.

RESULTS

Results up to April, 1941 indicate that the most effective treatments have been: Semesan, red copper oxide, steam sterilization and aluminum sulphate soil treatments; red copper oxide, zinc oxide and copper carbonate seed treatments; and combinations of effective seed and soil treatments.

Uniform nursery tests of treatments effective in the greenhouse will be made at Orono and Ottawa during the Summer of 1941.

Investigations, Subcommittee on Forest Tree Breeding
National Research Council of Canada

V.A Resistance to disease in poplar breeding materials

Annual Report, 1940

C. G. Riley and A. J. Skolko
Dominion Forest Pathological Service

The breeding stock in the two nurseries at the Petawawa Forest Experiment Station is being studied to determine the degree of inherent resistance or susceptibility to disease in each of the numerous lines. It is important to bear in mind that, while proof of susceptibility to a disease may be readily obtained, resistance or immunity requires to be demonstrated repeatedly and under a wide variety of conditions.

Two methods of obtaining the required information are practised. (1) Observation of diseases that occur naturally. This method depends upon the accidental introduction of inoculum under conditions favourable to infection. (2) In order to remove this factor of uncertainty, inoculation is practiced by artificial means, thus ensuring that an adequate amount of inoculum reaches every plant and that every plant is subject to the same conditions. While the occurrence of disease on any plant indicates susceptibility under either method, resistance or immunity can be determined by method 2 only. Successful application of the inoculation method requires a thorough knowledge of the optimum conditions for infection and development of the disease. To acquire this fundamental knowledge is the first task to be undertaken. Some progress has been made in this direction, but the results of the inoculations that have been made, indicate that a great deal more remains to be ascertained. This will continue to be one of the primary aims of further research.

In 1940, periodic examinations of all poplar breeding stock in the nurseries were conducted. In addition, several hundred inoculations have been made, using Melampsora medusae Thum. (rust) and Septoria musiva Peck. (Septoria canker). The combined results of these examinations and inoculations are indicated in Table 1. Table II indicates those lots in which the presence or absence of rust has been consistent for the two years in which observations have been made.

The natural occurrence of rust was not as severe in 1940 as in previous years, some clones of known high susceptibility remaining relatively free of the disease until late in the season. The C x W seedlings were the outstanding exception, these being severely attacked.

Special mention should be made of C x W #475. In a plot of some 1500 C x W seedlings, most of which have for two years been so heavily attacked by rust that they have become prematurely defoliated, this individual plant has been conspicuous in both years for the reason that it has retained all but the lowermost leaves, and the rust was comparatively scarce on the remainder. Other individuals that exhibited similar tendencies in 1939 and 1940, but to a lesser degree, were CxW 122, CxW 208, CxW 1134 and CxW 1264. None of these approached No. 475 with respect to height and form.

It has been demonstrated, by means of artificial inoculations, that Melampsora medusae Thüm. is present on poplars in the nurseries, and there is sound reason to believe that the annual attack of rust is caused principally, if not solely, by this species. Teliospores on severely rusted poplar leaves that had lain on the ground in the nursery all winter, were germinated in the laboratory. The resulting sporidia were used to inoculate two species of Larix, which in turn produced the typical aecial stage of the rust. Fresh poplar leaves were inoculated with these aeciospores, and the consequent production of uredospores and teliospores completed the life cycle. Unless this rust is capable of overwintering in the uredinial stage, it is not likely to be the cause of serious disease in Larix-free regions. This possibility is being investigated further. Other rusts that attack poplar are: (1) M. albertensis Arth., alternate host, Douglas fir. (2) M. abietis-canadensis (Farl.) Ludw., alternate host, eastern hemlock. (3) M. occidentalis Jacks, alternate host unknown, western North America. (4) M. aecidioides (DC) Schroet., alternate host unknown, western North America.

Septoria musiva is common as a "leaf spot" fungus (see Table 1). This form of disease is not usually serious, though it causes premature defoliation in severe cases, examples of which are: Calgary 4, Calgary 6, Calgary 16 and Calgary 17. In addition, it causes a serious canker disease on certain hosts, notably Russian, Northwest and Saskatchewan poplars[1]. This aspect of the disease has not yet appeared on any of the trees being tested except through wound inoculations on Northwest poplars.

(1) Bier, J.E., Septoria canker of introduced and native hybrid poplars. Can. Jour. Res. 17:195-204. 1939.

Napicladium die-back seriously attacked TG 2, TG 3, and TG 4, as in previous years. The disease is common on other lines, but only to a negligible degree.

In addition to the above reported observations and tests conducted in the nurseries, inoculations with Hypoxylon, Septoria, and Napicladium were carried on elsewhere at the Station, for the purpose of developing methods and observing symptoms.

Two types of insect injury were observed. These were brought to the attention of officers of the Dominion Entomological Laboratory, and were identified by them as the work of aphids and of Epitrix sp. Aphid injury was severe on Masson, OP 5, OP 49 and Strathglass. The last-named was severely attacked in 1939 also. Epitrix feeding was common in both 1939 and 1940, but the injury did not appear very serious.

Table I. List of poplar breeding stock in nurseries at Petawawa Forest Experiment Station, showing incidence[x] of diseases in 1940.

Designation	Rust	Septoria leaf spot	Misc.	Designation	Rust	Septoria leaf spot	Misc.
A - 22	0	0		Bassano	0	0	
A - 26	0	+		Berolinensis	0	+	
A - 35	0	+		B.N.W. - 1	3	-	
A - 36	0	0		B.N.W. - 2	0	+	
ACE - 1	0	tr.		B.N.W. - 4	0	0	
ACE - 4	0	0		B.N.W. - 6	tr.	0	
ACE - 8	0	+		B.N.W. - 8	0	0	
ACE - 10	0	0		B.N.W. - 9	0	+	
ACE - 11	0	+		B.N.W. - 11	0	tr.	
ACG - 1	+	-		B.N.W. - 15	0	0	
ACG - 12	+	-		B.N.W. - 16	0	0	
ACG - 27	+	-		B.N.W. - 17	+	+	
Acuminata	0	+		B.N.W. - 18	0	0	
Acuminata - 1	+	+		B.N.W. - 19	0	tr.	
AG - 2	+	+		B.N.W. - 22	+	-	
AG - 7	0	+		B.N.W. - 23	0	0	
AG - 10	+	0		B.N.W. - 25	0	+	
AG - 15	+	+		Brooks - 4	0	+	
AG - 21	+	+		Brooks - 10	0	+	
AG - 22	+	-		C - 1	0	0	
AG - 24	0	0		C - 3	+	0	
AG - 29	0	0		C - 12	0	0	
AG - 32	0	-		CA - 1	0	0	
AG - 33 - 5	0	+		Calgary - 1	0	+	
AG - 33 - 13	0	+		Calgary - 4	0	++	
AG - 33 - 14	+	+		Calgary - 6	0	++	
AG - 33 - 19	+	+		Calgary - 16	0	+	
AG - 48	0	0		Calgary - 17	0	++	
AG - 56	0	0		Calgary - 23	0	+	
AG - 59	0	0		Candicans	0	0	
AG - 61	0	0		Canescens	0	0	
AG - 63	0	0		Carolina	0	-	
AG - 81	+	+		Cathayana - 1	0	0	
AG - 93	0	0		Cathayana - 13	0	-	
AG - 98	.	0		Cathayana - 15	0	0	
AG - 99	(	0		Cathayana - 16	0	-	
AG - 107	.	+		Cathayana - 17	0	-	
Angulata erecta	0	+		Cathayana - 18	0	0	
AT - 2	0	0		Cathayana - 20	0	-	
AT - 13	0	0		CG - 1	+	0	
AT - 15	0	0		CG - 8	+	0	

[x] indicates presence of disease
0 indicates absence of disease
- indicates no information

Table I. (cont'd

Designation	Rust	Septoria leaf spot	Misc.	Designation	Rust	Septoria leaf spot	Misc.
CG - 12	+	0		OP - 26	0	0	
CG - 16	0	0		OP - 27	0	+	
CG - 17	+	0		OP - 30	0	0	
CG - 18	0	0		OP - 38	0	+	
CG - 27	+	+		OP - 41	0	0	
CG - 28	0	0		OP - 42	0	0	
CG - 30	0	0		OP - 44	0	0	
CS - 1	0	0		OP - 45	0	+	
CS - 2	0	0		OP - 46	0	0	
CS - 3	0	0		OP - 47	0	0	
CS - 4	0	0		OP - 48	0	+	
CS - 5	0	0		OP - 49	0	0	aphids
CS - 6	0	0		OP - 50	0	+	
CT - 6	+	+		OP - 51	tr.	+	
D - 1	+	+		OP - 52	0	0	
D - 2	0	+		OP - 53	0	0	
D - 3	0	0		OP - 54	0	+	
D - 4	0	0		OP - 55	0	+	
D - 5	0	0		P.alba - 671	0	0	
D - 17	0	0		P.alba - 5568	0	0	
Eugenie	0	0		PT - 3	0	+	
Eugenie - 2	0	0		Pyramidalis	0	0	
Gelrica	0	+	Napic-ladium	Raverdeau	+	+	
				Rochester	0	+	
Generosa	0	+		Rotundifolia - 1	0	0	
Geneva	0	+		Roxbury	0	+	
Jackii - 1	+	+		R x T f1	0	0	
Jackii - 2	0	+		Saskatchewan	+	+	
Koriana - 5	0	0		Simonii - 1	0	0	
Koriana - 6	0	0		Strathglass	0	+	aphids
Koriana - 9	0	+		Suaveolens	0	+	
Laurifolia	0	+		T - 8	0	0	
Maine	0	+		T - 10	+	+	
Masson	tr.	+	aphids	Tacamahaca-2	0	+	
N - 2	0	0		Tacamahaca-3	0	+	
Nigra - 1	0	0		TG - 2	0	0	Napic-ladium
Northwest	+	+					
OP - 5	0	0	aphids	TG - 3	+	0	Napic-ladium
OP - 6	0	0					
OP - 7	0	0		TG - 4	0	0	Napic-ladium
OP - 10	0	0					
OP - 14	0	+	Napic-ladium	Tremula	tr.	0	
OP - 16	0	0		Tremula - 2	+	+	
OP - 23	0	0					

Table I. (cont'd)

Designation	Melampsoria Rust	Septoria leaf spot	Misc.	Designation	Rust	Septoria leaf spot	Misc
Tremula - 4	+	+		Trichocarpa Victoria-19	0	+	
Tremula-104	0	0		Trichocarpa Victoria-20	0	+	
Tremula-105	0	0		Trichocarpa Victoria-21	0	+	
Tremula (Wettstein)	0	0		Trichocarpa Victoria-22	0	+	
Trichocarpa-5	0	+		Tristis	0	0	
Trichocarpa-6	0	+		Tristis - 2	0	0	
Trichocarpa Victoria-12	0	+		TS - 4	+	0	
Trichocarpa Victoria-13	0	+		TS - 5	+	0	
Trichocarpa Victoria-14	0	+		TS - 7	0	0	
Trichocarpa Victoria-15	0	+		22 - 11	0	+	
Trichocarpa Victoria-16	0	+		Vernirubens	0	+	
Trichocarpa Victoria-17	0	+		West end of Bassano Row C x W (all numbers)	+	0	
Trichocarpa Victoria-18	0	+			+	-	

Table II. Poplar breeding stock in nurseries at Petawawa Forest Experiment Station, in which the presence or absence of rust has been consistent for two years.

Rusted in 1939 and 1940	Rust-free in 1939 and 1940
Accuminata 1	Maine
Northwest	Geneva
T. G. 3	Brooks 4
Tremula	A. T. 2
O. P. 51	A. G. 7
C x W (all numbers)	Vernirubens
Masson	Trichocarpa
	Calgary 23

V B a

Blister rust in white pine breeding materials.

Annual Report - C. G. Riley

As a preliminary step in this project, some young natural seedlings of white pine at the Petawawa Forest Experiment Station were inoculated in 1940, for the purpose of developing technique and observing the early manifestations of the disease. Results will not normally be visible before summer, 1941.

V B a 1

Freedom from blister rust in Pointe Platon white pines

Annual Report - C. G. Riley

At the time of aecial development in 1940, conditions were such that the annual inspection of the pines at Pointe Platon could not be conducted by any member of the Dominion Forest Pathological Service. Through the co-operation of the Quebec Department of Lands and Forests, Dr. Rene Pomerleau, Forest Pathologist for Quebec, made the inspection for us, and placed metal tags bearing numbers 1 to 20, on twenty apparently rust-free trees. He reports that on the date of his inspection, June 21, the aecial stage was past. This fact would increase the chances of missing small cankers. It is planned to repeat the inspection at an earlier date in 1941.

APPENDIX "E"

List of Publications on Vegetative Propagation since 25 April, 1940.

Vegetative propagation of conifers.

VI. Hormone solution and dust treatments of spruce cuttings propagated in greenhouse and outside frames. Can. J. Research, C,18: 401-414. 1940. N. H. Grace and J. L. Farrar.

VII. Outdoor propagation of a November collection of Norway spruce cuttings treated with phytohormones, cane sugar, and an organic mercurial disinfectant. Can. J. Research, C, 18: 566-577. 1940. N. H. Grace, J. L. Farrar and J. W. Hopkins.

VIII. Effects of media and phytohormone dust treatments on the rooting of Norway spruce cuttings. Can. J. Research, C, 18: 591-598. 1940. N. H. Grace and J. L. Farrar.

Note on the propagation by cuttings of white pine and white spruce. Can. J. Research, C, 18: 612. 1940. J. L. Farrar and N. H. Grace.

APPENDIX "F"

Report on Woody species being propagated in the Dominion Arboretum

Forest Tree Breeding Committee,

8 April, 1941

H. A. Senn

During the past two years a new nursery has been established which now includes about 10,000 plants of 1665 woody species and varieties. The genera of special interest to the Committee with the number of species and varieties is as follows:

Abies	8	Pinus	40
Acer	7	Populus	33
Betula	15	Pseudotsuga	3
Celtis	14	Quercus	18
Fraxinus	11	Salix	68
Larix	4		
Picea	23		

These plants are still very small and the probability is that a number of them will not be hardy.

During 1940 the American Association of Botanical Gardens and Arboretums was formed. The Dominion Arboretum is cooperating with this Association in bringing together a list of all the woody species and varieties under cultivation in the Botanic Gardens and Arboretums of Canada and the United States. This will be most useful in indicating sources of plant breeding material.

The work of identifying all the plants of the Dominion Arboretum is progressing. The information acquired will be useful in determining the exact identity of parental material used in breeding.

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