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NATIONAL RESEARCH COUNCIL OF CANADA

PROCEEDINGS

OF THE

SIXTEENTH MEETING

OF THE

SUBCOMMITTEE ON FOREST TREE BREEDING

OTTAWA

20 MARCH, 1946

NATIONAL RESEARCH COUNCIL

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Held in the office of the Dominion Forester,
20 March, 1946.

Members present:

Mr. D. A. Macdonald, Chairman
Dr. E. S. Archibald, Vice-chairman
Mr. J. L. Farrar, Joint-secretary
Dr. N. H. Grace
Dr. C. C. Heimburger
Dr. L.P.V. Johnson, Joint-secretary
Mr. C. G. Riley
Mr. W. M. Robertson
Dr. H. A. Senn

Visitor present:

Mr. A. Leslie (Ont. Dept. of Lands and Forests).

166. Minutes — The Minutes of the Fifteenth Meeting were approved without change.

167. Disease garden — Referring to Minute 163, Mr. Riley expressed concern about the continuity of the pathological and breeding work dependent upon materials growing in the white pine blister rust disease garden at the N. R. C. Annex.

Dr. Johnson said he was unable to give any assurance that these materials would not be molested by future building operations, and advised a new site for the disease garden.

Proposals that a disease garden be established at the Petawawa Forest Experiment Station did not meet with the approval of Messrs. Macdonald and Robertson, who pointed out the fact that the disease garden could not be located at the station without menacing established white pine plantations and sample plots.

Dr. Archibald suggested that suitable land might be made available for disease garden purposes on the tract (in the Connaught Ranges area) leased by the Department of Agriculture from the Department of National Defense. It was agreed that the suitability and availability of this land be investigated by a committee composed of Mr. Riley, Dr. Heimburger and Dr. Johnson. It was further agreed that this committee should have the power to make such arrangements as might be necessary to facilitate immediate utilization of the land in the event that it was suitable and available.

Discussion on the size of disease garden required brought general agreement on an area of ten acres with prospects for expansion. It was considered feasible to move materials now in the Annex disease garden. Between one and two acres of prepared ground would be required to accommodate these materials.

168. Provincial representation

The subject of provincial representation on the Subcommittee arose out of Minute 164. It was pointed out that the issues of the Dominion-Provincial Conferences were still unsettled and that it may be inopportune to go further into the matter.

Mr. Leslie, visiting representative of the Ontario Department of Lands and Forests, said he was greatly interested in the proceedings and that he felt his organization would be favorable toward any move for its closer identification with the Subcommittee's work. He did not believe that the status of the Dominion-Provincial Conferences should hold up preliminary arrangements with provincial forestry officials.

Dr. Johnson stated that three provinces, Ontario, Alberta, and British Columbia were already co-operating with the Subcommittee. There was no doubt that as time went on provincial facilities for the production and distribution of planting stock would become increasingly important in multiplying and distributing Subcommittee materials.

Dr. Johnson read Mr. Walker's comment on provincial representation, which stressed Ontario's annual distribution of planting stock (see Appendix D).

The meeting agreed that a letter should be sent to the proper forestry official in each province outlining the work of the Subcommittee and inviting active participation in the undertaking. It is hoped that this will advance the interests of forest tree breeding and prove

mutually beneficial to both federal and provincial departments.

169. Dr. Johnson's report

Dr. Johnson's report, appended hereto as Appendix A, had been previously circulated to the members and was only briefly presented to the meeting.

Discussion centered upon prospective work during the coming season. Dr. Johnson said that he believed provisions would be made to enable him to operate along the same lines as in the past. He felt that some hybridization work in conifers might be undetaken at Petawawa should the season be favorable. The policy, in general, would be to complete work already underway and to arrange transfer of materials already on hand rather than to undertake new work or to produce new materials.

170. Dr. Heimburger's report

Dr. Heimburger's report, attached hereto as appendix B, had been also circulated previous to the meeting.

Dr. Heimburger emphasized the fact that the plans for 1946 outlined in the report were based on the assumption that a qualified person would be present at the Petawawa station to take charge of the work.

171. Mr. Riley's report

Mr. Riley's report, attached hereto as Appendix C, had been presented at the Fifteenth Meeting (see Minute 160) and subsequently circulated to the members.

172. Letter from Mr. Walker

Dr. Johnson read a letter dated 14 March from Mr. John Walker (appended hereto as appendix D). The various points raised in the letter were considered and it was agreed that positive action should be taken where possible. In another letter Mr. Kerr stated that Mr. Walker in submitting the above proposals was speaking on their joint behalf.

173. Circulation of reports

It was proposed by Mr. Riley that sufficient copies be made of all reports prepared for circulation to permit submission of a special copy to the Secretary, which would insure that a draft of the report would be available for reference and for inclusion in the proceedings. The Meeting agreed that this should be done.

174. Election of a second secretary

Dr. Johnson drew attention to the possibility of his leaving his Subcommittee work within a few months, and suggested that a new Secretary be placed in office. Upon the Chairman's call for nominations, Dr. Johnson named Mr. Farrar (at the moment a non-member). Dr. Archibald proposed Mr. Farrar for membership. This was seconded by

Mr. Riley and carried. Mr. Farrar was then elected to the office of Secretary. Dr. Archibald suggested that Mr. Farrar and Dr. Johnson serve jointly in office pro tem. The Meeting agreed that this procedure should be followed until Dr. Johnson's departure.

The action of the Subcommittee in proposing Mr. Farrar for membership, and in subsequently electing him to the office of Secretary, will be submitted to the Associate Committee on Forestry for confirmation.

APPENDIX A

Progress Report for 1945

By L.P.V. Johnson

I-A-10 Selection and testing for prairie shelterbelts

A trip was made to the prairies during the fall in the interests of this work, and a complete report was given in Progress Report 17-18/45.

Briefly, the work undertaken on the trip consisted of the following:

1. Extension of selection work in the older prairie shelterbelts and in severe natural habitats. Emphasis was placed on selecting burr oak forms, and in this connection arrangements were made to test materials already growing in the provincial forest nursery at Oliver, Alberta.

2. Examination of Subcommittee materials already being tested on the prairies. Of the older hybrid poplars at Indian Head, Brooks-10 appeared most promising. It was considered premature to pass judgment on the one- and two-year-old poplars (which includes all poplars on test in southern Alberta). The ash hybrids were generally promising at Indian Head and in southern Alberta. Fraxinus Richardi X F. americana showed low vigour. F. lutea X F. pubescens was variable with some very good individuals in the population.

Green ash lines selected last year from the best of surviving trees in old prairie shelterbelts appeared, on the basis of first year seedlings, to fall into two growth-rate classes — one characterized by high-vigour, the other by low-vigour populations. Relating these growth rate classes to the habitats from which the lines were selected strongly indicates that the vigorous types come from habitats capable of supporting vigorous growth, and that the non-vigorous types come from habitats incapable of supporting vigorous growth. These non-vigorous forms are probably highly adapted to severe prairie conditions and, if the habitat cannot be improved to support the more vigorous type, we should follow the natural principle of balancing the organism and the environment by distributing these slow-growing forms to the more severe prairie regions.

3. A study of the question of whether or not available tree materials, facilities, etc. would justify the immediate employment of a full-time, resident breeder on the prairies. The answer was in the affirmative, but later developments made it unnecessary to go into the matter here.

I-B-1 Interspecific hybridization in forest tree genera

Fairly extensive cross pollinations were made, on a

cooperative basis, in spruce and pine at the Petawawa Forest Experiment Station and at the Dominion Arboretum. Details of this work have already been given in Progress Reports Nos. 9-10/45 and 11-12/45, and seed-set results from the spruce crosses were indicated in Dr. Heimburger's Quarterly Report for July-September, 1945.

Briefly, these cross pollinations represented: in spruce, 216 bags involving white (four strains), black, Norway and Serbian spruces; and in pine, 279 bags involving red, jack, Scotch, Austrian, Japanese and Russian pines.

Dr. Heimburger reported good seed sets from the work on spruce. Seed from the pines will be collected next fall.

Other hybridization activities included work in poplar, ash and elm, the most notable result being about a hundred seedlings of Populus berolinensis x Lombardy poplar.

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

The following report was published: Development of sexual and vegetative organs on detached forest tree branches cultured in the greenhouse. Forestry Chronicle 21: 130-136. 1945.

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

The following report has been prepared for publication: Further results on the viability of pine pollens after eight and twelve months of storage.

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

This work was continued in both greenhouse and nursery, emphasis being placed on systematic treatments to growing points of young seedling and cutting material grown in the nursery, especially for that purpose. The material included all nursery stock commonly distributed by the prairie Forest Nursery Stations and by the Ontario Forest Stations. It would be premature to discuss the effects of these treatments at this time.

In the older colchicine-treated materials (treated 2 to 4 years ago), which includes all conifers commonly grown in Canada, there is a wide variety of treatment effects ranging from dwarfing through variously distorted intermediate types to giant forms. The most striking effects are to be found in Abies grandis and in lodgepole pine.

Selections from non-hardy genera were sent to the Green Timbers Nursery, New Westminster, B. C.

I-E-1 Studies of reaction to blister rust of selected natural and artificial white pine materials

Observations on materials in the blister rust disease garden have been reported in Progress Report 19-20/45 and in Mr. Riley's Annual Report.

Among the older lines of white pine in the garden, disease reaction appears to vary from high susceptibility to complete resistance. Methods of further testing are being devised to provide conclusive data on lines and individuals withstanding the ordinary disease garden infection.

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

Two papers have been prepared which deal with this subject. The first, entitled "Reduced vigor, chlorophyll deficiency, and other effects of self-fertilization in Pinus" appeared in Can. J. Research, C, 23: 145-149. 1945; the second, entitled "Fertilization in Ulmus with special reference to hybridization procedure" will appear in the February, 1946, issue of the same journal.

I-Z-4 Chemical stimulation of seed germination

Two papers have been prepared on this subject, each having the title, "Effect of chemical treatments on the germination of forest tree seeds". The first appeared in Journal of Forestry, 43: 825. 1945; the second will appear in Forestry Chronicle early in 1946.

I-Z-5 Acid extraction and scarification of bass-wood seeds

A paper giving the final results of this work has been prepared under the following title, "A practical method of overcoming seed dormancy in Tilia americana L.". It is expected that the paper will be published shortly.

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

Analyses of data from these studies indicate difficulties in separating generic effects from environmental effects. Consequently, results have not been reported.

II-A-2 Inheritance studies

An experiment has been started with the object of obtaining further information on the inheritance of rooting capac-

ity in Populus. It involves rooting tests of cuttings of P. alba 36, P. grandidentata, P. tremuloides, and a number of hybrids between the former (good rooting capacity) and each of the two latter species (poor rooting capacities).

In another experiment the inheritance of growth vigour, form, and of leaf, bark, twig and bud characters is being studied in parental, F_1 and F_2 material of a P. alba x P. grandidentata cross. The F_2 population comprises 170 5-year-old trees.

II-B-1 Cytology of colchicine-treated materials

There is little new to report in this work except the publication of a report on the cytological technique, developed in the course of the investigation, as follows: A rapid squash technique for stem and root tips. Can. J. Research, C, 23: 127-130. 1945.

V-A-2 Testing hybrid poplars for Septoria canker reaction by artificial inoculation at the N.R.C. Annex nursery

A detailed report on this work has already been made in Progress Report 19-20/45.

This report, involving data from nine crosses comprising 256 trees, indicated that materials belonging to the balsam-cottonwood-black poplar taxonomic group were susceptible, while materials belonging to the aspen-white poplar group were relatively resistant. Obviously, intercrossing between materials in these groups should provide valuable new forms.

G-1 Physiological studies on the sugar maple

This work has been completed and the results have been published as follows: Physiological studies on sap flow in the sugar maple, Acer saccharum Marsh. Can. J. Research, C, 23: 192-197. 1945.

Note: It has been customary to include in the Annual Report outlines of new experiments and of proposed activities for the coming outdoor season. These outlines are omitted from the present report because of the indefinite future of the work concerned.

APPENDIX B

Report on Work in Nurseries and Test Plantations, Petawawa Forest Experiment Station, 1945

By C. Heimburger

Introduction

The working conditions at this Station were about the same in 1945 as in 1944. No regular labour was again available for nursery work and conscientious objectors were used for this. One worker had been employed since 1943 and was promoted to straw-boss, while two other workers were inexperienced to begin with but later proved quite satisfactory. As in 1944, it was easier to obtain support for physical improvement of the nursery than for research work. A student assistant was employed for seasonal work during the summer and his time was largely allotted to vegetative propagation, assistance in surveying of test plantations and, later in the summer, to seed collection, extraction and cleaning.

The summer of 1945 was abnormal in several respects. An extremely early spring was followed by very cool and wet weather in May which was favourable for planting. June and early July were also abnormally cool and moist. An extremely dry period in early August caused some abnormal mortality in new test plantations and necessitated heavy watering of the nurseries. The fall was rather late and favourable for poplar propagation and other nursery work.

General Nursery Work

The existing working conditions were utilized in setting up a small greenhouse, in excavating all remaining propagation beds and supplying them with a sawdust sponge, and in thorough removal of stones from a new compartment in nursery No. 1 which was levelled with a bulldozer and received a heavy application of sawdust.

The ditch separating the east side of the nursery No. 1 from the road leading to the lake was completed, as was the tool shed near nursery No. 1. A lane was cut through the alder thicket separating nursery No. 2 from the lake, and a platform for setting up a fire pump was erected on the shore at the end of the lane. Watering of nursery No. 2 by means of a fire pump and hose is now greatly facilitated during periods of dry weather when this is necessary.

Maintenance of Plantations

The good results with an electric fence around plantation No. 52 were repeated in 1945. Some of the posts in the fence were replaced and a new electric battery was installed for the summer of 1945.

Plantations: 52-poplar test plantation on Thomas Field, 55-poplar plantation in arboretum, 56-pine plantation in arboretum, 57-black spruce plantation in arboretum, and 59-Norway spruce test plantation in Thomas Field were cleaned by cutting tall grass and shrubs competing with the planted stock.

Plantations: 51-poplar disease garden on Woermke Field, 52-poplar test plantation on Thomas Field, 53-white pine test plantation east of nursery No. 2, 55-poplar plantation in arboretum, 58-poplar arboretum plantation east of nursery No. 2, and 59-Norway spruce test plantation on Thomas Field, were extended by planting of additional stock in the spring of 1945.

Two new plantations:- 60-hard pine plantation near Montgomery Lake and 61-poplar test plantation on Thomas Field, were established on sites prepared in 1944.

Project 50 Vegetative Propagation

The following experiments are active at present:

54:2, 1937 - Development of plants from stem cuttings of Norway spruce, Black spruce and Colorado spruce.

Material is in the nursery and Norway spruce has been used for cutting production and trimmed back this year. Colorado spruce are now straightening up very well and promise to grow into more or less normal trees.

50:4-41, 1941 - Development of plants from stem cutting of white pine.

The rooted cuttings have been set out in test plantation No. 53 in the spring of 1945. During planting it was observed that the root system of the cuttings is somewhat abnormal in that a regular tap root is lacking. The plants were set deeper in the ground than ordinary seedling stock of the same size, as they tended to be somewhat top-heavy. Apart from some mortality caused by the severe drought in the summer of 1945, development of this material does not differ from that of ordinary seedling stock.

50:5-41, 1941 - Development of plants from stem cuttings of white spruce.

The plants are still in the nursery, in all respects yielding results similar to 54:2, 1937.

50:4-42, 1942 - Physical and biological properties of various propagation media.

No new analyses have been made in 1945.

The following older experiments were terminated in 1945:

50:4-43 - Rooting of semi-lignified, hormone treated cuttings of several softwood species in hot bed and cold frame in sand and peat mixtures.

White spruce, Lodgepole pine and Douglas fir showed slight response to hormone treatment of cuttings; Colorado spruce and Norway spruce rooted fairly well without hormone treatment; Picea asperata, black spruce and red spruce gave inconclusive results, while white pine, Scotch pine and red pine did not root.

50:1-44 - Vernalization of cuttings of Populus alba x grandidentata in the laboratory with subsequent treatment with hormone solutions.

Vernalization and vacuum application proved harmful to the cuttings. Hormone application counteracts the harmful effects of vernalization and application of vacuum in increasing the rooting capacity of cuttings so treated. Cuttings collected in early spring with buds swelling showed poorer rooting than winter-collected cuttings in the laboratory.

The following experiments were started and terminated during 1945:

50:1-45 - Rooting of early semi-lignified cuttings of hardwoods in beds covered with cellophane and lath-cloth screens and surrounded with lath screens, treated with hormones.

White birch, yellow birch, white ash, trembling aspen and largetooth aspen did not root. Basswood responded to IB in talc in sand and in sand-peat. Caragana arborescens responded to applications of IB in talc when planted in coarse sand but not in sand-peat. Populus alba x grandidentata (bulk collection) responded moderately to applications of Na-phenyl stearate and Na-xylyl stearate in talc but not to IB in talc when planted in coarse sand.

50:2-45 - Rooting of early semi-lignified cuttings of softwoods in beds covered with cellophane and lath-cloth screens and surrounded with lath screens, treated with hormones.

Variable survival of cuttings depending on position in bed, media and time of planting. No rooting in red spruce, white pine, Scotch pine, red pine, tamarack. Good response of early plantings of black spruce in sand to

sebacic acid in charcoal; moderate response to sebacic and traumatic acids in talc. Moderate response of early planted white spruce and Norway spruce to sebacic and traumatic acids in talc and charcoal. Results as a whole inferior to those of experiment 50:4-43 probably because bottom heat was lacking.

50:3-45 - Greenhouse propagation of semi-lignified cuttings of white pine and Populus alba x grandidentata planted in sand and treated with hormones.

The poplars showed moderate response to all soaps in doubling rooting as compared with controls. White pine showed moderate response of early collection to sebacic acid in charcoal - the only rooted cutting was so treated.

Project 51 - Methods of Raising Nursery Stock

(1) Poplars - Material of the cottonwood and balsam poplar group was propagated according to methods worked out previously and with good results. As stump planting of poplars in the spring of 1945 gave good results, all poplar material for setting out in 1946 was lifted in the fall of 1945 and the tops cut off and used for cutting production of desirable clones while the roots were buried for the winter.

The results of spring planting of aspen hybrid cuttings stored upside down during last winter were inferior to those obtained in 1944, probably because the planting was done too late and the spring was abnormal.

The cuttings of aspen hybrids were again prepared in the fall of 1945 and stored upside down in a shaded place in nursery No. 2 to avoid too early sprouting in the spring of 1946, if possible, and thus to ensure better results in spring planting.

(2) Conifers - The results of fall transplanting of larch and of transplanting of stored seedlings and rooted cuttings in the spring were quite promising.

Fall transplanting of spruce again resulted in heavy frost heaving during the following winter in spite of protection by sowing oats between the rows in the fall. Frost heaving was especially severe in Nursery No. 1 with its moister soil.

In the fall of 1945 all stock for transplanting and setting out was lifted and heeled in, either in seed beds under protection of lath screens or in a shaded place in nursery No. 2 and covered with balsam fir branches for protection.

An experiment in early fall transplanting of larch seedlings was started. The seedlings were transplanted in early September when they were in full leaf so as to make the use of the Yale transplant board possible. Later, in October, they lost their leaves and were hilled for the winter.

(3) Other Hardwoods - The results of fall transplanting of white birch and related species were not as good as those with white ash and basswood species.

Fall-lifted Caragana survived the winter very well and was suitable for spring planting.

In the fall of 1945 all seedlings of white birch and related species were lifted and heeled-in for the winter, for spring transplanting.

All yellow birch and related species were left in the nurseries for spring lifting and transplanting.

Caragana was again lifted and heeled-in for the winter in the fall of 1945, following the good results with this method of last year.

(4) Soil Treatment - No new methods were tried in 1945.

Spring-sown hairy vetch in the seed beds of nursery No. 1 was inferior to fall-sown hairy vetch.

Sand and soil were applied to some older seed beds when vacated by fall-lifting of seedlings, to improve their drainage.

Sawdust application, together with treatment with superphosphate and potash in the fall, followed by fall sowing of hairy vetch is now the standard procedure in most of the empty compartments and seed beds.

Project 52 - Strain Testing of Spruce

The following lots were set out in test plantations in the spring of 1945:

Lot	192	Picea Excelsa, Vilppula, Finland,	30	to plantation	59
"	195	Picea excelsa, France,	237	" "	"
"	196	Picea excelsa, Poland,	164	" "	"
"	199	Picea excelsa, Smaland, Sweden,	152	" "	"
"	204	Picea excelsa, Inntrondelag, Norway	150	" "	"
"	205	Picea excelsa, No. 1, Roumania,	452	" "	"
"	207	Picea excelsa, U.S.S.R.,	255	" "	"
"	209	Picea glauca, Notakim depot P. Q.	98	" "	53
"	228	Picea rubra, Berthierville, P. Q.	1358	" "	59

All available cuttings were collected from the selected seed tree SN-15 in plantation No. 8, as well as from rooted cuttings of the same clone in nursery-No. 1 and planted in a propagation bed, in the fall of 1945.

The following seed lots were sown in nursery No. 1 in the fall of 1945:

Lot 466 Picea asperata, Indian Head, Sask.
" 467 Picea glauca, Petawawa F.E.S.
" 473 Picea excelsa, Petawawa F.E.S. plantation No. 8.
" 480 Picea excelsa, Indian Head, Sask.
" 482 Picea mariana x Omorika F1, harvested in 1944 and stored.

All seeds resulting from spruce hybridization in the spring of 1945 as reported under Project 86 were sown.

Project 53 - Strain Testing of Hard Pines

A very large number of pine transplants were set out in the test plantations in the spring of 1945. They were the following:

Lot	176	Pinus	silvestris, Rovaniemi, Finland,	460	to plantation	43
"	177	"	silvestris, Vindeln, Sweden,	65	" "	43
"	238	"	banksiana, Petawawa FES, Racehorse	740	to "	60
"	239	"	contorta, Comox B.C.	1830	" "	60
"	240	"	banksiana, Notakim Depot P.Q.	1060	" "	60
"	241	"	contorta, Fraser River delta B.C.	620	" "	60
"	242	"	banksiana, Petawawa FES Highview	900	" "	60
"	243	"	contorta latifolia, Kananasksis FES	6210	to "	60
"	244	"	nigra, Hungary,	1957	" "	60
"	245	"	densiflora, Korea,	622	" "	60
"	246	"	banksiana, Massey, Ont.	364	" "	60
"	258	"	contorta latifolia Kitwanga, B.C.	90	" "	60
"	261a	"	contorta latifolia, Shuswap lakes, B.C.	1378	"	60
"	261b	"	contorta latifolia, Shuswap lakes, B.C.	2522	"	60
"	262a	"	silvestris, Riga, Latvia,	1135	to "	60
"	262b	"	silvestris, Riga, Latvia,	3890	" "	60

The material showed very good survival and growth during early summer. Later, especially during the dry period experienced in August, some mortality was evident.

Project 54 - Strain Testing of Soft Pines

A number of white pine strains were set out in test plantation No. 53 in the spring of 1945, these are as follows:

Lot 225 Pinus Strobus, Notakim Depot, P. Q. 536 to plantation 53
" - " Strobus, rooted cuttings, Petawawa FES all available to plantation 53

Lot 251 Pinus Strobus, Petawawa FES, Barron River No. 4, 1 to plantation 53
" 252 " Strobus, Petawawa FES, Barron River No. 6, 26 to plantation 53
" 256 " Strobus, Petawawa FES, Barron River No. 12, 20 to plantation 53
" 257 " Strobus, Petawawa FES, Barron River No. 9, 6 to plantation 53

A large part of plantation 53 was also interplanted with seedlings of Ribes Cynosbati, for testing the resistance of the material to blister-rust under plantation conditions.

In October, all available cuttings were collected for routine propagation of desirable material. This was as follows:

Lot 26 Pinus Armandi, Mts. of W. China.
" 55 " excelsa, Punjab.
" 64 " parviflora, Japan.
" 68 " Peuce x Strobus Fl., Central Expt. Farm, Ottawa.
" 89 " Strobus, Central Exp. Farm, Ottawa.
" 144 " monticola, Salmon Arm. B. C.
" 278 " Strobus, Pointe Platon, P. Q.

In the spring, lots 26, 55, 64 and 68 growing in nursery No. 2 were interplanted with ordinary white pine stock set close to the plants in the nursery rows, for future inarching.

Project 55 - Strain Testing of Douglas Fir

No new work has been undertaken in this project as no new material could be obtained.

Strain No. 67, from Kananaskis FES was severely culled in the spring and all plants subject to late frost damage were discarded. In the fall, all available cuttings were collected from the selected plants of this strain and planted in one of the propagation beds.

The entire Shuswap lake material was discarded as none of it proved sufficiently hardy during the winter of 1944-45.

All the plants of lot No. 223, Prince George, B.C. were also discarded as not being fully hardy.

Material from a much wider variety of localities is needed for a better evaluation of this species here and to provide raw material for selection and vegetative propagation.

Project 56 - Strain Testing of Larch

Most of the abundant larch material sown in the fall of 1944 showed very good germination in the spring of 1945. In the fall of 1945 all the strains containing a sufficient number of large plants for transplanting were lifted and heeled-in for winter in a protected seed bed.

Experimental fall transplanting was tried with a small number of hybrid larch seedlings of the same age.

The good seed crop of native tamarack at the Station was utilized for a fairly large collection.

Part of the seeds was sown to serve as a check for comparison with exotic larch material and a part was used for exchange purposes.

Project 57 - Strain Testing of Birch

In 1945 a number of seed lots of Betula verrucosa from different localities and collected from selected trees in Sweden, was obtained through the Imperial Forestry Bureau. One small portion was sown in the spring of 1945, without stratification, and germinated promptly. The rest was stored until the fall and sown in early November, 1945, in the regular manner. It comprised the following strains:

Lot	463	Betula	verrucosa, Ovanaker, Gästrikland, Sweden
"	464	"	dahurica, Dropmore, Man.
"	465	"	verrucosa, Ostavall, Sweden
"	468	"	verrucosa, Torsaker, Gästrikland, Sweden
"	469	"	verrucosa, Strombacka, Hälsingland, Sweden
"	470	"	verrucosa, Gunnarskappar, Värmland, Sweden
"	471	"	verrucosa, Uppland, Sweden
"	502	"	pubescens x papyrifers Fl. Petawawa, FES

Seeds of native paper birch were collected at the Station and obtained from several other localities in Canada, cleaned and forwarded to Imperial Forestry Bureau in exchange for the seeds received from Sweden. Another collection of native birch seeds was forwarded to the Ukraine.

Project 58 - Strain Testing of Poplars

Seeds resulting from two artificial crosses were sown in the early summer of 1945, namely lot 459-P. tacamahacca Calgary 99 x tristis 1, Fl and lot 460-P. acuminata 2 x tristis 1, Fl.

An experiment was made in collecting F2 seeds of a P. alba x grandidentata hybrid at Petawawa and separating the

seeds from the fluff in a washing machine. It was possible to separate the seeds but no germination was obtained.

Cuttings of the following aspen hybrids were planted in the spring of 1945 after upside down storage during the previous winter:

Lot	A 11 (alba)	C 8
"	A 44	C x AG (population)
"	A 25 x G (alba x grandidentata)	CG 1 (canescens x grandidentata)
"	A 35 x G	CG 6
"	AG 10 (alba x grandidentata)	CG 8
"	AG 12	CG 12
"	AG 35-5 (F2)	CG 16
"	AG 33-17 (F2)	CG 17
"	AG 33-19 (F2)	CG 27
"	AG 44	CG 28
"	AG 73	CG 30
"	AG 92	CW (canescens x tremuloides, West)
"	AG 112	GC 1 (grandidentata x canescens)
"	AG 114	GC 2
"	AG 115	GC 3
"	AG Arnprior (population)	GC 4
"	AG Aylmer road (population)	GC 9
"	AG Masson (population	GC 10
"	AG x AT (AG x (alba x tremuloides))	GC 11
"	AGE (AG x Eugenei)	grandidentata, native
"	AGW (AG x tremuloides, western)	Tremula 2 (triploid)
"	C1 (canescens)	tremuloides, native

The rooting of the cuttings was far inferior to that obtained in 1944, partly because of the abnormal weather experienced during planting time and partly because the cuttings were too far advanced vegetatively at that time. This latter factor can be guarded against by deeper storage of cuttings in a shaded locality so as to retard their spring development before planting.

In 1944 the cuttings were precallused by placing them upside down in a seed bed, while in 1945 no precallusing was resorted to. This also may be a factor influencing rooting and subsequent survival of cuttings of this kind.

The following poplar material was planted in the arboretum:

Lot	acuminata 1	Maximoviczii 4
"	AcE 11 (acuminata x Eugenei)	Maximoviczii 5
"	Andrewsii 1 (acuminata x deltoides)	OP 38

Lot Brooks 4
" Brooks 10
" DT (deltoides x tremuloides)
" Jackii 2
" Maximoviczii 1
" Maximoviczii 3
OP 45
sp. 6709-39
sp. 6710-39
szechuanica 1
trichocarpa 11

The poplar disease garden was extended in 1945 by planting some additional rows with the following poplar varieties:

Lot berolinensis 1
" BNW 1 (berolinensis x Northwest)
" BNW 4
" BNW 11
" BNW 15
" BNW 16
" BNW 17
" BNW 18
" BNW 22
" BNW 23
" BIG Brooks (berolinensis from Brooks, Alta.)
" koreana 9
" RT 4 (lasumowskyana x tacamahacca)
" RT 5
" RT 6
RT 8
Rt 10
Rt 20
Rt 25
Rt 32
Rt 33
Rt 46
Rt 47
Rt 52
trt 1 (trichocarpa x tacamahacca)
trt 2
trt 3
trt 4
trt 5
trt 6
trt 7

Poplar test plantation No. 52 was also extended considerably by interplanting fail places in rows and by planting new rows. Most of the plants were pruned down to the stump before planting, which proved superior to the planting of rooted cuttings with their tops largely intact, in reducing mortality after planting. The following poplar varieties were set out in this manner in the plantation:

Lot angulata erecta
" Calgary 23
" D 1 (deltoides)
" D 2
" D 5
" D 7
" D 483
" D 484
" Carolina 1 (angulata robusta)
" gelrica
" Generosa
" Jackii 2
" Jackii 3

Lot Jackii 9
" koreana 5, and 6
" Masson
" Maximoviczii 2
" N 8 (nigra)
" Northwest
" OP-38
" Rasumowskyana
" Raverdeau
" vernirubens
" 22-11

A new poplar test plantation No. 61 was established on an old field on good but rocky soil from which the sod had been removed in 1944 for use at the military camp. Furrows were then ploughed and the poplars planted by stump-planting of the following varieties:

Lot berolinensis 1
" Jackii 2
" Northwest
" OP-45
" vernirubens

During the summer of 1945 a number of poplar clones were examined cytologically by Dr. Landes of the Division of Botany and Plant Pathology at the Central Experimental Farm.

Fresh root tips were obtained by the buried glass plate method, fixed, preserved in 70% alcohol and forwarded to Ottawa in this condition. The results were as follows:

Lot Calgary 1 2n-38
" Calgary 23 2n-38
" Calgary 91 2n-38
" Calgary 92 2n-38
" Calgary 94 2n-38
" Calgary 95 2n-38
" Calgary 96 2n-38

Lot Calgary 99 2n-38
" Calgary 108 2n-38
" Calgary 109 2n-38
" Calgary 120 2n-38
" Calgary 121 2n-38
" Sutherland 4 2n-38
" Salix nigra (amygdaloides) Dropmore, Man. 2n-38

It is thus evident that none of the Calgary poplars are triploids or higher polyploids as has been suspected. The native black willow of Manitoba is diploid, and not tetraploid as most European tree willows.

The results of the current examination of rust infection and tests for canker have already been presented in a report by Mr. Riley and Dr. Skolko. In the fall of 1945 cuttings were prepared of a number of new cottonwood and balsam poplar hybrids, P. alba material and second-generation P. alba x aspen hybrids and planted by the usual vertical hilled cutting method. The varieties so planted are the following:

Lot aS 1 (angulata x Simonii)
" aS 2
" aS 3
" aS 4
" aS 5
" aS 6
" aS 7
" aS 8
" aS 9

Lot BL 1 (berolinensis x Lombardy)
" BL 2
" BL 3
" BL 4
" BL 5
" BL 6
" BL 7

Lot BS 1 (berolinensis x Simonii)	Lot A 39
" BS 2	" A 40
" BS 3	" A 42
" BS 4	" A 43
" BS 5	" A 49
" BS 6	" AG 33-5 (alba x grandidentata F2)
" BS 7	" AG 13-17
" Jt 1 (Jackii x tristis)	" AG 33-19
" Jt 3	" AGAT (AG x (alba x tremuloides))
" Jt 4	" AGAT 2
" A 10 (P. alba)	" CAG 1 (canescens x AG)
" A 17	" CAG 2
" A 18	" CAG 3
" A 20	" CAG 4
" A 21	" CAG 5
" A 22	" CAG 6
" A 29	" CAG 7
" A 34	" CAG 8
" A 36	
" A 37	
" A 38	

Cuttings of various aspen hybrids were again prepared and stored upside down for the winter in a shaded locality in nursery No. 2 for early spring planting.

A number of cuttings were distributed to nurseries in the Prairies and of the Ontario Department of Lands and Forests.

Project 59 - Strain Testing of Miscellaneous Species

The Abies grandis from Courtenay B.C. again suffered heavy frost damage during the winter of 1944-45 and was culled heavily during transplanting in the spring. Another strain of Abies grandis from an unknown source in the U.S. was much hardier, however. All the other Abies material has thus far been fully hardy here and Abies Nordmanniana promises to be of value.

The Acer glabrum from B.C. did not grow very well in the dry soil of nursery No. 2 in 1944 and consequently the best plants of this strain were moved to nursery No. 1 after some culling.

The seedlings of Alnus glutinosa showed very good growth but rather poor lignification in the fall of 1945. They were left in the seed bed without protection for this winter and heavy culling of the damaged material during next spring at time of transplanting is expected.

Fraxinus manshurica continued to show very good development and full hardiness in the nursery but is not drought resistant in test plantations.

Of Libocedrus decurrens there are now only two seedlings at hand after very poor germination and great mortality of the original seed lots. All available cuttings were collected from these two plants in the fall of 1945 and planted in one of the propagation beds.

Quercus acutissima and Q. serrata from Korea again were not hardy last winter, froze down to the ground but sprouted vigorously during the summer. As lignification again was very poor in the fall of 1945 they were dug up and shipped to the Green Timbers Forestry Station in B.C. where they may have a chance to grow into something better than at this Station.

Tsuga Mertensiana from the Coast Range in B.C. is still quite hardy but of very slow growth. The material was transplanted in the spring of 1945 and culled lightly. It is doubtful if this species will be of any but decorative value in eastern Canada.

Seedlings of several Tilia species were transplanted from the seed beds in the spring of 1945. Of these, Tilia tomentosa was not quite hardy and required heavy culling, while those of T. amurensis and T. manshurica were fully hardy.

Seedlings raised from seeds of several European species grown at the Central Experimental Farm also were quite hardy and required but very slight culling at time of transplanting.

One set of seedlings representing the progeny of a cutleaf linden, showed a wide variety of leaf shapes including some maple-leaved specimens.

In the fall of 1945 the following strains of miscellaneous species were sown:

Lot 472 Alnus sinuata, Kananaskis F.E.S.
" 486 Abies sibirica, Indian Head, Sask.
" 501 Thuja occidentalis, Pembroke, Ont.

Project 60 - Vermin Control

The strychnine treatment of all seed beds and propagation beds in the fall of 1944 was quite successful in protecting the material there against damage by mice of the genus Peromyscus. Burrowing mice (probably Microtus) were not controlled by this method in the propagation beds, however, and did considerable damage to rooted cuttings.

The electric fence around plantation 52 was again in operation during the summer of 1945 and very effectively pro-

tected this plantation against browsing by deer.

In the fall of 1945 all seed beds and propagation beds were again treated with poisoned oatmeal as a protection against mice.

No effective method against burrowing mice, except trapping, has as yet been found.

No cutworm damage to poplars in nursery No. 2 was again experienced, in marked contrast to previous years.

A leafhopper of some kind caused some curly leaf in birches in the seed beds but the damage was not serious and subsided towards fall without control measures.

Project 61 - Planting Technique

The plantation No. 60 was established near Montgomery Lake by planting in prepared spots with planting spades. Survival was very good in the spring because of favourable weather; later in the summer there was some mortality caused by drought.

The poplar plantation No. 61, established by stump-planting in ploughed furrows with planting spades in rich but stony ground, was very successful. Results were superior to similar planting of rooted cuttings with their tops intact.

The plantation No. 55 in the arboretum was supplemented by re-planting some fail places. The sod was removed from relatively large spots before planting. The results were fair but grass was still a serious factor competing with the planted material.

Project 86 - Hybridization

The following crosses were made:

Populus tacamahacca Calgary 99 x tristis 1, successful
Populus acuminata 2 x tristis 1, successful
Pinus Strobus x monticola
seeds were collected from the natural cross Betula pubescens x papyrifera.

In co-operation with the National Research Council the following crosses involving hard pines were made:

Red pine crosses:	
Pr-5 x PJ-4 (Jack pine)	20 bags
x PJ-1	20 bags

Pr-1 x Pn-1 (Austrian p.)	27 bags
x Pn-2	28 bags
Pr-4 x Psp-1 (No. 1774:P.Thunbergii)	34 bags
x Psp-2 (P.Thunbergii)	21 bags

Scotch pine crosses:

PS-1 x Psp-1 (No. 1774:P.Thunbergii)	11 bags
PS-16 x Pn-2 (Austrian P.)	20 bags
x Pn-1	5 bags
PS-17 x Pr-4 (Red P.)	6 bags
x Pr-2	6 bags
PS-19 x Pn-2	19 bags
x Pn-1	6 bags

Crosses using native white spruce as female parent:

Sw-1 x Sw-17 (New Brunswick white spruce)	7 bags 26 cones harvested
x Sw-20 (planted Ont. white spruce)	6 bags 55 cones harvested
x Sw-18 (New Brunswick white spruce)	2 bags 53 cones harvested
Sw-5 x Sb-2 (black spruce)	15 bags 0 cones harvested
Sw-6 x Sb-2	4 bags 9 cones harvested
Sw-7 x Picea Omorika, C.E.F.	9 bags 21 cones harvested
Sw-15 selfed	5 bags 36 cones harvested
x Sb-2	5 bags 59 cones harvested
x SN-8 (Norway spruce)	5 bags 55 cones harvested
x Sw-18	5 bags 14 cones harvested
x Sw-23 (planted Ont. white spruce)	5 bags 56 cones harvested

Crosses using planted Ontario white spruce as female parent:

Sw-20 x SN-8	15 bags 170 cones harvested
Sw-21 x SN-8	8 bags 123 cones harvested
Sw-22 x SN-8	14 bags 0 cones harvested
Sw-23 x Sb-2	14 bags 15 cones harvested
Sw-24 x Sb-2	14 bags 188 cones harvested
Sw-25 x Sb-2	5 bags 257 cones harvested

Crosses using planted Ontario white spruce as female parent:

Sw-25 x SN-8	6 bags	273 cones harvested
x Sw-15	9 bags	32 cones "
x Sw-18	9 bags	131 cones "
x Sw-20	4 bags	34 cones "

Crosses using planted New Brunswick white spruce as female parent:

Sw-17 x self	2 bags	0 cones harvested
x Sb-2	5 bags	0 cones "
x Sw-15	10 bags	2 cones "
x Sw-18	2 bags	1 cone (no seeds) harvested
x Sw-20	6 bags	0 cones harvested
Sw-18 x Sb-2	7 bags	1 cone "
Sw-19 x SN-8	5 bags	1 cone "

Crosses using planted Norway spruce as female parent:

SN-8 x Sb-2	7 bags	0 cones harvested
x Sw-15	5 bags	0 cones "
x Sw-18	10 bags	2 cones "
SN-9 x Sb-2	6 bags	4 cones "
SN-14 x Sw-26 (planted western white spruce)	18 bags	0 cones harvested

Project Plans for 1946 in Forest Tree Breeding and Propagation

The following plans are based on the assumption that it will be possible for the Dominion Forest Service to assign a qualified person to take charge of all the current projects in this field at the Petawawa Forest Experiment Station, to co-operate with the National Research Council and the Dominion Department of Agriculture and to keep the material more or less on a maintenance basis during the coming year. If additional experience is gained and competence in carrying out original research is at hand, it should be possible, starting with 1947, to expand the program in several projects and to re-organize other projects in line with the requirements of the Dominion Forest Service and other co-operating agencies at that time. Less detailed project plans based on lower spoon feeding intensity should then be possible and desirable. The experiments and other phases of each project are listed in descending order of importance unless stated otherwise.

General Nursery Work

Maintenance of all nursery stock in a weeded and orderly labelled condition.

Maintenance of all seed beds in the best possible condition with the available screening and watering facilities.

Care of empty compartments by growing soiling crops.
Maintenance of ditches, fences and tool sheds in good condition.
Cutting grass in and around nursery No. 1 and on roads in nursery No. 2.
Preparation of plans of distribution of nursery stock in all compartments in both nurseries.

If excess labour is available or it is desirable to expand nursery No. 1, there is room for much additional work in preparation of new ground aiming at the establishment of a new compartment to the south of the seed beds in nursery No. 1.

Maintenance of Plantations

The maintenance of test plantations, especially of those established recently, is at present, one of the most important problems at the Petawawa Station. It is essential that plantations consisting of material obtained with difficulty and subjected to rigid selection in the nurseries before setting out, be maintained in a satisfactory condition, as they represent the most valuable and tangible result of work carried out through

many years. It has thus far not been possible to carry out this project in a fully satisfactory manner, chiefly because of abnormal working conditions during the war period. As these improve, efforts should be directed towards maintenance of stock already produced rather than towards the production of new stock. The following is a list of test plantations requiring immediate attention in the form of weeding and cleaning: (not listed in order of importance) -

No. 39 - Scotch pine, Jack pine and red pine at Crooked Rapid Plains
No. 43 - Scotch pine and other hard pines west of Racehorse Camp
No. 46 - Poplars, white pine and white spruce, west of Bransted Road
No. 50 - Poplars west of Bransted Road
No. 51 - Poplar disease garden, Woermke Field
No. 53 - White pine test plantation, east of Nursery No. 2
No. 58 - Spruce and poplar test plantation, east of Nursery No. 2
No. 61 - Poplar test plantation, Thomas Field.

If time and labour are available, light thinnings in the following plantations could be made to advantage: (not listed in order of importance) -

No. 1 - Scotch pine in arboretum
No. 3 - New Brunswick white spruce in arboretum
No. 8 - Red spruce and Norwary spruce in arboretum
No. 36 - Western white spruce in arboretum

The electric fence should be maintained in working order throughout the summer around plantation No. 52, on Thomas field and a new electric fence may be necessary around plantation No. 61, on Thomas field also.

Project 50 - Vegetative propagation

Maintenance of stock in nursery No. 2 and plantation No. 53 pertaining to active experiments 54:2, 50:4-41, 50:5-41.

Maintenance of all propagation beds by weeding, cutting grass and proper screening of material planted there in the late summer and fall of 1945. Utilization of present greenhouse facilities in starting several short-term experiments in the rooting of semi-lignified cuttings of the more important softwood and hardwood species with the aid of growth hormones and other substances beneficial to root formation in stem cuttings.

Utilization of present propagation bed facilities in starting several short-term experiments in rooting of dormant cuttings of the more important softwood and hardwood species with the aid of growth hormones and other substances beneficial to root formation, by early spring planting. Application of recently gained screening experience to this material. Greenhouse planting may be tried also if time and labour permit this. An experiment with the late fall collection and heeling-in of conifer cuttings may be started. The cuttings should, if possible, survive the winter in a satisfactory condition and be treated with growth hormones and other substances previous to early spring planting in the propagation beds and greenhouse. A similar experiment including upside down storage of cuttings of larch and several hardwood species may be started also.

Experiments in grafting by inarching and the use of growth promoting substances in young plantations of pine and spruce throughout the summer, including early spring before the start of new growth and several stages of lignification during late summer and early fall.

Project 51 - Methods of Raising Nursery Stock

(1) Poplars

Continuation of experiment in upside-down winter storage of cuttings of the aspen hybrid group with subsequent spring planting and various treatments in connection with this. Early fall planting of hormone-treated cuttings of this group, in combination with wetting agents.

(2) Conifers

Follow-up of experiment in early fall transplanting of larch seedlings with subsequent hilling.

Experiments in raising of red pine and white pine by sowing in drills in combination with various cover crops in suitable compartments of nursery No. 2.

(3) Other Hardwoods

Experiments in propagation of Phellodendron from root cuttings.

Application of results obtained in propagation of basswood from stem cuttings. Application of results obtained with cuttings of aspen hybrid poplars to elm, Caragana, birch, ash, maple, oak.

(4) Soil Treatment

Continued search for an annual upright legume species suitable for use as soiling crop in soil of nursery No. 2, and also of possible use as cover crop for protecting conifer seedlings sown directly in drills, without seed beds. Experiments with crimson clover, annual sweet clover, Dalea alopecuroides, if obtainable.

Project 52 - Strain testing of Spruce

Transplanting of all seedling and cutting lots lifted and heeled-in for this purpose in the fall of 1945. Setting out in test plantation No. 59 of all transplant stock lifted and heeled-in for this purpose in the fall of 1945.

Continued observations on winter hardiness, drought resistance and growth performance of material in nurseries and test plantations. Culling of stock deficient in these respects at appropriate stages. Routine vegetative propagation of desirable spruce clones.

Continued acquisition of new spruce material in form of seeds, cuttings and nursery stock in so far as conditions permit.

Project 53 - Strain testing of hard pines

Transplanting of all seedling lots lifted and heeled-in for this purpose in the fall of 1945 as well as setting out of transplant stock in test plantations No. 43 and No. 60. Supplementing of test plantation No. 60 with stock of red pine and white pine to be obtained from the Ontario Department of Lands and Forests. Acquisition of new strains of red pine, Jack pine, lodgepole pine and Scotch pine for further tests.

Project 54 - Strain testing of soft pines

Transplanting of all seedling and cutting lots lifted and heeled-in for this purpose in the fall of 1945, as well as setting out of transplant stock in test plantation No. 53. Grafting of all white pine and other material prepared for this in nursery No. 2 by inarching in early spring. Setting out of Ribes Cynosbati heeled-in for this purpose in plantation No. 53 to supplement earlier plantings. Establishment of a block of Ribes Cynosbati for seed production purposes in nursery No. 2. Acquisition of new strains of white pine for further tests - 1946 should be a good seed year for white pine at the Petawawa Station and possibly elsewhere.

Continued observation on winter hardiness, disease and drought resistance and growth performance of white pine and related stock in nurseries and test plantations and culling of stock deficient in these respects at appropriate stages. Routine vegetative propagation of desirable clones of white pine and related species.

Project 55 - Strain testing of Douglas Fir

Maintenance of rooting cuttings and of transplant stock in nursery No. 2. Culling of material deficient in late spring frost resistance and of poor growth performance. Routine propagation of desirable populations and clones. Acquisition of new material for testing as soon as such becomes available.

Project 56 - Strain testing of Larch

Transplanting of all seedling stock lifted and heeled-in for this purpose in the fall of 1945. Setting out of older plants from nursery No. 2 into plantation No. 56 by filling in fail spaces with available larch material. Construction of porcupine-proof fences around definitely established plants in this plantation in early fall of 1946.

Project 57 - Strain testing of Birch

Transplanting of material lifted and heeled-in for this purpose in the fall of 1945. Lifting and transplanting of yellow birch and related species from seed beds into suitable compartments in nursery No. 1. Acquisition of new birch material for further tests.

Project 58 - Strain testing of Poplars

Continued maintenance of poplar material in nurseries and observations on rust, dieback and canker in co-operation with the pathologists. Transplanting of hybrid seedlings from seed beds into nursery No. 2 when suitable size has been reached. Transfer of all lifted and heeled-in stock to arboretum and test plantations. Notes on rooting capacity of aspen hybrid and P. alba cuttings planted for this purpose in the fall of 1945. Distribution of cuttings of suitable varieties to the Prairie nurseries and elsewhere in the fall of 1946. Routine propagation of clones found especially desirable for tests on a larger scale in test plantations.

Acquisition of new poplar material as post-war conditions become more normal in various parts of the world.

Project 59 - Strain testing of Miscellaneous Species

Transplanting of seedlings of various Abies species

lifted and heeled-in for this purpose in the fall of 1945. Transplanting of seedlings of Alnus glutinosa after appropriate culling for lack of winter hardiness. Maintenance of rooting cuttings of Libocedrus and of seedling stock of Tsuga, Tilia and Thuia. Continued observation of disease resistance, winter hardiness and growth performance of stock of Phellodendron, Ash, Basswood, and Alder on hand.

Project 60 - Vermin control

Continued strychnin treatment of seed beds and propagation beds as protection against mice. Experiments in controlling burrowing mice in the propagation beds. Maintenance of electric fence around plantations No. 52 and No. 61. Control of fleabettles, leafhoppers, cutworms and other insects in consultation with entomologists if any of these pests become serious. Maintenance of plantation No. 34 and also of No. 56 in a porcupine-proof condition.

Project 61 - Planting technique

Further experiments in stump-planting of various poplar material. Fall planting of hard pines and of white pine, as well as poplars and larch. Treatment of planting areas with chemicals to destroy vegetation previous to planting - in co-operation with fire hazard division.

Project 85 - Breeding arboretum

See recommendations for maintenance of test plantations. Cutting of grass and various shrubs along main road and some of the main side-roads. Construction of proper signs plainly visible from the main road, designating kind of stock and plantation numbers in arboretum. Continued de-budding of red pine and white pine, leaving a number of trees untouched to see what happens to them at this stage.

Project 86 - Hybridization

Collection of hybrid seeds from the crosses involving native red pine and white pine and planted Scotch pine made in 1945. Continued crossing of pine and spruce, as well as birch, elm basswood if flowering condition and labour for this purpose is favourable and available. Co-operation with the Central Experimental Farm and other arboreta in acquiring suitable pollen for these crosses.

APPENDIX C

Annual Report on Section V (Pathology), 1945

By C. G. Riley

Contributions by the Forest Pathologists toward the objectives of the Subcommittee on Tree Breeding, have been limited to the barest requirement, owing to the shortage of personnel to conduct the work. It is fully realized that the projects in hand merit a great deal more attention than has thus far been possible. While there are no immediate indications of relief in this respect, vigorous efforts are being made to improve the situation. However, progress will be slow at best, due to the fact that there are no trained forest pathologists available, and as far as is known, no students are being trained in this special field. Certainly, good men will not be attracted by present salaries and prospects of promotion.

Project V-A-1, Resistance to diseases in poplar breeding materials

Poplars in the nurseries and plantations at Petawawa Forest Experiment Station were inspected on September 19-20. The only noteworthy disease observed was rust. The degree of infection is shown in the following table in which the host material is arranged according to its position in the respective nurseries and plantations. The purpose of this arrangement is to reduce chances of error in identification of host material. The solid lines in the Table indicate nursery rows. The degree of rust is indicated in accordance with Schreiner's schedule, i.e. four degrees ranging from degree 1 (very light) to degree 4 (very heavy).

NURSERY NO. 1

Compt. 6:	Deg. Rust
Ta 2	0
AG 10	0
AG 73	0
CG 12	0
C 1	0
AG 114	0
AG 115	0
Ta 2	0
CG 17	0
AG 112	0
AG 33-17	2
AG 92	0
AG 33-19	0

	Deg. Rust
CG 16	0
CG 8	0
CG 30	0
AG 12	1
CG 27	0
CG 6	0
CG 30	0
CG 28	0
CG 8	0
CG 1	0
AG 33-5	0
All others in this bloc	0

NURSERY NO. 2

Compt. 1:	Deg. Rust
18P39-7	3
V 69	2
V 55	3
V 48	3
V 23	2
38P38	4
Sutherland 4	3
GCH 2	0
GC 11	0
AG Masson	0
CG 30	0
CG 17	0
AG 33-5	0
A 36/G	1
A 40	0
A 39	0
A 38	0
A 37	0
A 34	0
A 21	0
A 20	0
A 18	0
A 17	0
A 4	0
A 3	0
C 8 /AG 37	0
AG/AT (379)	2
CG 30	0
A 43	0
A 42	0
A 38	0
A 29	0
6710-39	1
6709-39	2
Andrewsii 1	3
koreana 6	2
szechuanica 1	2
Maximowiczii 5	1
Maximowiczii 4	1
Maximowiczii 3	1
Maximowiczii 2	0
Maximowiczii 1	1
D 7	3
D 5	3

	Deg. Rust
Brooks 10	4
Brooks 4	4
Calgary 23	2
Carolina 3	3
Carolina 2	3
Carolina 1	3
GC 2	0
D 483	2
D 484	2
D 482	3
D 481	2
D 7	3
D 5	3
D 2	4
D 1	4
Jackii 12	4
Jackii 11	4
Jackii 3	4
Jackii 10	4
Rt 50	4
Rt 48	4
Rt 45	4
Rt 44	4
Rt 43	4
Rt 35	4
Rt 34	3
Rt 30	4
Rt 29	4
Rt 28	3
Rt 27	4
Rt 26	3
Rt 23	4
Rt 19	4
Rt 15	3
Rt 11	4
Rt 3	4
Roxbury	3
trichocarpa 11	4
cathayana 17	1
cathayana 15	1
cathayana 1	1
BNW 19	3
koreana 9	0
koreana 6	2

Compt. 1 (Cont'd)	Deg. Rust
Calgary 121	3
Calgary 120	4
Calgary 109	4
Calgary 108	2
Calgary 96	4
Calgary 95	4
Calgary 94	4
Calgary 92	4
Calgary 91	4
R/t	2
berolinensis x Lombardy No. 1	3
berolinensis x Lombardy No. 2	2
berolinensis x Lombardy No. 3	1
berolinensis x Lombardy No. 4	1
berolinensis x Lombardy No. 5	2
berolinensis x Lombardy No. 6	1
berolinensis x Lombardy No. 7	1
berolinensis x Simonii No. 1	1
berolinensis x Simonii No. 2	1
berolinensis x Simonii No. 3	2
berolinensis x Simonii No. 4	1
berolinensis x Simonii No. 5	1
berolinensis x Simonii No. 6	2
berolinensis x Sominii No. 7	1
angulata x Simonii No. 1	3
angulata x Simonii No. 2	3
angulata x Simonii No. 3	3
angulata x Simonii No. 4	3
angulata x Simonii No. 5	3
angulata x Simonii No. 6	3
angulata x Simonii No. 7	2
angulata x Simonii No. 8	3
angulata x Simonii No. 9	3

Compt. 2	Deg. Rust
OP-38	1
generosa	1
gelrica	2
angulata erecta	3
vernirubens	3
22-11	3
Jackii 2	2
Compt. 3	
V 94	1
Jackii 18	3
V 69	1
Jackii 17	3
V 64	1
Jackii 16	3
V 55	2
Jackii 15	3
V 48	2
Jackii 14	3
V 23	1
Jackii 13	3
laurifolia 4	1
38P38	2
Maximowiczii 6	0
18P 39-7	3
A 45	0
D9	1
Brooks 7	2
D8	2
Rt 6	3
tRt 2	0
Rt 5	1
Maximowiczii 1	0
Rt 2	2
tRt 1	2
t10PW	2
t9PW	2
t7PW	2
t2PW	2
A 35 (no reading)	-
A 23	0
A 13	0
tristis 1	3
tacamahaca 4	2
BNW 18	2
BNW 15	3
BNW 2	1

Compt. 3 (cont'd)	Deg. Rust
tRt 7	0
D8	2
tRt 6	2
AcE 11	3
tRt 5	0
Rt 52	0
Jackii 13	3
Rt 47	3
tRt 4	0
Rt 46	1
Maximowiczii 5	0
Rt 33	3
tRt 3	2
Rt 32	2
Maximowiczii 3	0
R/t (425)	3
G/A (424)	0
Jackii/tristis (423)	4
C/AG (422)	2
A 47	0
A 46	0
A 26	0
A 25	0
A 24	0
R/t (425)	3
R/t (425)	3
Calgary 107	3
OP-45	0

PLANTATION NO. 55
(Arboretum - Hudson Place)

Near Road:

OP-45	0
C 16	0
OP-45	dead
OP-45	0
A 36	0
OP-45	0
A 36	0
Calgary 23	0
Calgary 23	0
OP-45	0
A 36	0
OP-45	0
C 3	1
OP-45	0
C 3	0
OP-45	0
A 38	0
Brooks 4	0
OP-45	0
Brooks 4	0
OP-45	0
OP-45	0
Saskatchewan	1
Brooks 4	0
OP-45	0
Jackii 2	0
Jackii 2	0
vernirubens	0
angulata erecta	0
Jackii 2	0
angulata erecta	0
Jackii 2	0
Rochester	0
Jackii 2	0
tristis 1	0
Jackii 2	0
A 29	0
C 17	0
Jackii 2	0
Roxbury	0
Jackii 2	0
C 2	0
A 22	0

PLANTATION NO. 51
(Woermke Field)

	Deg. Rust		Deg. Rust
Northwest	3	OP-38	0
Masson (no reading)	-	OP-54	0
vernirubens	0	OP-45	0
Carolina	0	Northwest	2
Maine	0	cathayana	0
Brooks 4	1	OP-49	dead
Brooks 10	dead	cathayana	0
Northwest	0	tristis 1	0
Northwest	2	berolinensis 1	0
Jackii 1	0	OP-49	0
Geneva	0	Raverdeau	0
Calgary 23	0	generosa	0
Rochester	0	berolinensis 1	0
Roxbury	0	cathayana	0
cathayana	0	Rasumowskyana x tacamahaca	0
Northwest	2	BNW 1	0
Strathglass	0		
22-11	0	(remainder too small for satisfactory examination)	
candicans	0		

A large number of inoculations on poplar made by Dr. Heimburger, using the canker fungus Septoria musiva, were examined on September 19. The results were all negative, and no significance is attached thereto. It seems probable that either the inoculum was not in good condition or that weather at the time of inoculation was too warm and dry.

Project V-B-1, Resistance to blister rust in white pine breeding materials

White pines in the disease garden, N.R.C. Annex, were examined by Dr. Skolko. Many of the trees have died as a result of white pine blister rust infection, but it would seem inadvisable to consider all the remaining uninfected trees as resistant to white pine blister rust. It was suggested that ample uredinial infection be assured by artificial inoculation of the Ribes plants in the adjacent rows, and if time is available, to inoculate all the white pines under favourable moisture conditions by covering the rows of pines with muslin tents.

APPENDIX D

Letter from Mr. John Walker, 14 March, 1946

1. I think that studies with reference to crosses between evergreen species as reported by Dr. Heimburger at the last meeting should be expanded. In this connection the specific details of other successful crosses indicated under heading 1-B-1 of Dr. Johnson's Progress Report, 1945, would be welcome.

   What about the reciprocal species crosses of those reported to be successful by both Dr. Heimburger and Dr. Johnson?

2. We shall be pleased to make a report to the Subcommittee at the next or any meeting on the development and value of poplar selections supplied to this Station by the National Research Council and Petawawa Forest Experiment Station.

3. Plans should be completed to have Provincial Forest Services represented on the Subcommittee, so that the broadest possible programme for forest tree improvement may be adopted. Annual forest tree distribution in Ontario alone exceeds the annual distribution of this Department by nearly 10 million trees.

4. We will welcome additional information on the use of fatty acids in stimulating rooting of poplar cuttings as reported by Dr. Heimburger.

5. Cytological studies and colchicine work should be continued. (Dr. Johnson's report, 1945, Sub-section 1-C-1).

   More information would be desirable on the relationship between chromosomes and vigor in hybrids, particularly poplar hybrids.

   If seedlings of the Populus berolinensis x Lombardy Poplar cross are available we would be glad to receive some of them for test. (Dr. Johnson's report, Sub-section 1-B-1).

6. If a pathologist can be secured to give help with tree diseases this year his time might be divided between Dominion Forest Services Stations at Petawawa and Kananaskis and the Department of Agriculture, Forest Nursery Station, Sutherland and Indian Head.

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