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NATIONAL RESEARCH COUNCIL OF CANADA

PROCEEDINGS

OF THE

EIGHTH MEETING

OF THE

SUBCOMMITTEE ON FOREST TREE BREEDING

OTTAWA

15 APRIL, 1942

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NATIONAL RESEARCH COUNCIL

P R O C E E D I N G S

of the

Eighth Meeting

of the

SUBCOMMITTEE ON FOREST TREE BREEDING

Held at the National Research Laboratories,
Ottawa, 15 April, 1942.

Present:

Members: Dr. J. G. Malloch, Chairman,
Mr. D. R. Cameron
Dr. N. H. Grace
Mr. D. E. Gray
Dr. C. Heimburger
Mr. M. B. Morison
Mr. C. G. Riley
Mr. W. H. Robertson
Dr. H. A. Senn
Dr. L.P.V. Johnson, Secretary.

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88. Minutes — The minutes of the Seventh Meeting were read and approved without change.

89. Action on proposal to obtain additional pathologist. — Dr. Johnson explained that, although he had been instructed (Minute 81, Seventh Meeting) to prepare a memorandum to the parent Committee re appointment of an additional pathologist, this had not been carried out since, upon discussing the matter with the administrative heads concerned, it was decided that it was not possible at present to make a strong case and that under such conditions nothing would be gained by placing the matter on record with the parent Committee.

Mr. Cameron read a letter from Dr. Gussow supporting the decision stated above.

Mr. Riley said that it would not be possible during the coming Summer for him and Dr. Skolko to spend the season at Petawawa as has been done in the past. It would probably be possible, however, to make visits at critical periods during the season, thereby maintaining continuity in the more important of the established investigations.

90. Progress report on breeding.

Dr. Johnson reported briefly on the progress made in the breeding work during the past year. These statements are covered by the progress report which is given, together with a proposed program for the coming year, in Appendix A.

Dr. Johnson drew special attention to the fact that the progress report which he had prepared on the white pine blister rust investigation covered the work done by Dr. Heimburger and Mr. Riley and that they should assume co-authorship. The report was read and accepted in that form by Dr. Heimburger and Mr. Riley.

91. Progress report by Dr. Heimburger.

Dr. Heimburger presented progress reports on his activities during the past year. These reports and an outline of work to be undertaken during the coming year are given in Appendix B.

Dr. Heimburger also outlined a "vernalization" technique for inducing rooting in dormant poplar cuttings. The procedure involves: (1) placing dormant cuttings under growing conditions for about two weeks to permit breaking of dormancy and some developmental activity, followed by (2) vernalization treatment for about two months at about 5°C., and (3) placing under optimum conditions for rooting test. Dr. Heimburger carried the cuttings through all steps of the procedure in beakers of water.

92. Progress report on vegetative propagation.

In close co-operation with Dr. Heimburger the program has been carried forward. Since the departure of Mr. J.L. Farrar it has been necessary to abandon some of the experiments he started, but the more essential phases of the major investigations have been maintained. A number of the experiments described in the Proceedings of the Fifth Meeting of the Subcommittee have been completed and it is hoped the data will be published in due course, others are still under way. The experiments initiated during 1941 are listed as 50:1 to 50:19 - 1941; for the most part these experiments represent merely necessary continuations of earlier work. The first experiment 50:1 - 41, has involved collection, planting and some hormone dust treatments of upwards of 30,000 cuttings. Experiments 50:2-10-41 were made by Dr. Heimburger and the remaining nine by myself at the N.R.C. laboratories (See Appendix C).

During the past year, in co-operation (joint authorship) with Mr. Farrar, four articles have been published in the Canadian Journal of Research.

These were published under the general title:
Vegetative propagation of conifers-

IX. Effects of chemical treatments and a wax spray on the outdoor propagation of spruce cuttings.
X. Effects of Season of Collection and propagation media on the rooting of Norway spruce cuttings.
XI. Effects of type of cutting on the rooting of Norway spruce cuttings.
XII. Effects of Media, time of collection, and indolylacetic acid treatment on the rooting of white pine and white spruce cuttings.

Greenhouse studies of the past year have been directed to further consideration of the effects of media on rooting of Norway spruce. While final data have not been taken, preliminary observations suggest that a large part of the beneficial features of certain media may be attributed to physical rather than chemical effects. Certain hybrid poplars have been rooted and transplanted in satisfactory percentages. Dust treatments with indolylbutyric acid proved definitely advantageous.

93. Progress report on pathology.

Mr. Riley reported on the progress of pathological work carried on under the Subcommittee. This is covered by the progress report which is given, to-gether with plans for the coming season, in Appendix D.

94. Report on entomological work.

Mr. Gray pointed out that all of the entomological work of direct bearing on forest tree breeding was of a co-operative nature, and that he had nothing to add to what had already been reported in the outline of co-operative experiments.

Mr. Gray stated that it would be a very simple matter to incorporate a test for weevil resistance in white pine blister rust disease garden. This could be accomplished merely by growing a row of susceptible white pines at the back of the garden. If natural infestation did not occur insects of proper stage could be placed on the trees.

95. Dominion Arboretum.

Dr. Senn reported on the progress of re-classification of the older specimens in the Dominion Arboretum and on the addition of new species of interest to the Subcommittee.

96. Co-ordination of work under the Subcommittee

Mr. Cameron raised the point of whether the Subcommittee had been doing all it should as the directing and co-ordinating body. The matter was discussed at considerable length with general agreement that immediate consideration be given to possible improvements in the function of the Subcommittee. It was agreed that Dr. Malloch and Mr. Cameron should go thoroughly into the question and decide upon a course of action.

APPENDIX A

Progress Report, 1941-42

L.P.V. Johnson

I-B-1. Interspecific hybridization in forest-tree genera

The previous report listed spruce, pine, poplar, basswood, elm and birch as the genera in which interspecific hybrids have been obtained. During the past year, further hybrids have been produced in all the above genera except spruce and basswood and, in addition, hybrid seeds were obtained from several interspecific cross pollinations in larch and ash. In larch the species involved were Larix siberica and L. Kaempferi, while in ash Fraxinus americana, F. lutea, F. pubescens, F. quadrangulata and F. Richardii. Interspecific cross pollinations were also made in oak but results will not be known until acorns mature in the coming season.

I-B-2. The development of crossing technique for forest tree genera

There is nothing new to report in this connection. Publication of results is contemplated for the near future.

I-B-3. Studies on the storage and artificial germination of forest-tree pollen

An experiment on the longevity of various kinds of pollen stored under different conditions of temperature, humidity and light is in progress. Until results from this experiment are known, there is nothing further to report.

I-C-1. Production of polyploid forms of forest trees by the colchicine method

Colchicine treatments of forest-tree seeds and seedlings have been given greater attention than in previous years. Several new methods of application have been used, some of which are particularly promising.

The most successful new method involves the soaking of stratified and non-stratified seeds in 0.2% colchicine for various periods at each of two different temperatures, i.e., 2, 6 and 11 days at 40°F. and 2, 4 and 6 days at 70°F. Stratification produces greater physiological activity in the embryo, which

in turn should increase the susceptibility of the embryo to colchicine treatment. The low temperature treatment was suggested by previous colchicine experiments in which it appeared that the embryonic root commenced development before and for some days grew more rapidly than the embryonic stem. This resulted either in over-treatment of the root or in under-treatment of the stem. It was felt that treatment at temperatures below the minimum for germination would prevent embryonic development during the treatment, thus making possible a more equal effect on root and stem. Most of the 22 species treated have shown characteristic colchicine effects, especially where stratified seed was used.

Good results were also obtained from a new seedling immersion method. The seedling is grown in a 2-inch pot which at time of treatment is inverted over a similar pot in which a shell vial containing the colchicine solution is imbedded in moist sand. The vial is adjusted so that the seedling is properly immersed. Solutions of 0.1, 0.2 and 0.4 percent colchicine were each applied for durations of 6, 16 and 48 hours.

Very good results were obtained by spraying newly-emerged Populus seedlings of the cross P. alba-36 x P. grandidentata-8 several times with 0.2% colchicine.

I-Z-1. Studies on self sterility in forest trees

No further results to report.

I-Z-2. Storage humidity in relation to longevity of seeds of poplar and elm

No further results to report. Experiment completed.

II-A-1. Studies on genetic variability for sugar production in the sugar maple

This experiment is being continued as previously described with the following changes: the work at the Holy Ghost sugar bush has been discontinued, 20 new trees at the N.R.C. Annex and 20 in Rockliffe have been selected for study (making a total of 50 trees), and the work on white birch has been discontinued. No new results to report at this time.

III-A-1. The relation of growth rate to wood quality in Populus hybrids

The results of this work were published in Canadian Journal of Research, C, 20:28-40. 1942.

III-D-2. Comparative pulp and paper tests of hybrid and parental trees in Populus

The results of this work were published in Canadian Journal of Research, C, 20:28-40. 1942.

V-Z-1. Studies on the control of damping-off of forest-tree seedlings in greenhouse and nursery

A one percent solution of Semesan (=0.3 percent hydroxymercurichlorophenol) applied to the soil was the most effective treatment. Report for publication in the course of preparation.

Experiments Commenced in 1941

Classification Number: I-E-1
Classification Subject: Breeding: disease garden tests.
Title of Experiment: Studies on reaction to blister rust of white pine materials collected from natural individuals remaining rust free after exposure to infection.
Schedule: Commenced May, 1941.
Conducted by: L.P.V. Johnson, C. Heimburger and Pathologists.
Objective: To establish definitely the degree of resistance, or of susceptibility, possessed by white pine individuals which under natural conditions have remained free from blister rust after repeated exposures to the pathogene.
Materials: Any individual white pine coming to our notice which has persistently remained free from blister rust under conditions favorable to infection will, if possible, be included in the tests. There are at the moment (April, 1942) two main sources of materials: (1) Pointe Platon plantation from which cutting material has been collected from 18 individuals; and (2) selections of Dr. A.J. Riker, University of Wisconsin, of which six samples of seed from individual trees were obtained. Species of reputed resistance, such as Pinus peuce, and various hybrid productions will also be included in the tests.

Methods: Cutting material or seeds will be obtained from the selected tree and propagated in nursery beds. After one or two years these materials will be transplanted to the disease garden where they will grow within six feet of infected Ribes sp., the alternate host of the pathogene. The material will also be subjected to artificial inoculations by the pathologists.

The importance of using cuttings should be mentioned especially. This method permits observations on hundreds of genetically identical plants, making possible the direct comparison of results from a series of experiments and the checking of results by repeated tests.

Results: To date (April, 1942) there are no definite results to report; but substantial progress has been made in the work preliminary to the actual tests. A disease garden has been established at the N.R.C. Annex; the Pointe Platon material has been thoroughly examined by the pathologists, and cuttings and seeds collected from selected trees are now growing in the nurseries at the Annex and Petawawa; and, seedlings from the six Riker selections are two years old and ready to transplant to the disease garden this spring.

Extensive cross pollinations between the native white pine and the reputedly resistant Pinus peuce have been made with good success. About a hundred hybrids will be ready to transplant to the disease garden this spring.

Classification Number: IV-Z-1.
Classification Subject: Vegetative propagation: general.
Title of Experiment: Studies on effect of heeling-in temperatures on periodic collections of hardwood cuttings.
Schedule: Commenced Oct., 1941.
Conducted by: L.P.V. Johnson.
Objective: To find the best practical method of heeling-in cuttings for propagating selected trees on a relatively large scale. The method must admit of fairly large quantities of cuttings, yet owing to the valuable trees involved a certain amount of refined technique is warranted.
Materials: Four species of Populus as well as basswood, sugar maple and white birch are used.
Methods: Cuttings are collected after trees have undergone various outdoor temperature conditions: (1) freezing temperatures, leaves more or less fallen; (2) heavy frost, ground not permanently frozen; (3) ground

permanently frozen; (4) midwinter collection, in some cases coinciding with change to obligatory dormancy - see I-Z-3; (5) at critical period of change from true to obligatory dormancy; and (6) spring collection to be planted directly to bed. Cuttings are heeled-in in 3:1 sand-peat at time of collection under each of the following conditions: (1) outside in ground, (2) in heeling-in chamber in which slight freezing occurs, (3) in alternating freezing and thawing temperatures, (4) at 40°F., and (5) at 13°F. Rooting tests will be made in the spring under practical nursery conditions.

This experiment differs from those commonly conducted by Dr. Grace and Mr. Farrar in that cuttings are heeled-in after collection rather than placed immediately in rooting tests.

Results: Nothing to report at present (April, 1942).

Classification Number: I-Z-3.
Classification Subject: Breeding: general.
Title of Experiment: Studies on true and obligatory dormancy in forest trees.
Schedule: Commenced Nov., 1941.
Conducted by: L.P.V. Johnson.
Objective: To determine the time at which a tree passes from a state of true dormancy to one of obligatory dormancy, the latter being a state in which the tree is no longer truly dormant but where growth cannot start because of unfavorable environmental conditions. Information of this kind is needed in connection with the greenhouse hybridization work and with various practices such as the forcing of male flowers for pollen production. It may also prove useful in indicating critical periods bearing on vegetative propagation experiments.
Materials and Methods: Nineteen species of common trees are being used in the study. The experiment involves semimonthly collections of flower branches and cutting wood (one year old) which are placed in water in the greenhouse under conditions which simulate outdoor conditions in mid-May, i.e., temperature varying from 50°F. at midnight to 70°F. at noon, 15 hours of light and about 60% relative humidity.

Results: It is considered advisable to withhold report of results until two years' data are available.

Proposed Breeding Program - Summer, 1942

1. Further hybridization of spruce and pine, if season is favorable.

2. Transplanting of selected white pine materials to blister rust disease garden; extension of disease garden.

3. Transplanting of samples of some forty species on hand to permanent sites in the breeding arboretum.

4. Cytological observations on numerous colchicine-treated plants presumed to be amphidiploid, and on Populus hybrids originating from crosses involving a triploid parent.

5. Further collections of white pine materials for rust resistance tests.

6. General observations on breeding materials throughout the season.

Owing to travel restrictions and reduction in staff it will be necessary to carry out this program very largely in the Ottawa district.

APPENDIX B

Strain Testing

I-A-1 (I-E-a-1)

Project-Strain Testing of Spruce.

Sowings.

Spring 1941

Seed lot No.

259 Picea excelsa Latvia; good

Fall 1941

269 Picea glauca, Petawawa FES, sown beginning of September, no germination fall-41
281 " " Petawawa FES
282 " rubens, Petawawa FES (plantation)
283 " glauca, Acadia FES
284 " excelsa, Petawawa FES (plantation)
285 " glauca, Cape Breton Island, N.S.
286 " rubens, Fernmount, N.B.
287 " glauca, Florenceville, N.B.
288 " mariana, St. Zenon, P.Q.
289 " glauca, Prince Edward Island
290 " pungens, San Isabel Forest, Colo.

Vegetative Propagation

Fall 1941 (clones)

Picea Engelmanni #1713, 63 planted	C.E.F. Plantation at Petawawa FES	
" excelsa SN-15, about 1000 planted	Plantation near Hawkesbury	
" " #485,356 planted	" "	
" " #486,386 "	" "	
" " #487,178 "	" "	
" " #488,228 "	" "	
" " #489,149 "	" "	
" " #490,215 "	" "	
" " #491, 49 "	" "	
" " #492,329 "	" "	
" " #493,204 "	" "	
" " #494,210 "	" "	
" " #495,283 "	" "	
" " #496,212 "	" "	

Picea glauca #4, about 1200 planted — Petawawa FES
" " Gaspe #1, 204 planted — Gaspe
" " Gaspe #2, 97 planted — "
" " O.1, 61 planted — Ottawa
" " O.2, 48 planted — "
" pungens #1, 1080 planted (including summer 1941) - plantation at Petawawa FES

Fall 1941 (populations)

Picea excelsa Petawawa FES, 1260 planted (including summer 1941)
" glauca " " , 5040 planted (including summer 1941)
" asperata, Dropmore, 1260 planted (including summer 1941)
" rubens, Petawawa FES, 1620 planted (including spring and summer 1941)
" mariana, Petawawa FES, 4320 planted (including spring and summer 1941)

Results

Norway Spruce from Roumania is outstanding in the strain tests started in 1939 and may contain valuable biotypes for several important regions in Canada.

Norway Spruce from northern Europe suffered badly from drought in the dry summer of 1941.

Picea asperata from Nancy and from Dropmore is very promising, and may be of direct value in plantations established in a climatic region similar to that of Petawawa FES.

Seedlings of Picea mariana show a surprising rapid growth after their second year in the seed beds. The upland strain from Fort William, Ont., is much more drought resistant on upland than the local muskeg biotypes.

White Spruce from Western Canada shows uniformly very slow growth in the nursery seed beds and transplant rows, after the effect of seed size on the growth during the first year is superseded by inherent growth characters.

I-A-2 (I-E-a-2)

Project: Strain testing of Hard Pines

Sowings

Spring 1941

No.
258 Pinus contorta latifolia, Kitwanga-poor
261 " " " , Shuswap Lakes-excellent
262 " silvestris, Latvia-good
263 " " " -sown in open drills-very good

Fall 1941

277 Pinus Thunbergii, Japan
279 " contorta latifolia, Kananaskis FES.

Vegetative Propagation

Fall 1941 (populations)

Pinus banksiana, Petawawa FES, 3960 planted (including summer 1941)
" contorta, Petawawa FES (planted), 1260 planted
" resinosa, Petawawa FES, 1260 planted
" silvestris, Petawawa FES (planted), 1260 planted

Results:

Lodgepole Pine from Prince George, B.C. (northern interior) seems so far to suit the climatic conditions of the Petawawa FES best and shows very good growth form, and hardiness in the transplant rows. Most of the stock of Scotch Pine and Jack Pine is too large at the 1-2 stage and is more suitable for setting out in plantations as 1-1 stock. Very good results have been obtained in the seed beds sown fall 1940-very little damping-off and good uniform crops of seedlings are at hand.

I-A-3 (I-E-a-3)

Project: Strain Testing of Soft Pines

Sowings:

Spring 1941

No.				
251	Pinus	Strobus	#4, no germination	Petawawa FES-weevil-free
252	"	"	#6, fair germination	" "
253	"	"	#11, no germination	" "
254	"	"	#8, no germination	" "
255	"	"	#7, no germination	" "
256	"	"	#12, poor germination	" "
257	"	"	#9, poor germination	" "
260	"	"	Angus, Ont.-good germination	Ontario Forestry Branch.

Fall 1941

278	Pinus Strobus, Pte. Platon, P. Q.			rust-free

Vegetative Propagation:

Fall 1941 (clones)

Pinus	Strobus	D-1; 10	planted	Dunn	County,	Wisconsin	rust-free
"	"	D-2; 14	"	"	"	"	"
"	"	D-3; 12	"	"	"	"	"
"	"	D-5; 15	"	"	"	"	"
"	"	D-6; 17	"	"	"	"	"
"	"	D-7; 14	"	"	"	"	"
"	"	D-17; 14	"	"	"	"	"
"	"	D-18; 14	"	"	"	"	"
"	"	D-19; 15	"	"	"	"	"
"	"	D-20; 15	"	"	"	"	"
"	"	D-22; 14	"	"	"	"	"
"	"	D-23; 8	"	"	"	"	"
"	"	D-24; 15	"	"	"	"	"
"	"	D-25; 11	"	"	"	"	"
"	"	D-27; 14	"	"	"	"	"
"	"	D-28; 11	"	"	"	"	"
"	"	D-29; 16	"	"	"	"	"
"	"	D-30; 12	"	"	"	"	"
"	"	D-31; 17	"	"	"	"	"
"	"	D-32; 13	"	"	"	"	"
"	"	D-39; 18	"	"	"	"	"
"	"	D-40; 12	"	"	"	"	"
"	"	P. 3; 387	"	Petawawa	FES.		weevil-free
"	"	P. 7; 210	"	"	"		"
"	"	P. 8; 225	"	"	"		"
"	"	P. 22; 49	"	"	"		"

Pinus	Strobus	P.73;48	planted	Petawawa FES		weevil-free
"	"	P.84;53	"	"	"	"
"	"	P.123;47	"	"	"	"
"	"	P.135;33	"	"	"	"
"	"	P.201;48	"	"	"	"
"	"	P.303;51	"	"	"	"
"	"	P.B.1361;65	"	"	"	rust-susceptible
"	"	P.B.1461;52	"	"	"	"
"	"	PeP-42;10	"	Pepin County, Wisconsin,		rust-free
"	"	PeP-43;21	"	"	"	"
"	"	PeP-44;12	"	"	"	"
"	"	PeP-45;12	"	"	"	"
"	"	PeP-46;11	"	"	"	"
"	"	PeP-47;11	"	"	"	"
"	"	PeP-48;14	"	"	"	"
"	"	PeP-50;11	"	"	"	"
"	"	PeP-51;16	"	"	"	"
"	"	PeP-52;15	"	"	"	"
"	"	PeP-54;11	"	"	"	"
"	"	PeP-55;12	"	"	"	"
"	"	PeP-56;12	"	"	"	"
"	"	PeP-57;16	"	"	"	"
"	"	PeP-62;13	"	"	"	"
"	"	P.P.0;15	"	Pointe Platon, P.Q.		rust-susceptible
"	"	P.P.1;183	"	"	"	"
"	"	P.P.2;163	"	"	"	"
"	"	P.P.3;133	"	"	"	"
"	"	P.P.4;13	"	"	"	"
"	"	P.P.5;160	"	"	"	"
"	"	P.P.6;78	"	"	"	"
"	"	P.P.51;135	"	"	"	"
"	"	P.P.52;134	"	"	"	"
"	"	P.P.53;72	"	"	"	"
"	"	P.P.54;153	"	"	"	"
"	"	P.P.56;131	"	"	"	rust-free
"	"	P.P.57;110	"	"	"	"
"	"	P.P.58;112	"	"	"	"
"	"	P.P.59;159	"	"	"	"
"	"	P.P.60;253	"	"	"	"
"	"	P.P.61;103	"	"	"	"
"	"	P.P.62;198	"	"	"	"
"	"	P.S.L.2;43	"	Petawawa FES		weevil-free
"	"	P.S.L.3;78	"	"	"	"
"	"	P.S.L.4;66	"	"	"	"
"	"	P.S.L.8;38	"	"	"	"
"	"	P.S.L.9;71	"	"	"	"
"	"	P.S.L.10;71	"	"	"	"
"	"	P.S.L.12;67	"	"	"	"
"	"	P.S.L.13;26	"	"	"	"
"	"	P.S.L.14;36	"	"	"	"
"	"	P.S.L.15;23	"	"	"	"
"	"	P.S.L.18;94	"	"	"	"

Pinus	Strobus	P.S.L.21;68	planted	Petawawa	FES	weevil-free
"	"	P.S.L.22;58	"	"	"	"
"	"	P.S.L.24;76	"	"	"	"
"	"	P.S.L.65;54	"	"	"	"
"	"	P.S.L.76;88	"	"	"	"
"	"	P.S.L.80;57	"	"	"	"
"	"	P.S.L.82;61	"	"	"	"
"	"	S1-3;20	"	Stinchfield,Mich.		"
"	"	S4-5;8	"	"	"	"
"	"	S6-7;11	"	"	"	"
"	"	S8-9;9	"	"	"	"
"	"	S10-11;10	"	"	"	"
"	"	S12-13;12	"	"	"	"
"	"	S14-15;9	"	"	"	"
"	"	S16-17;8	"	"	"	"
"	"	S18-19;12	"	"	"	"
"	"	S20-21;7	"	"	"	"
"	"	S22-23;9	"	"	"	"
"	"	S24-25;8	"	"	"	"
"	"	S26-27;13	"	"	"	"
"	"	S28-29;8	"	"	"	"
"	"	S30-31;10	"	"	"	"
"	"	S32-33;9	"	"	"	"
"	"	S34-35;10	"	"	"	"
"	"	S36-37;8	"	"	"	"
"	"	S38-39;8	"	"	"	"
"	"	S40-41;8	"	"	"	"
"	"	S42-43;9	"	"	"	"
"	"	S44-45;9	"	"	"	"
"	"	S46-47;7	"	"	"	"
"	"	S48-49;8	"	"	"	"
"	"	S50-51;7	"	"	"	"
"	"	S52-53;9	"	"	"	"
"	"	S54-55;9	"	"	"	"
"	"	S56-57;13	"	"	"	"
"	"	S58-60;15	"	"	"	"
"	"	T 1;150	"	Temple, N.H.		rust-free
"	"	T 2;210	"	"		"

Fall 1941(populations)

Pinus Armandi(26);166 planted
" flexilis,Alberta;160 planted
" korsiensis(63);91 planted
" parviflora(64);209 planted
" Peuce(6);93 planted
" Peuce(68);87 planted
" Strobus Petawawa FES;255 planted weevil-susceptible
" Strobus Petawawa FES;4600 planted(including spring and summer 1941)

Results

White Pine from Petawawa again showed poor germination when spring-sown without stratification, in contrast to some other strains which germinate quite well without any pre-treatment. Pinus Peuce(68) from C.E.F. begins to show characters intermediate between Pinus Peuce and P. Strobus indicating that this material may be of hybrid origin.

Pinus koraiensis,Japan, and Pinus parviflora,Japan, are surprisingly winter-hardy thus far, although not yet above the snow-line.

I-A-4 (I-E-a-4)

Project: Strain Testing of Douglas Fir

Sowings

No. Fall 1941

280 Pseudotsuga taxifolia glauca,Kananaskis FES.

Vegetative Propagation

Fall 1941(clones)

Pseudotsuga taxifolia cassia #696;1080 planted(including summer 1941) C.E.F.

Results:

Douglas Fir from Prince George,B.C. begins to show up very favourably in the seed beds, indicating that this strain may be more suitable to the climate of the Petawawa Region than strains from further south in the interior of B.C. or from high altitudes in the Rockies. This is in agreement with the findings obtained from strains of Lodgepole Pine.

I-A-5 (I-E-a-5)

Project: Strain Testing of Larch

Sowings:

No. Fall 1941

292 Larix Lyallii, Oldman River

Vegetative Propagation:

Fall 1941

Larix eurolepis F1, Petawawa FES; 1080 planted (including summer 1941)
" laricina, Petawawa FES; 900 planted (including summer 1941)
" eurolepis F1, Petawawa FES-a number of cuttings collected fall 1940, buried for the winter 1940-41 and planted in various media spring 1941-total failure, although wintering of cuttings quite successful.

Results

Larix eurolepis F2 shows segregation also in regard to winter-hardiness, although both original parent species are fully winter-hardy at Petawawa FES. Some of the segregates look very promising and a method of propagating these vegetatively is of increasing importance.

I-A-6 (I-E-a-6)

Project: Strain Testing of Birch

Sowings:

No. Fall 1941

293 Betula costata, Harbin
294 " Japonica, Harbin
297 " lutea, Lake Edward, FES
298 " " , Valcartier FES

Vegetative Propagation:

Fall 1940

Betula lutea, Petawawa FES-a number of cuttings collected, buried for the winter 1940-41 and planted in various media spring 1941-total failure.

Results

Betula davurica Harbin shows very good growth and may be of some use; as it hybridizes with Yellow Birch in Russia and is drought-resistant, some valuable new birches may be produced with it as a basis. Vegetative propagation of birches needs working out more urgently with the accumulation of valuable original and hybrid material.

I-A-7 (I-E-a-7)

Project: Strain Testing of Poplar

Sowings:

Summer 1941

Populus alba x grandidentata Mountain Road

Vegetative Propagations:

Spring 1941

P. Anrewsii, Montreal Bot. Gard.-being grown
P. epirotica 11039-37, Montreal Bot. Gard.-no rooting, cancelled
P. italica gigantea 3441-37, Montreal Bot. Gard. (A), being grown
P. italica gigantea 3441-37, Montreal Bot. Gard. (C), being grown
P. Jackii 9, Montreal-being grown
P. kanjilalaiana 3435-37, Montreal Bot. Gard.-being grown
P. Maximoviczii, Harbin, being grown-larger part of population at NRC Annex.
P. Simonii fastigiata, 3454-37, Montreal Bot. Gard.-being grown
P. sp. 3442-37, Montreal Bot. Gard.-being grown
P. sp. 6709-39, Montreal Bot. Gard.-being grown
P. sp. 6710-39, Montreal Bot. Gard.-being grown
P. sp. 6712-39, Montreal Bot. Gard.-being grown
P. sp. 11042-37, Montreal Bot. Gard.-being grown(is P. szechuanica)
P. alba(41) T. V. A.-being grown
P. alba(42) T. V. A.-being grown
P. alba 43, T. V. A.-being grown
P. epirotica 3439-37, Montreal Bot. Gard.-being grown
P. canescens 16, T. V. A.-being grown(Bowman Poplar)

P. canescens 17, T. V. A. - being grown
P. tomentosa 3453-37, Montreal Bot. Gard. - no rooting; cancelled
P. tomentosa 11043-37, Montreal Bot. Gard. - no rooting; cancelled

Spring 1942 cuttings

Will include a number of clones of P. jackii and P. deltoides from in and around Ottawa, Ont. as well as a large number of aspen hybrids, cuttings, treated with different methods of winter storage.

Artificial hybrid populations:

1938 crosses

P. canescens x tremuloides var. aurea - of 1538 seedlings obtained, 1458 have been discarded; 80 clones are still being grown of the other crosses made this year about the same number of clones are at hand as reported last year and these are being propagated for further testing.

1940 crosses

P. grandidentata x canescens (triploid) - ab out 45 seedlings obtained which are being grown at the Annex of the N. R. C.

1942 crosses

P. grandidentata x Salix daphnoides - successful
P. alba x tremuloides aurea Calgary - successful
P. berolinensis x nigra italica - successful
P. tristis x nigra italica - good seed setting, but later failure
P. angulata x Simonii - successful
P. canescens 8 x (alba x grandidentata 37) - successful
P. (alba x grandidentata) 33 x canescens 13 - successful
P. berolinensis x Simonii - successful
P. berolinensis x (alba x grandidentata) 37 - unsuccessful

Results

A couple of the new Oxford Hybrid poplars received in 1939 appear promising and are being propagated for further tests. A poplar disease garden has been established at the Petawawa FES in 1941 and much material is placed in it for testing. Many clones have been grown for arboretum purposes and are now ready for setting out. Vernirubens appears to be one of the most promising clones obtained to date. Several P. canescens x grandidentata clones are very good also, in the nursery at least. Most of the P. alba x grandidentata material in and around Ottawa is becoming stagheaded with increasing age, indicating that it is not of any direct use to forestry because of the short life of the trees. Further work with derivates

of this cross and possibly with polyploid forms is indicated. A method of practical propagation of aspen hybrids by stem cuttings is still lacking and becomes increasingly necessary with the increased material at hand of this group.

I-A-9 (I-E-a-x)

Project: Strain Testing of miscellaneous species

Sowings:

No. Fall 1941

270 Tilia glabra, Petawawa FES-891 seeds
271 " vulgaris grandiflora #736, C.E.F.-1022 seeds
272 " platyphyllos filicifolia nana #6622, C.E.F.-1521 seeds
273 " dasystyla #2442, C.E.F.-1093 seeds
274 " cordata #6124, C.E.F.-225 seeds
275 " vulgaris grandiflora #743, C.E.F.-1383 seeds
276 " platyphyllos, Central Europe
291 Abies sachalinensis, Japan
295 Alnus Maximoviczii, Japan
296 Alnus cordata, Central Europe
299 Quercus borealis maxima, Morton, Ont.
300 Quercus alba, Morton, Ont.
301 Fraxinus manshurica, Harbin
302 Fraxinus rhynchophylla, Harbin

Vegetative Propagation:

Fall 1941

Abies Balsamea, Petawawa FES-360 planted
Libocedrus decurrens, 6000' in Sierras-463 planted.

Results

Phellodendron amurense appears to be fully hardy and fast growing in Nursery 1 so far. Some strains of White Ash require 2 years of stratification for successful germination of their seeds. Basswood can be raised in "hatcheries" and the maximum number of seedlings appears 2 years after sowing, at least as far as Petawawa material of Tilia glabra is concerned. Other species show more prompt germination,

notably Tilia amurensis and T.cordata. T.manshurica behaves essentially as T.glabra in this respect. Ash seedlings can profitably be cut down to the ground after transplanting and produce good new stems after this operation. Vegetative propagation of Ulmus pumila and of native basswood by layering is in progress. Neither species produces new roots on the stems during the first summer of the layering.

TREE BREEDING PROJECT PLANS

For Season 1942

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As Provided for by Dominion Forest Service

BOTANY

Projects 52 to 59 IE (a) Strain Testing of various species.

Current work in propagation -- measurements and records in nurseries and plantations, exchange of material, seed collection, white, black, red, Norway spruce; balsam fir, white, red pine, birch, maple, ash, basswood; extraction of seed; collection and care of cuttings.

Project 50 IE (b) Vegetative Propagation

Current maintenance of beds. Preparation of media for beds. Eighty new cotton covers for beds. Twelve new beds. Construction of root cellar for hardwood cuttings. Seasonal collection of cuttings, both conifers and hardwoods. Layering experiments with hardwoods. Preliminary experiments in top-grafting. Fall storage of cuttings. Testing organic media.

Project 86 - IE (b) Hybridization of Strains and Species

Pollen collection - Collection of twigs of black spruce with male flower buds.

Cytology - Collection, fixing, staining of growing material of birch and poplars to develop technique.

ECOLOGY

Project 85 - IIE Breeding Arboretum

Current work in maintenance of arboretum. Extension and protection of poplar plantation. Completion of thinning Scotch pine, and Norway spruce. Thinning red spruce and white spruce.

APPENDIX C.

VEGETATIVE PROPAGATION

50:1-41 conducted by Heimburger and Grace.
50:2-41 to 50:9-40 conducted by Heimburger.

Classification: I-Eb Tree Breeding.

Project No: 50 Subject: Vegetative Propagation (stem cuttings).

Experiment No: 50:1-41 Date: 1941.

Location and particulars: Petawawa F.E.S. To determine propagability of several conifer species at various times of collection of cuttings and in various peat-sand-soil media in outside propagation frames.

Dates	Treatment and Status
20/5 1941	Cuttings of Black spruce (360) Red spruce (360) planted in the 12 media of Experiment 50:4 Also 60 cuttings of white pine in bed 74, medium 24.
Late June 1941 -	Cuttings of Douglas Fir (180) Red spruce (360) White spruce (1140) White pine (1000) Picea asperate (360) Lodgepole Pine (3600) Scotch Pine (360) Red Pine (360) Colorado spruce (180) planted in 6 beds with 6 different media (randomized) White spruce and white pine were also treated with hormone dusts.
Middle July 1941 -	Planting of about the same numbers of cuttings of the same species including native Tamarack. This time, white spruce, White pine, black spruce and Jack Pine received treatments with hormone dusts.
12/7/41	White spruce cuttings planted in late June were examined and notes on condition taken.
Early August 1941 -	Another collection and planting of cuttings of the same species, with hormone dust treatments as above.
Late August 1941 -	Another collection and planting as above.
Late September 1941 -	Another collection and planting of the species mentioned above and of Balsam Fir (180) untreated.
Late October 1941 -	Another collection and planting as above.

23 and 24/10, 1941-Examined all cuttings of late June collection.

25/10/41 - Examined and removed cuttings of Black Spruce and Red Spruce planted 20/5/41.
27/10/41 - Examined white pine cuttings planted 20/5/41.

Classification: I-Eb Tree Breeding.

Project No: 50 Subject: Vegetative Propagation (stem cuttings).

Experiment No: 50:2-41 Date: 1941.

Location and particulars: Petawawa F.E.S. To determine rooting capacity of Fall-collected hardwood cuttings of various species, stored over winter and planted in outside propagation frames, in early spring.

Dates	Treatment and Status
10 - 1940	Collected cuttings of Red Oak and White Ash (terminal) Yellow Birch, Beech, Hybrid Larch, White Elm and P. canescens 13 (basal and intermediate) and sugar Maple, Red Maple and basswood (terminal and intermediate). Tied together with stovepipe wire and stored over winter in hole in Nursery no. 2, covered with fine sand and poplar debris.
5 - 1941	Wire injured cuttings during storage but sufficient number of cuttings available from inside of the bundles. Cuttings first heeled in in a bed in Nursery no.1, and all with rot and injuries were culled. Cuttings planted in beds of Exp. 50:4 and in beds 1 & 2 Comp. 5, N.1. Canescens 13 was planted in C.2.N.1. All cuttings in N.1 were planted in soil-sawdust mixtures, those in propagation beds in sand and sand-peat mixtures.
10 - 1941	All cuttings dead everywhere except those of White Elm out of 41 callused cuttings planted as S.V. in bed 2, C.5.N.1-4 basal cuttings were with good roots-these were carefully lifted and heeled in for the winter 1941-42.

Classification: I-Eb Tree Breeding

Project No: 50 Subject: Vegetative Propagation (stem cuttings)

Experiment No: 50:3-41 Date: 1941

Location and particulars: Petawawa F.E.S. To determine rooting capacity of long 3-year old cuttings of aspen hybrids in vertical planting in the spring after storage over winter.

Dates	Treatment and Status
10/41	Long cuttings of Populus canescens x tremuloides aurea prepared out of discarded plants and buried in Nursery

Dates	Treatment and Status
	no. 2 over winter. All side-branches removed so that cuttings are long whips.
5/41	Cuttings dug out and planted in C2, N.1 in slits prepared by a spade.
7/41	Some cuttings have produced a few green leaves, although most appear dead.
10/41	All cuttings appear dead; those with green leaves in July look dead also.

Classification: I-Eb Tree Breeding

Project No: 50 Subject: Vegetative Propagation (development of vegetatively propagated material)

Experiment No: 50:4-41 Date: 1941

Location and particulars: Petawawa F.E.S. To study development growth form and growth rate, and other characters of plants developed from rooted white pine cuttings.

Dates	Treatment and Status
5 1941	Collected rooted white pine cuttings heeled in during fall of 1940 from Farrar's rooting experiments with this species and planted these in a sandy soil mixture in bed 1, C.2, N.1 Bed was first covered with cloth screen and watered. Later bed had latch screen for the rest of the summer.
10 1941	Cuttings have nearly all survived the summer and look very good. The growth is in every case upright. The needles of the current summer's growth are longer than those produced by the cuttings in the propagation beds.

Classification: I-Eb Tree Breeding

Project No: 50 Subject: Vegetative Propagation (development of vegetatively propagated material)

Experiment No: 50:5-41 Date: 1941.

Location and particulars: Petawawa F.E.S. To study development, growth form and growth rate, and other

characters of plants developed from rooted white spruce cuttings.

Dates	Treatment and Status
5/41	Collected rooted white spruce cuttings heeled in during fall of 1940 from Farrar's experiments in rooting this species and planted these in sandy mixture in bed 1, C.2, N.1. Bed was first covered with cloth screen and watered. Later bed had lath screen for the rest of the summer. Cuttings have nearly all survived and look fairly good. The growth is in nearly every case horizontal. The needles of the current summer's growth are longer than those produced by the cuttings in the propagation beds.

Classification: I-Eb Tree Breeding

Project No: 50 Subject: Vegetative Propagation (Layering)

Experiment No: 50:6-41 Date: 1941

Location and particulars: Petawawa F.E.S. To determine propagability of Chosenia splendida by layering

Dates	Treatment and Status
5/41	Layered lower side-branches of 2 chosenia plants in Nursery 1 by digging shallow trenches with a trowel and burying central parts of branches in these. Young growth just starting-2 first leaves out.
7/41	Layered branches show very vigorous growth; one was partially dug out and showed numerous roots on the buried parts.
10/41	Layered branches thicker beyond the trenches than the parts connecting layered branches with the original plants. Left intact over winter.

Classification: I-Eb Tree Breeding

Project No: 50 Subject: Vegetative Propagation (layering)

Experiment No: 50:7-41 Date: 1941

Location and particulars: Petawawa F.E.S. To determine time of rooting of layered Basswood plants.

Dates	Treatment and Status
5/41	Young Basswood plants raised from furrow-layered material in 1936 and twice transplanted were planted in a row in C.6, N.1 and cut off at the ground.
7/41	Young shoots from stumps of planted basswood now semi-lignified. They were hill-layered at this time.
10/41	Several of the hill-layered plants were examined but no roots were formed on the stems as yet. The plants were covered up again with soil and left intact over the winter.

Classification: I-Eb Tree Breeding

Project No: 50 Subject: Vegetative Propagation (layering)

Experiment No. 50:8-41 Date: 1941

Location and particulars: Petawawa F.E.S. To determine rooting capacity of Chinese Elm (ulmus pumila) by layering and feasibility of raising good plants from such material.

Dates	Treatment and Status
5/41	Young plants of Ulmus pumila raised at the Annex of the N.R.C. from seeds in 1939 were planted in rows in C.6, N.1, after their tops have been cut off to the ground.
7/41	Young shoots from stumps of the plants are now semi-lignified. They were hill-layered at this time.
10/41	Several of the hill-layered plants were examined but no roots were formed on the stems as yet. The plants were covered up again with soil and left intact for the winter.

Classification: I-Eb Tree Breeding

Project No: 50 Descriptive Title: Vegetative Propagation

Purpose: (stem cuttings)

Experiment No: 50:9-41 Descriptive Title: 1941

Location and Particulars (plot numbers etc.) Ottawa and Petawawa F.E.S. To find suitable storage method for stem cuttings of aspen hybrids, and method of raising good plants from these if and when they root.

Date	Treatment and status
10/12/41	Collected cuttings of C13, A20 and A36 and cut up into 6" lengths. Stored some of these in bundles with elastic bands in box with sand and moss outside, covered with snow.
11/12/41	Stored some of the cuttings in cylindrical cardboard containers in moist moss and sand at room temperature in lab., and also in refrigerator at 5-8°C. and cool shed (on floor).
26/12/41	New growth of cuttings stored in lab. now visible. Cuttings moved to refrigerator and cool shed.
11/3/42	Some of the cuttings in refrigerator and cool shed taken in the lab. and placed in beakers with water for rooting. (Only those cuttings taken in which showed new growth on 26/12/41).

Classification: I-Eb Tree Breeding

Project No: 50 Descriptive Title: Vegetative Propagation

Purpose: (stem cuttings)

Experiment No: 50:10/41 Descriptive Title: 1941

Location and particulars (plot numbers etc.) Ottawa, rooting test of poplars of the aspen group in beakers with water to determine rooting capacity of material under uniform conditions.

Date	Treatment and status
11/12/41	Cuttings of A36 and C13 placed in beaker with water in lab. to observe start of new growth and root formation.
26/12/41	New growth started on cuttings in beaker and root formation fully evident in A36 but not in C13. Cuttings discarded.
4/1/42	New cuttings of A17 and A36 collected and placed

in beakers with water in lab.

2/2/42 A 17 rooted 85% and A36, 98%; cuttings discarded. The two P. alba clones have a similar rooting capacity from stem cuttings under uniform conditions when cutting material is similar in origin. This is contrary to results in nursery at Petawawa.

1941 Experiment outlines brought to date:

Classification Number IV-A (50:1-23)
IV-C (52:1)
IV-E (54:1-5)

See proceedings of the fifth meeting of the Subcommittee Pages C-(46-73).

Number	Status April, 1942.
50:1	Published, C.J.R. Vegetative propagation of Conifers IX and X.
50:3	Data obtained and further experiments in hand.
50:4	Data obtained, results inconclusive and not directly publishable.
50:5	Data on hand at N.R.C.
50:6	Data obtained, not directly publishable but worthy of ultimate publication.
50:7	Discontinued May 1941.
50:8	Data to be published in due course.
50:9	Experiment under way, cuttings to be removed Autumn, 1942.
50:10	Not undertaken
50:11	Not undertaken
50:12	Valuable data taken and records in hands of Dr. Heimburger.
50:13	Experiment under way, cuttings to be removed Autumn, 1942.
50:14	Experiment under way, cuttings to be removed Autumn, 1942.

50:15 Data at N.R.C., experiment being carried on, results worthy of ultimate publication.

50:16 Not undertaken alone, included in 50:1-41.

50:17 Discontinued for time being, initial results of Mr. Farrar on record.

50:18 Data taken, suitable for publication.

50:19 Data taken, suitable for publication.

50:20 Data taken, suitable for publication.

50:21 Data taken, suitable for publication.

50:22 Results inconclusive, data at N.R.C.

50:23 As of 5 August, 1941, there were ten living cuttings of 3 clones (transferred to P. F. Experimental Station.

52:1 Discontinued

54:1 Discontinued

54:2 Data taken by Dr. Heimburger

54:3 Discontinued

54:4 Discontinued

54:5 100% cuttings heaved with no screened shades; lath screen only 50% heaved; cloth screen, no frost heaving. Experiment discontinued.

Classification Number: IV-E (50:11-41)

Classification Subject: Development of vegetatively propagated material.

Title of Experiment: Growth of rooted Conifer cuttings.

Schedule: Transplantings May, 1941.

Conducted by: N. H. Grace at the N.R.C. Annex.

Objectives: (1) To have available a substantial number of conifers rooted for cuttings.

(2) Specifically to note the comparative growth of

small and large rooted Norway Spruce cuttings.

Materials and Methods:

Several hundreds of rooted Norway Spruce cuttings which had been heeled in over winter at Petawawa were lined out without any protection.

Norway Spruce cuttings of different lengths (Experiment 50:20) were transplanted to slat covered beds.

A few White Pine cuttings were planted in shaded beds, others outside without shade.

Progress to April, 1942.

There has been low mortality and excellent growth. Large Norway Spruce cuttings show up well.

Classification Number: IV-A (50:12-41)

Classification Subject: Vegetative propagation stem cuttings.

Title of Experiment: Rooting of different types of cuttings from Norway spruce trees 35 to 60 years of age (Hawkesbury).

Schedule: Commenced October, 1941.

Conducted by: N. H. Grace.

Objectives: To observe response of cuttings from older trees than used heretofore and to compare the behaviour of different types of cuttings.

Materials and Methods: Branches were collected by Drs. Heimburger and Johnson near Hawkesbury and included branches from different parts of the tree and from an individual with exceedingly short needles. Cuttings were prepared of one and two year's growth, and some branched cuttings also were used. These were planted in outdoor frames and in the greenhouse. The medium used was three volumes sand to one volume black sedgetype peat.

Progress: To April, 1942.- Survival of the greenhouse plantings has been poor excepting cuttings of the short needle spruce which are doing fairly well. Comparison with cuttings taken at Petawawa suggests that poorer survival may be related to the age of the tree.

Classification Number IV-A (50:13-41)

Classification Subject: Vegetative propagation stem cuttings.

Title of Experiment: Effects of wire girdling on responses of conifer cuttings.

Schedule: Commenced November, 1941.

Conducted By: N. H. Grace.

Objectives: To determine effects of girdling on rooting and subsequent growth of cuttings.

Materials and Methods: Branches were collected above and below the wire girdle from Norway and White Spruce trees, (See IV-A-3 (50:3). Branches were also collected from normal trees. Indolylbutyric dust treatments were applied to some of the cuttings.

Progress: To April, 1942.- Survival of cuttings taken above the girdle was the same as for cuttings from trees without girdling and those taken below girdle showed significantly reduced survival. Girdling had apparently no effect on the development of new growth. Indolylbutyric acid treatment reduced both survival and new growth. Cuttings from girdled White Spruce trees survived in greater numbers than from not-girdled trees. The dust treatments all reduced survival significantly.

Classification Number: IV-A (50:14-41).

Classification Subject: Vegetative propagation stem cuttings.

Title of Experiment: Greenhouse propagation of conifer cuttings.

Schedule: Commenced October, 1941.

Conducted By: N. H. Grace.

Objective: To obtain information on response of conifer cuttings to greenhouse propagation and to supplement information from Experiment 50:1-41.

Material and Methods: All cuttings were planted in a medium of three volumes sand to one volume sedgetype (Alfred) peat. The frames in greenhouse were open but surrounded by a two foot cheese-cloth curtain to cut down air currents. There were two collections of White Spruce and White Pine and one of each of Red Pine, Jack Pine and Larch. Some phytohormone treatments were used, on White and Red Pine both dust and solution treat-

ments, some of the solution treatments were applied under reduced pressure. Additional collections had been originally planned for, pressure of other work limited the work as described.

Progress: To April, 1942.- All cuttings of the first collection of White Pine and Spruce, of Larch and nearly all of Jack Pine are dead. December plantings of White and Red Pine still look fairly well.

Classification Number: IV-A (50:15-41)

Classification Subject: Vegetative propagation stem cuttings.

Title of Experiment: The effects of peat and other media on greenhouse propagation of Norway Spruce cuttings.

Schedule: Commenced January, 1942.

Conducted by: N. H. Grace.

Objectives: A continuation of Experiment 50:18-40, a study of factors responsible for the beneficial effects of peat. Several peats were considered, and one mixture with a moisture retaining substance, active silica.

Materials and Methods: Branches were collected at the Petawawa Forest Experimental Station, Chalk River, on November 24. These were stored outside on the roof of the Council until January 5 when cuttings were prepared and planted. Groups of 15 cuttings were planted in crocks with drainage, (IV-A-18(50:18)1940). There were four replicate groups of each of 15 different media. The following media were used: (1) sand only, (2) Sand overlaid with one-half inch Alfred peat, (3) sand with Alfred peat, (4) sand overlaid with Swedish peat, (5) sand mixed with Swedish peat, (6) sand overlaid Wylie Mill ground Swedish peat, (7) sand mixed with the ground Swedish peat, (8) sand overlaid with Petawawa peat, (9) sand mixed with Petawawa peat, (10) sand overlaid with ground Petawawa peat, (11) sand mixed with ground Petawawa peat, (12) sand overlaid with soil and (13) mixed with soil, (14) sand overlaid with active silica and (15) mixed with active silica. All mixtures involved overlaying with one-half inch after cuttings were planted, the mixtures involved 3 volumes sand to one of the peat, silica or soil. The propagation frame was maintained without a cover.

Progress: to April, 1942.- Most of the cuttings are in good condition and considerable new growth is showing. Differences attributable to media are apparent. The good condition of plantings with active silica suggests that a substantial part of the beneficial effect of peat medium may be related to the purely physical effects on moisture retention and the maintenance of a consistently humid atmosphere near the base of the cutting.

Classification Number: IV-A(50:16-41)

Classification Subject: Vegetative propagation stem cuttings.

Title of Experiment: Effects of season of collection, media and indolylbutyric acid treatment on the rooting of Basswood cuttings.

Schedule: Commenced July, 1941.

Conducted By: N. H. Grace and L.P.V. Johnson.

Objective: To determine effects of season of collection, media and chemical treatment on Basswood cuttings.

Materials and Methods: Cuttings were collected and planted at the N.R.C. Annex in cotton covered frames in sand only and three volumes sand mixed with one volume black sedgetype peat. Treatment groups of 10 cuttings involved: no treatment, talc only, and talc containing 1000, 2000 and 4000 p.p.m. of indolylbutyric acid. Three replicates were planted in sand and three in sand peat. Collections were made July 16, August 9, September 5, October 15 and November 18. A final collection will be included prior to the formation of new growth, i.e. cuttings maintained on the branch over winter.

Progress: To April, 1942 - Most of the cuttings of the two earliest collections have died. Mortality appeared to be somewhat worse in the sand-peat medium.

Classification Number: IV-A(5 0:17-41)

Classification Subject: Vegetative propagation stem cuttings.

Title of Experiment: Greenhouse propagation of Basswood cuttings in the greenhouse in sand.

Schedule: Commenced September, 1941.

Conducted By: N. H. Grace.

Objectives: To supplement the experiment in outdoor frames (50:16-41). Periodic winter collections and heeling in were also under consideration.

Materials and Methods: Cuttings were collected at the N.R.C. Annex, treated with talc dusts containing indolylbutyric acid and planted in sand in the greenhouse. Collections were made in September, October, November and February. Cuttings of September and November collections were heeled in sand and stored at the N.R.C. Annex until April when they were treated and planted.

Progress: To April, 1942 - There are indications that the early collections have experienced about 100% mortality.

Classification Number: IV-A (50:18-41).

Classification Subject: Vegetative propagation stem cuttings.

Title of Experiment: Greenhouse propagation of Autumn collections of Birch and Elm cuttings.

Schedule: Commenced September, 1941.

Conducted By: N. H. Grace.

Objectives: Responses of early Autumn collection of cuttings to greenhouse propagation in sand. Earlier work had demonstrated that mid-winter and late collections gave poor results, early collections of dormant material had not been made.

Materials and Methods: Cuttings were collected at the N.R.C. Annex. Some were planted directly after phytohormone treatment, others heeled in sand for two months.

Progress: To April, 1942.- Virtually no response was shown by cuttings planted in September, heeling in resulted in substantial new growth, usually followed by death, though a few (less than 1%) White Birch cuttings rooted. It may be concluded that collection of material in the early stage of dormancy is not advantageous.

Classification Number: IV-A (50:19-41).

Classification Subject: Vegetative propagation stem cuttings.
Title of Experiment: Greenhouse propagation of poplar cuttings.
Schedule: Commenced November, 1941.

Conducted By: N. H. Grace.

Objectives: Rooting and subsequent maintenance of poplar cuttings. The chief interest relating to the successful transplanting of rooted or callused cuttings.

Materials and Methods: Populus A x G cuttings were collected from Thomas' field, Petawawa Forest Experiment Station. Groups of ten cuttings involved no treatment, talc only and 1000, 2000 and 4000 p.p.m. indolylbutyric acid in talc. There were three replicates all planted in white sand. Collection was made November 24 and cuttings made and planted December 4, 1941. On December 24, in company with Dr. Heimburger cuttings of A36 (Mountain road), C13 (Rideau River sand pits) and A20 (Hogs' Back) were collected and planted in white sand, December 31. Treatments as above were used. The scheme of randomization permitted comparison of both hybrid varieties and chemical treatments. An equal number of cuttings were made and heeled into sand and held until early April at the N.R.C. Annex basement. These also were then planted in white sand.

Progress: To April, 1942.- The A x G cuttings of November collection all developed new growth and a few some callus, none were rooted. It is believed that transfer from sand should have been made earlier than it was (19 February). The hybrid cuttings were removed 20 February. There was good rooting, A36 and A20 showing about 85% on the average and C13, 30%. However, phytohormone treatments had a markedly beneficial effect. The 2000 p.p.m. indolylbutyric acid treatment rooted 97% of each of A36 and A20 and 53% of cuttings of C13.

Cuttings were immediately transplanted to a mixture of equal volumes of brown sand and sterilized soil. On April 8 counts were taken of the number of living cuttings. At this date 80% of each of A36 and A20 and 43% of C13 were alive and growing well (percentages based on the number of cuttings originally planted in white sand). These results stress the value of phytohormone treatments and indicate that successful transplanting of rooted cuttings can be achieved, a consideration which has given difficulty in the past.

APPENDIX D

Subcommittee on Forest Tree Breeding
Section on Pathology - C.G. Riley

Summary (1) Work to date
(2) Plans for 1942

General note re plans for 1942: Due to war time emergencies, it has been necessary to limit plans for work in 1942 to the minimum that will suffice to maintain present projects without detriment to results thus far obtained. New work will not be undertaken excepting as required by very special circumstances.

V-A-1. Pathology: poplar
Resistance to disease

Project summary:
Proc. 5th Meet. of Subcom., April 8, 1941, page C-74.
Results in 1941:
Proc. 8th Meet. of Subcom., April 15, 1942.
Summary: Rust and Septoria canker continued to be the most important diseases demanding attention. Clones vary greatly in their degree of freedom from rust, from year to year. Many clones and seedlings have been definitely placed in the rust-susceptible category. Inoculation tests with Septoria canker were very successful, indicating certain clones as susceptible and others as resistant to this disease. These results should be confirmed by repetition. After several years of experimenting, a satisfactory method of inoculating trees with the heart-rot fungus has been developed. It is indicated that trees may be tested for susceptibility to this disease, at age of 10 years or younger.

Plans for 1942: Repeated inspection of breeding materials. Further studies by inoculation to be postponed.

V-B-1. Pathology: White pine; Blister rust.
Resistance to blister rust in white pine breeding materials.
Project summary:
Proc. 5th Meet. Subcom., April 8, 1941, page C-75.
Results in 1940:
Loc. cit. page D-8
Preliminary experiments in methods and technique of inoculation, early symptoms of disease, etc. Normally, results of inoculations not visible for 2 - 3 years.

Results in 1941:
Proc. 8th Meet. Subcom., April 15, 1942.
No results yet, from 1940 inoculations. Further inoculations made.
Plans for 1942:
Confined to observations on above inoculations, and inspections of breeding materials.

V-B-2. Pathology: White pine: Blister rust: Pointe Platon.
Freedom from blister rust in Pointe Platon white pine.

Project summary:
Proc. 5th Meet. Subcom., April 8, 1941, page C-76.
Results in 1940:
Loc. cit. page D-8.
Plantation inspected by Dr. Pomerleau, and 20 rust free trees marked.
Results in 1941:
Proc. 8th Meet. Subcom., April 15, 1942.
Plantation re-examined by Mr. A.W. McCallum. Five outstanding disease-free trees selected and marked. Cuttings from these, Aug. 3, delivered to Dr. Heimburger.
Plans for 1942:
If possible, the plantation will be re-examined in the blister rust season every year.

V-C-1. Pathology: Douglas fir
Resistance to sooty mold in Douglas fir.

Project summary:
Proc. 8th Meet. Subcom., April 15, 1942.
Results 1941:
New Project. To determine resistance or susceptibility of Douglas fir breeding materials in nursery. Inoculations made. Results will not be known for one or two years.

V-A-I. Resistance to disease in poplar breeding materials

Annual Report, 1941

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

Previous work on this project has been reported in Proceedings of the Second and of the Fifth Meetings of the Subcommittee on Forest Tree Breeding (Nov. 28, 1939 and April 8, 1941).

As in previous years, indications of the degree of resistance and susceptibility to disease, were sought by two methods, (1) observations on naturally occurring diseases and (2) tests by means of artificial inoculations. Three complete inspections of all poplar breeding materials in both nurseries and in the test plantation, were made. Rust, caused by Melampsora medusae Thüm., continued to be the most prevalent disease of natural occurrence.

The following lists indicate the poplar clones that have remained consistently free of rust or only lightly attacked since observations were begun.

	Rust free	
One year's observations	Two years' observations	Three years' observations
A-29: A-35: AcE-10: At-7: AT-13: AT-15: C-2: C-12: Canescens	A-22: A-26: A-36: P. alba 671 CG-30: Koreana 9: Laurifolia 2: Rotundifolia L: Simonii 1: TS-7:	AG[x] CA-1: CG-28: Geneva: OP-44: OP-46: OP-48: OP-50:
	Lightly attacked	
One year's observations	P. berolinensis 1: BNW-19 CS-2: CS-3: CS-5: Nigra 1: Pyramidalis: TG-5:	AG[x] AT-2: Maine: OP-10: OP-14: OP-16: OP-30: OP-41: OP-45: OP-47: OP-49: OP-54: OP-55: Rochester: Roxbury: Strathglass: TG-2: P. trichocarpa 5:

[x] All of the AG materials have remained either entirely free, or else have been affected so lightly that it has not been necessary to list them individually.

The CXW seedlings in the lower nursery were not given individual ratings as above. They were all examined, and a list was made of those that were free of rust or only lightly attacked. These were as follows:

Free of rust: Nos. 102, 122, 208, 372, 293, 1447, and 1509.
Lightly rusted: 422, 440, 475, 643, 756, 920, and 1348.

It will be noted CXW 475, the outstanding rust-free tree in this lot in previous years, was lightly attacked in 1941. Also, other lots of material that had remained free of rust previously, became infected in 1941.

The fact that a given clone can be heavily attacked in one year, and remain healthy in another, indicates that strong factors are operating, uncontrolled, in addition to the mere presence of inoculum and host susceptibility, and it is clear that final conclusions can not be drawn until these have been thoroughly explored. The history of cereal rusts indicates that this may require many years of intensive research. However, the kind of investigations thus far conducted, do serve the very useful purpose of indicating those lots of breeding materials that are definitely susceptible to the kinds of rust present, locally. It is the negative results that must be viewed with the greatest of caution.

Summary of Inspections of Poplar Breeding Stock to the End of 1941

Although the determination of disease resistance[x] or susceptibility of poplar hybrids in the nurseries, disease garden, and arboretum at Petawawa F.E.S., as determined by observations of natural infection and by inoculation during the past three years has yielded some contradictory results, it is still possible to segregate clones and individuals which have been strikingly and often consistently susceptible. However, a clone which has been consistently resistant may suddenly appear completely susceptible. This may be attributed to one of several possible reasons.

(1) In considering resistance to rust, for example, we may be dealing with physiologic or biologic races or even different species of rust which vary from year to year. (2) The host may have escaped infection by accident rather than possess resistance or immunity. (3) Unfavourable weather conditions may have prevented infection or retarded the development of the fungus thus making escape possible. Data on resistance must, therefore, be taken with reserve pending further observations. Information with respect to susceptibility may be considered reliable, and susceptible clones or individuals may be discarded unless they are desirable for breeding for characters other than disease

[x] The term "resistance" as used in this report, implies any relative degree of freedom from rust, and is not necessarily associated with immunity.

resostamce. A summary of the observations of the past three years is given below.

P. alba: (A-22: A-26: A-29: A-35: A-36: P. alba 671)
Has shown complete resistance to rust. Reported to have moderately rust resistance in Britain (Peace).
All clones free of Septoria leaf spot except A-26 and A-35 which showed some in 1940. Thomson found no leaf spot after inoculation. No infection obtained from Orange Rd. inoculations for both leaf spot and canker.

AcE: (alba x canescens) x Eugenei. (AcE-1: AcE-4: AcE-8: AcE-10: AcE-11). All susceptible to rust with possible exception of AcE-10. All have had some Septoria leaf spot except AcE-4 and AcE-10.

ACG: (alba x canescens) x grandidentata. (ACG-1: ACG-12: ACG-17: ACG-27: ACG-28). All slightly susceptible to rust except possibly ACG-17 and ACG-28. No evidence of susceptibility to Septoria.

P. acuminata 1: Susceptible to both rust and Septoria leaf spot and canker. (Thomson found it susceptible to Septoria leaf spot by inoculation.)

AG: (alba x grandidentata). Fairly resistant to rust and to Septoria.

AGE: (alba x grandidentata) x Eugenei. All highly susceptible to rust.

AGW: (alba x grandidentata) x tremuloides aurea. Highly susceptible to rust. Also susceptible to Napicladium.

P. angulata erecta: Susceptible to Melampsora. Some evidence of Septoria susceptibility. Thomson found P. angulata susceptible to Septoria leaf spot.

AT: (alba x tremuloides). Resistant to rust and Septoria.

Bassano: Susceptible to rust. Resistant to Septoria.

P. berolinensis 1: (laurifolia x nigra italica). Only slightly susceptible to rust and Septoria. Reported to be highly susceptible to both rust and Septoria (Bier, Thompson) but moderately resistant to bacterial canker (Peace).

BNW: (berolinensis x northwest). All susceptible to rust. (BNW-19 appears to be least susceptible.) Variable susceptibility to Septoria.

Brooks: (Russian x cottonwood). Susceptible to rust and Septoria.

P. canescens: (C-1: C-2: C-3: C-12: Canescens). Fairly resistant to rust (C-1 and C-3 have been infected). Peace says canescens is highly resistant to rust. All resistant to Septoria.

Calgary: (balsam x Russian). Susceptible to rust and to Septoria.

P. Candicans: (tacamahacca). Moderately susceptible to rust and Septoria. (Peace - susceptibility to rust variable, but it is sometimes very severely attacked.) (Bier & Thomson - susceptible to Septoria leaf-spot.)

Carolina: (nigra x deltoides v. missouriensis). Susceptible to rust. Reaction to Septoria unknown.

P. cathayana: (#1, 13, 14, 15, 16, 17, 18, 19, 20). All susceptible to rust. Fairly resistant to Septoria.

CG: (canescens x grandidentata). (#1, 6, 8, 12, 16, 17, 18, 27, 28, 30). Moderately susceptible to rust except CG-28 and CG-30 which are apparently immune.

CS: (#1,2,3,4,5,6). Moderately susceptible to rust except CS-2, CS-3 and CS-5 which are fairly resistant. All resistant to Septoria.

CT: (canescens x tremuloides). Susceptible to rust and Septoria.

CxW: Very susceptible to rust (some not so heavily infected).

D: (deltoides?) (#1,2,3,4,5,7). Very susceptible to rust. Susceptible to Septoria but by inoculation only.

P. eugenii 2: (generata x nigra italica). Susceptible to rust but not to Septoria. (Peace - suffers severe defoliation from rust in America.) (Thomson - susceptible to Septoria leaf-spot.)

P. gelrica: (serotina x marilandica). Fairly resistant to rust amd Septoria. (Peace - highly rust resistant.)

P. generosa: (angulata x trichocarpa). Susceptible to rust but only moderately susceptible to Septoria. (Peace - susceptible to rust.) (Thomson - susceptible to leaf-spot by Septoria.)

Geneva: (Maximowiczii x berolinensis). Immune to rust. Susceptible to Septoria.

P. Jackii: (balsamifera virginiana x tacamahacca) #1 and #2. Susceptible to rust. #1 susceptible to Septoria but #2 is very resistant even after inoculation.

Koreana: (#1,5,6,8,9). All susceptible to rust except #9 which is immune. All resistant to Septoria.

Laurifolia #2. Rust resistant but susceptible to Septoria.

Maine: (candicans x berolinensis). Resistant to rust and to Septoria canker but not leaf-spot.

Masson: Susceptible to rust but resistant to Septoria.

N-2: Lightly susceptible to rust and resistant to Septoria.

Nigra 1: Resistant to rust and Septoria.

Northwest: (tacamahacca x balsamifera). Susceptible to rust and Septoria. (Bier - susceptible to Septoria.)

OP: (#5,6,7,10,14,16,23,26,27,30,38,41,42,44,45,46,47,48,49,50,51,52,53,54,55).

Rust Resistant	Mod. Susceptible	Highly Susceptible
#10,14,16,30,41, 44,45,46,47,48, 49,50,54,55	#5,6,7,42,51,52, 53	#23,26,27,38

Resistant to Septoria. OP-38 was inoculated and found resistant to canker but susceptible to leaf-spot.

Pyramidalis: Resistant to rust and Septoria.

Raverdeau: Susceptible to rust. Fairly resistant to Septoria.

Rochester: (Maximowiczii x nigra plantierensis). Resistant to rust but susceptible to Septoria.

Rotundifolia 1: Resistant to rust and Septoria.

Roxbury: (nigra x trichocarpa). Resistant to rust but moderately susceptible to Septoria.

Saskatchewan: (tacamahacca x balsamifera). Highly susceptible to rust. Susceptible to Septoria.

Simonii 1: Resistant to rust and Septoria. (Thomson - susceptible to Septoria.)

Strathglass: (nigra x laurifolia). Resistant to rust. Moderately susceptible to Septoria.

T-8: (tremuloides). Susceptible to rust.

TG: (tremuloides x grandidentata) #2,3,4,5. Fairly resistant to rust and Septoria but highly susceptible to Napicladium.

P. tremula: #2,4,5. Moderately susceptible to rust and Septoria.

P. trichocarpa: #5,6,11. #5 - rust resistant but susceptible to Septoria. #6 - less rust resistant and susceptible to Septoria. #11 - susceptible to rust and Septoria.

Tristis: #1 and 2. Susceptible to rust. Resistant to Septoria.

TS: #4,5,7. TS-7 - rust resistant. Others moderately susceptible. All resistant to Septoria.

22-11: (trichocarpa x angulata).. Susceptible to rust and Septoria.

P. vernirubens: Susceptible to rust and Septoria.

A number of clones were inoculated with the canker fungus, Septoria musiva. The results indicate that the method used will be satisfactory for testing poplars for susceptibility to this disease. This work will be carried on as rapidly as circumstances will permit. Activities in 1942 will be restricted due to war-time emergencies. The results of the 1941 inoculations are shown in Table 1. These must be confirmed by repetition before they can be accepted finally.

Table 1. Results of inoculations of poplar with Septoria musiva, Upper Nursery, Petawawa Forest Experiment Station, June 28, 1941.

Designation	Leaf inocn.	Wound inocn.	Control
Acuminata 1	+	+	–
Calgary 23	+	+	–
Cathayana 15	?[x]	+	–
D-1	+	+	?
D-2	+	+	–
Generosa	+	–	–
Geneva	+	+	–
Jackii 1	?	+	–
Jackii 2	+	–	–
Maine	+	–	–
Masson	?	–	?
Northwest	?	+	–
OP-38	+	+ tr	–
Raverdeau	?	+	–
Strathglass	+	+	–
Trichocarpa 5	?	+	–
Trichocarpa 6	+	+	–
22-11	+	+	–
Vernirubens	+	+ overcome	–

[x] At the time of the examination of the leaf inoculations, some of the older leaves had fallen so that no data are available. They are marked (?).

\+ indicates positive reaction
– " negative "

After several years of experimenting, a satisfactory method of inoculating poplars with the heart-rot fungus (Fomes igniarius) has been developed. It is indicated that trees may be tested for susceptibility to this disease, at ages of 10 years or younger, thus obviating the formerly presumed necessity of allowing trees to attain the age of heartwood formation before such tests can be made.

Classification Number: V-C-1.
Classification Subject: Pathology: Douglas fir.
Title of Project: Resistance to sooty mold in Douglas fir.
Schedule: Commenced 1941.
Conducted by: C.G. Riley and A.J. Skolko.
Objectives: To determine if Douglas fir breeding materials are susceptible or resistant to this disease.

Materials and Methods: Douglas fir in the lower nursery inoculated with Phaeocryptopus Gäumanni, by placing diseased branches bearing spore-discharging perithecia, in the foliage of the young trees, in moist weather. The inoculum was sent by J.E. Bier from Victoria, B.C.
Results: Will not be discernible till after at least one year.

V-B-1 Blister rust of white pine breeding materials

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No results of the 1940 inoculations were evident in 1941. The disease normally requires two to three years to produce macroscopic symptoms.

Additional inoculations were made in 1941.

V-B-2 Freedom from blister rust in Pointe Platon white pines

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The plantation of white pines on the Seigniory of Lotbiniere was re-examined by Mr. A.W. McCallum who placed identification tags on five outstanding trees that had escaped infection, as far as could be determined. Upon the request of the tree breeders, Messrs. Riley and Skolko brought a supply of cuttings from these and from rusted trees in the same plantation, enroute from a field trip, on August 3rd.

Distribution List

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