

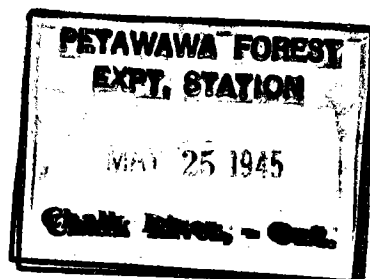
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NATIONAL RESEARCH COUNCIL OF CANADA

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PROCEEDINGS
OF THE
FOURTEENTH MEETING
OF THE
SUBCOMMITTEE ON
FOREST TREE BREEDING



OTTAWA

12 APRIL, 1945

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NATIONAL RESEARCH COUNCIL

PROCEEDINGS

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FOURTEENTH MEETING

of the

SUBCOMMITTEE ON FOREST TREE BREEDING

Held at the Office of the Dominion Forester, Norlite Building, Ottawa, 12 April, 1945.

Members present:

Mr. D. Roy Cameron, Chairman
Dr. N.H. Grace
Dr. C. Heimbürger
Mr. M.B. Morison
Mr. W.M. Robertson
Dr. H.A. Senn
Dr. A.J. Skolko
Dr. L.P.V. Johnson, Secretary

Visitor present:

Dr. W.H. Cook

140.
Minutes.

In Minute 132, Thirteenth Meeting, paragraph three, line two, the words "Dr. Johnson" were deleted and replaced with the words "Members of the Subcommittee". The Minutes of the Thirteenth Meeting were then approved.

141.
Cyto-
logical
work.

Arising out of Minute 133 and Appendix B, Proceedings of the Thirteenth Meeting, the question of getting immediate action on the cytological problems of the Subcommittee was discussed.

Dr. Senn suggested that a member of his staff might be able to undertake a certain amount of cytological work for the Subcommittee, and proposed that a formal request be made by the Subcommittee to the Dominion Botanist for such assistance on specified problems. With the Meeting in agreement on this proposal, the Chairman appointed a special subcommittee consisting of Dr. Senn (Chairman) Dr. Heimbürger and Dr. Johnson to outline definite cytological problems upon which the proposed request might be based. It was agreed that the report of the special subcommittee should be appended to the proceedings (Appendix A).

142. Dr. Johnson's report. Since Dr. Johnson's report, appended hereto as Appendix B, had been previously circulated to the members, only discussion of it took place at the Meeting.

Discussion centered upon arrangements for spruce and pine hybridization at Petawawa. Dr. Johnson stated that Mr. Bradley, and possibly Mr. Richards, would be available for spruce and pine hybridization work and would proceed to Petawawa upon notification that the material was in proper stage for bagging.

Dr. Heimbürger agreed to assume responsibility for notifying Dr. Johnson of the time when Mr. Bradley should go to Petawawa for spruce hybridization.

Mr. Morison stated that he felt suitable transportation could be arranged to accommodate Messrs. Bradley and Richards.

143. Dr. Heimbürger's report. Dr. Heimbürger's report, attached hereto as Appendix C, had been previously circulated to the members. Discussion of the report centered upon details of land and manpower requirements for plantation and nursery work at Petawawa. These were arranged to the mutual satisfaction of Mr. Morison and Dr. Heimbürger.

Dr. Heimbürger stated that he had undertaken a considerable amount of cytological work on poplars and was able to identify different polyploid types in the Populus grandidentata X P. canescens - 13 (triploid) hybrids. He was also able to increase the proportion of unreduced pollen grains in P. canescens - 13 pollen by mechanical means.

Dr. Heimbürger also reported that in a recent trip to Western Canada he had acquired a number of new poplar forms of potential value as parental material.

144. Correspondence from Messrs. Walker and Kerr. The question of providing a full-time worker to undertake breeding work at the Indian Head and Sutherland forest nursery stations arose from Minute 138, Thirteenth Meeting, and from recent correspondence with Messrs. Walker and Kerr. The Subcommittee agreed that such an arrangement should be made and that means of implementing it should be examined.

Mr. Walker requested that poplar selections exhibiting rust resistance and hardiness should be sent to Indian Head and Sutherland. It was agreed that this should be done.

The secretary was instructed to write to Mr. Walker on other points raised.

145.
Promotion of
Mr. Bradley.

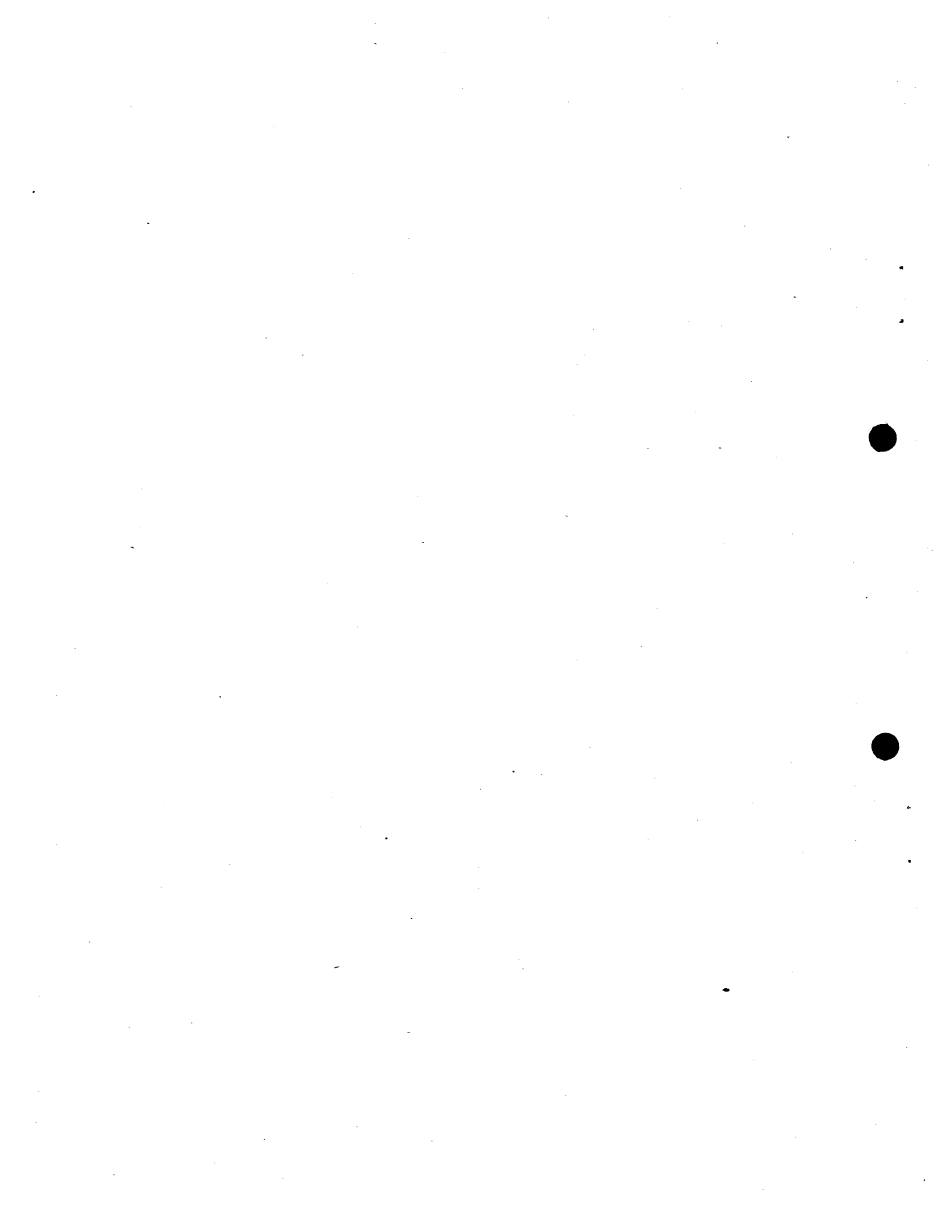
Dr. Johnson sponsored a request from Mr. Bradley that he be promoted to the Senior Laboratory Assistant grade. It was agreed that this matter be referred to the financial executive of the Subcommittee.

146.
Combined
annual
report.

Mr. Robertson proposed that a practice be instituted whereby an annual report would be prepared combining in suitable form the reports of individual workers. The report would be mimeographed and circulated to interested parties. It was decided that the matter be considered and a decision reached in time to put the proposal in effect, if accepted, on the 1945 reports.

147.
Change in
date of
Spring Meetings.

Upon the request of Dr. Heimbürger, it was agreed to hold future Spring Meetings during the latter part of March.



APPENDIX A.

Report of Committee on the Cytology of Poplar

This Committee, appointed at a meeting of the Sub-Committee on Forest Tree Breeding, April 12, consisted of Dr. C. Heimbürger, Dr. L.P.V. Johnson, and Dr. H.A. Senn, Chairman. The Committee met on April 12 and gave consideration to the most urgent problems in poplar cytology.

It was agreed that work should be started as soon as possible on the problems outlined below.

A. Western material.

1. Determination of somatic chromosome numbers of Populus collected at Calgary by Dr. Heimbürger. This material is presumably a mixture of diploids, triploids, and tetraploids and knowledge of chromosome number is essential to the utilization of the material in breeding. Cuttings are available at Petawawa and after root tips are collected the material should be grown.
2. Determination of somatic chromosome numbers of other material of Populus from Western Canada collected by Dr. Heimbürger. This is presumably triploid or tetraploid. Material is available in Petawawa as in 1.
3. Determination of somatic chromosome number of Calgary 23, presumably a diploid. Material is available both at Petawawa and National Research Council Annex.
4. Determination of somatic chromosome number of Populus hybrid, BXNW. Material is available at Petawawa.

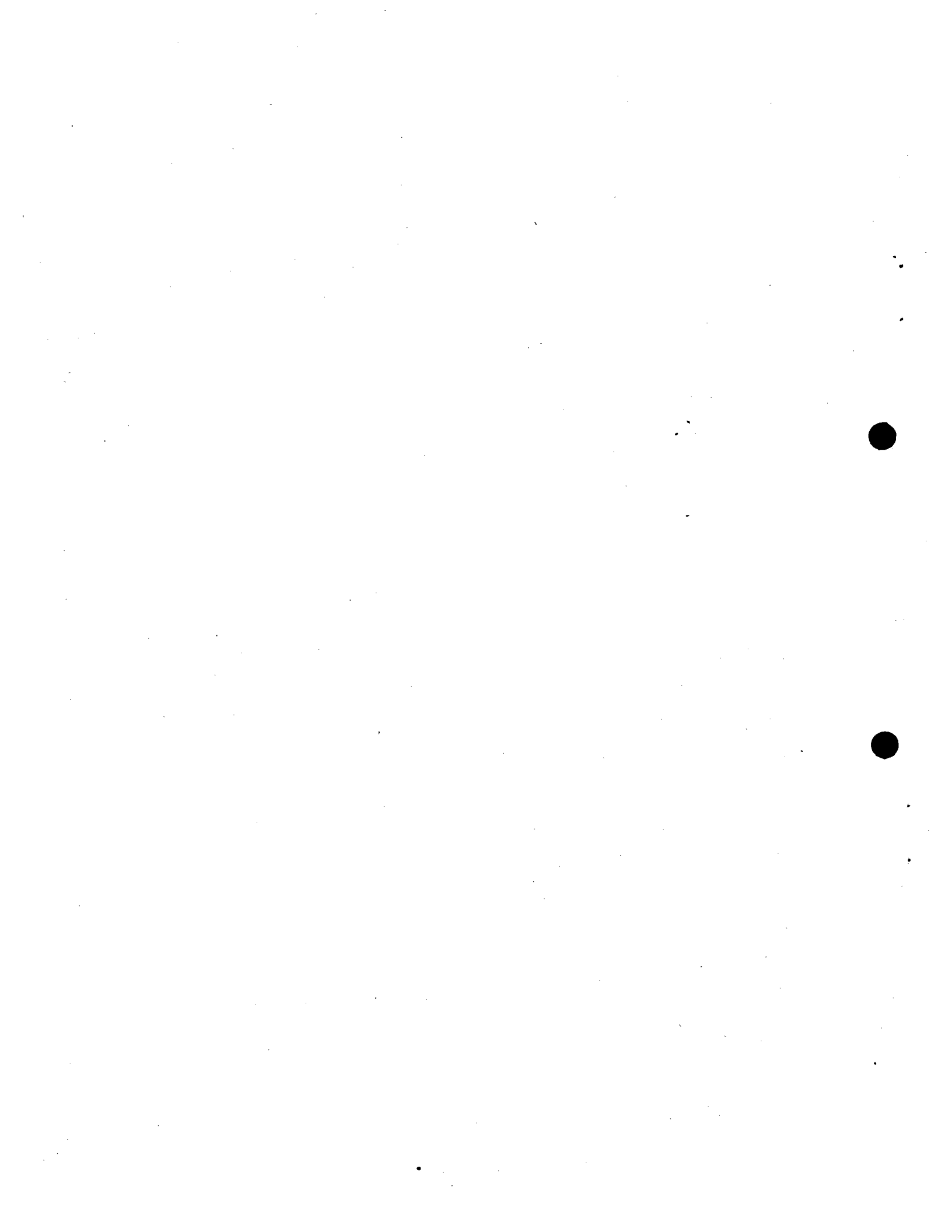
B. Eastern Canada.

1. Determination of somatic chromosome number of Populus canescens, C 13, and its progeny. Material is available at Petawawa and National Research Council Annex.

These problems are concerned entirely with material which is immediately available. Next winter further cuttings could be obtained for determination of somatic numbers and materials could also be obtained for studies of meiotic chromosomes in parental and hybrid material.

Dr. Heimbürger also asked that the chromosome number of Betula dahurica be determined as soon as possible. This was regarded as secondary to the work on Populus.

Harold A. Senn,
Chairman.



APPENDIX B.

PROGRESS REPORT FOR 1944 - 45

by

L.P.V. Johnson

EXPERIMENTS PREVIOUSLY IN PROGRESS

I-B-1 Interspecific hybridization in forest tree genera

The following cross pollinations yielded apparently viable seed:

Picea glauca x P. sitchensis

P. rubens x P. Abies

P. mariana x P. Omorika

P. pungens x P. glauca

" x P. sitchensis

Huntingdon elm x Ulmus pumila

Alnus glutinosa x A. rubra

The first three crosses were made at Petawawa in co-operation with Dr. Heimbürger, the next three at the Dominion Arboretum and the last at the N.R.C. Annex. The elm seedlings appeared to be weaker than those of the parents.

I-B-2 The development of crossing technique in forest-tree genera. In connection with hybridization and self-sterility studies in elm, comparisons of relative seed set and seed viability were made between the following types of bagging: glassine single, glassine double, kraft single, kraft double, kraft over glassine, parchment single, canvas single. It was concluded that canvas single, kraft single and glassine single provided the best conditions for seed development. Of these, glassine single gave a high proportion of broken bags while kraft single gave a small proportion of bags which appeared to permit some passage of foreign pollen, being the only bags in which selfing set seed. Canvas bags are heavy and led to some breakage of twigs. Parchment bags, while possessing great wet strength, were found unsatisfactory through their brittleness when dry. Everything considered kraft over glassine appeared to be best for elm, although on stiffer-twigged genera there would be some inclination to favour canvas.

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

A further test was made on pollen of three species of pine to determine definitely whether germination was higher after 12 months' storage than after 8 months'. The results were in the negative and are being prepared for publication.

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

This work is continuing. The report made last year (Proc. 12th Meeting, Appendix A, p. A-1) still applies. Some of the best results were obtained with Abies grandis but, since this species lacks hardiness here, arrangements are being made to send about a dozen of the best specimens to the West Coast. In the meantime, these specimens are growing in the greenhouse.

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

The disease garden was extended by producing existing rows of ribes to include an additional area of 50 x 100 ft. Black and red currants and both cultivated and natural gooseberries were included in the planting. White pine planting during the year was restricted to a number of unselected lines including some colchicine-treated material showing no treatment effect. The incidence of disease among the white pine material in the garden is covered by Dr. Skolko's report (Proc. 13th Meeting, Appendix C, p C-7).

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

Considerable work was done with elms which tended to confirm previous indications of high self-sterility in many species of this genus. The work is continuing in the greenhouse this winter, and it is hoped that the results of one more outdoor season (the fifth) will bring the accumulated data up to a standard warranting publication.

The 1944 results of observations on the relative vigour of pine seedlings derived from self and cross fertilization are being written up for publication.

I-z-4 Chemical stimulation of seed germination

The results of this work, summarized last year (Proc. 12th Meeting, Appz. A, p A-2), are being prepared for publication.

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

The data from this work has been analysed and a report is in course of preparation. If of sufficiently high standard it will be submitted for publication.

II-A-2 Inheritance studies. Nothing new to report.

II-B-1 Cytology of colchicine-treated materials.

Results from field materials during the summer indicated a mixture of doubled and normal tissue in a high proportion of the affected plants. Pruning of normal tissue was undertaken to favour the doubled segments of the plants. The squash technique for stem growing points and root tips is being perfected, and a report is in course of preparation for publication.

G-1 Physiological studies on the sugar maple.
 The results from this work are too involved for brief treatment. A detailed report is being prepared and will be made available to interested parties either in published or other form.

NEW EXPERIMENTS

Classification Number: I-A-10
Classification Subject: Selection and breeding general
Title of experiment: Selection and testing for prairie shelterbelts
Schedule: Commenced 1938, method revised and extended 1944.
Conducted by: L.P.V. Johnson, C. Heimburger, J. Walker, W.L. Kerr
Objective: To improve the stock distributed for shelterbelt planting (a) by selecting and testing superior individuals growing naturally in severe prairie habitats or artificially under average to poor conditions in prairie shelterbelts, and (b) by creating and testing hybrids between suitable parents: the materials proving of value in the tests to be increased for distribution.

Materials and methods: For an account of a method used in 1944, see Proc. 13th Meeting, Appendix A, especially the numbered "steps", and final paragraph on page A-2. It will not be possible to specify methods in general for the whole procedure of forest tree breeding may be involved.

Any material suitable for prairie shelterbelt planting may be included.

Results: A trip was made to the prairies during 1944 in the interests of this work (see Proc. 13th Meeting, Appx. A) resulting in 33 selections of broad-leaved and coniferous species from shelterbelts and natural habitats. Seed from 15 broad-leaved selections have been sown at the Forest Nursery Station, Indian Head, Sask., and seed from ten coniferous selections will be sown in the Spring. Of the remaining selections, three are green ash males, two are white elms (seeds to be collected in the Spring), and three are lodge-pole pines from the cones of which seeds have not yet been extracted.

A number of other experiments written-up separately, D.F.S. Project 58, V-A-2, etc., lead ultimately into this experiment (I-A-10). The materials under Project 58, for example, may be considered to have been transferred to I-A-10 when they are sent to the prairie Forest Nursery Stations for further tests.

Classification Number: I-2-5
Classification subject: Breeding general
Title of experiment: Acid extraction and scarification of basswood seeds.

Schedule: commenced 1940, experiment extended 1944

Conducted by: L.P.V. Johnson, with co-operation of the Ontario Forestry Branch.

Objective: To develop an efficient method of digesting the pericarp of basswood fruits without resort to the obnoxious nitric acid procedure, and to adjust the sulphuric acid scarification method to the new pericarp digestion method.

Method: Pericarp digestion is effected by soaking fruits in water for two or three days, draining, partly drying and treating with concentrated sulphuric acid in Fernback flasks immersed in cold water bath.

Results: The results from N.R.C. and Ontario Forest Nursery tests of both fall-sown and spring-sown (stratified) seed will be available in the early summer.

Classification Number: V-A-2

Classification Subject: Pathology, poplar

Title: Testing hybrid poplars for Septoria canker reaction by artificial inoculation at the N.R.C. Annex nursery.

Schedule: Commenced July, 1944.

Conducted by: L.P.V. Johnson and A.J. Skolko.

Objective: To obtain definite knowledge of reaction (resistance or susceptibility) to the canker pathogene while hybrids are in nursery tests.

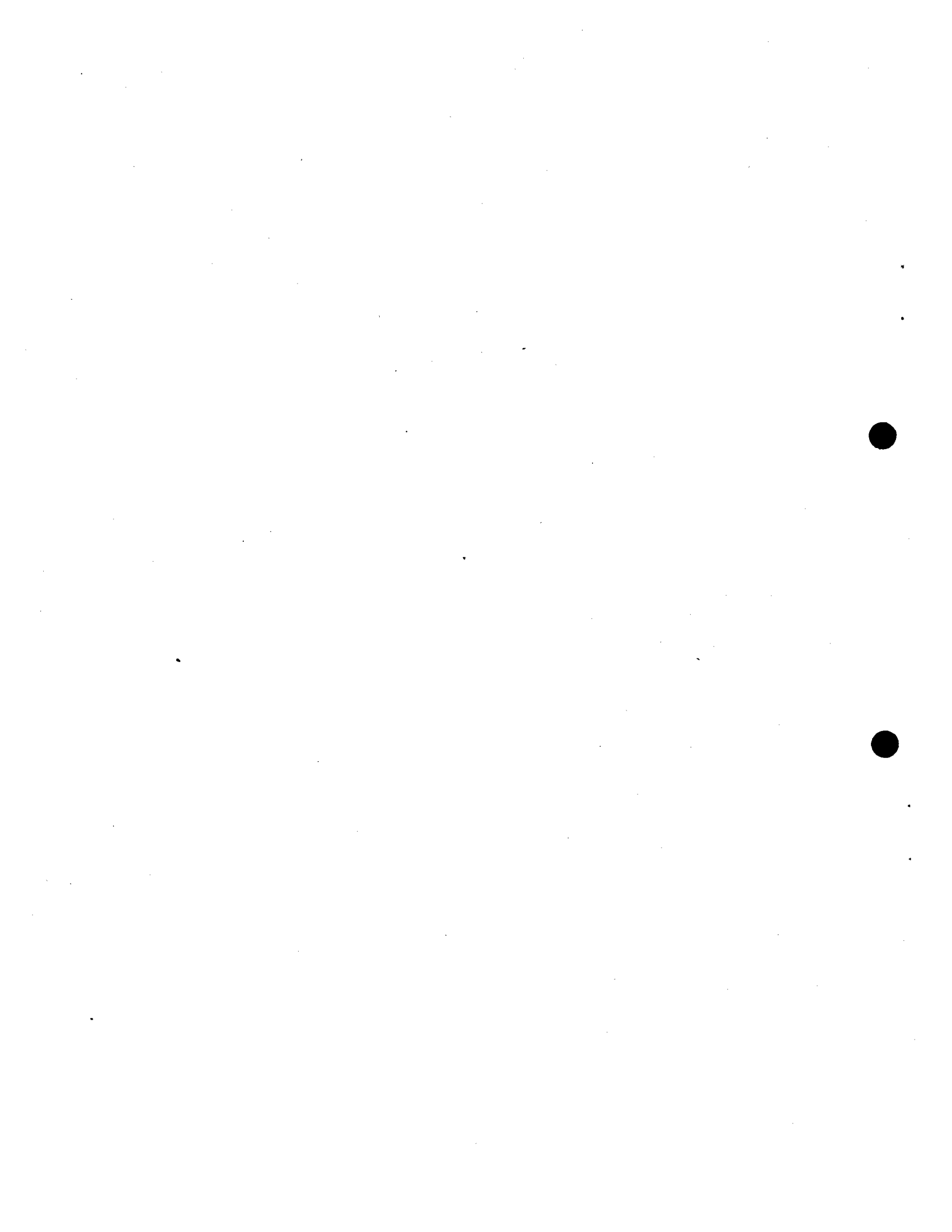
Materials and methods: About a hundred hybrids between Russian and balsam poplars form the basis of the work, but many other poplar hybrids will also be inoculated. The method is to insert a small piece of inoculum under a flap of bark, which is then bound into place to prevent drying. Inoculations should be made early in the growing season in order that cankers have time to develop should the tree be susceptible.

Results: In late July and early August 250 poplar hybrid trees were inoculated with the Septoria canker organism (Prog. Report 15-16/44). The period was very unfavourable, being extremely hot and dry, and the results were inconclusive. The material was for the most part retained for repetition of inoculation in 1945.

PROPOSED PROGRAMME, SPRING AND SUMMER 1945

1. Further hybridization in spruce, pine, elm, ash, alder and perhaps other genera will be undertaken as time, facilities and materials permit.
2. Transplanting of selected white pine materials to the disease garden.
3. Controlled infection of the older white pines in the disease garden (on advice of Dr. Skolko).
4. Artificial inoculation of poplar hybrids with Septoria canker.

5. Completion of basswood seed experiment (I-2-5).
6. Cytological observations on colchicine-treated plants.
7. Extension of breeding arboretum and disease garden.
8. Further experiments on self sterility in elm.
9. Further work in the prairie region (I-A-10) if time and finances permit.
10. Preparation of several manuscripts for publication.



APPENDIX CREPORT ON WORK IN NURSERIES AND TEST PLANTATIONS,
PETAWAWA FOREST EXPERIMENT STATION, 1944

C. Heimbürger

Introduction

The very unfavourable working conditions experienced at this Station in 1943 were somewhat improved during 1944. No regular labour was again available for current work and all the work was performed by conscientious objectors. It was possible, however, to maintain their work at a reasonably satisfactory level, by frequent replacement of less suitable individuals. One worker had been employed in 1943 also and was familiar with some details of the work which could be delegated to him. Very little work was done with new material and only a few new experiments were started. Work in vegetative propagation, formerly requiring a great amount of detailed observations, was almost suspended and most of the nursery work amounted to a maintenance of existing stock and to removal of rocks, digging of ditches and other elementary projects directed towards physical improvement rather than to research. By thus changing the programme of the work, it was possible to utilize the existing labour more adequately and without the regrettable waste of time experienced in 1943. The summer of 1944 was characterized by a late spring frost and later by very hot and dry weather. These conditions had a marked influence on the survival and performance of some of the plant material in the nurseries and test plantations and presented an unusual opportunity for making observations on their hardiness in these respects.

General Nursery Work

Besides general maintenance of the growing stock through weeding, watering, and current transplanting and heeling in, general improvements were made in nursery #1. Rocks were again removed and ditches were dug, one compartment was levelled off with a bulldozer to reduce future grass mowing and a light bridge across one of the ditches was constructed. All empty compartments were fertilized to soiling crops and kept free from weeds.

General Maintenance of Plantations

Very good results have been obtained with an electric fence around plantation #52, using it as protection against summer browsing by deer. A fairly large area was prepared for planting near Montgomery Lake, by clear-cutting the Jack pine remaining from a previous cutting operation and by burning the

slash. This work was done by prisoners of war, under the supervision of an officer of this Station.

Project 50. Vegetative Propagation

No new experiments in this project were started in 1944, and several current experiments were terminated. The latter are as follows:

- 50:23, 1941 White pine, cuttings of rust-free trees from Wisconsin, tests for rooting, and other observations - the entire material is now dead and none was rooted at the final examination.
- 50:1-41, 1941 Cuttings of various conifers collected at various times and planted in various media, all in one type of bed and one type of screens. Results compiled and tabulated, mostly in favour of late summer planting.
- 50:2-42, 1942 Response of basswood, chinese elm and yellow birch to layering of young nursery stock. Results compiled and tabulated. It is possible to obtain rooted plants with all these species by layering.
- 50:5-42, 1942 De-budding of various pines for the formation of juvenile growth and use of same as stem cuttings. Results compiled and tabulated. The resulting juvenile growth does not behave as such when used as stem cuttings in rooting experiments.

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 still in nursery; some of the older plants are being used as source of cuttings.
- 50:4-41, 1941 Development of plants from stem cuttings of white pine material still in nursery; growth form satisfactory, growth rate rather uneven and slightly slower than that of seedlings of comparable size.
- 50:5-41, 1941 Development of plants from stem cuttings of white spruce; plants still in nursery, in all respects yielding results similar to 54:2, 1937.
- 50:4-42, 1942 Physical and biological properties of various propagation media-chemical and other analyses if and when needed in connection with other experiments.

- 50:4-43, 1943 Rooting of semi-lignified, hormone-treated cuttings of several softwood species in hot bed and cold frame in sand and peat mixtures - all living cutting still in propagation beds; experiment to be terminated in 1945.
- 50:1-44, 1944 Vernalization of cuttings of *Populus alba* x *grandidentata* in the laboratory with subsequent treatment with hormone solutions of basic value to similar experiments on a larger scale and with practical applications in the nursery.

Project 51, Methods of Raising Nursery Stock

1) Poplars

In the spring of 1944 all new poplar material planted in 1943 and shown to be hardy was propagated in the ordinary way in nursery #1, as was all new poplar material obtained during the previous winter. The cuttings of *P. alba* x aspen hybrids stored with their butts up in nursery #2 over the winter were transferred to a seed bed for callusing and thereafter planted in the regular way in rows in nursery #1. The results were very encouraging. In the fall of 1944 all cuttings of the same class of poplars were stored with their butts up in nursery #2 for further propagation according to this method, with some recent improvements. All the other poplar material was propagated according to methods already worked out and described repeatedly in former progress reports.

2) Conifers

In the spring of 1944 some pine seedlings were transplanted according to the usual method and with good results, in spite of the very dry weather experienced later. In the fall of 1944 seedlings of lodgepole pine, Scotch pine, Douglas fir, and of several strains of white pine and other five-needled pines were transplanted into nursery #2 with subsequent watering. Some older larch transplants were also moved to a wider spacing in late fall. Seedlings of hemlock and of several spruce species were lifted and heeled-in in a seed bed under protection of lath screens for the winter for early spring transplanting. The results of fall transplanting of conifers will be evident in the summer of 1945. In the fall the plants looked alive and healthy with the exception of some red lodgepole pines, apparently succumbing to the drought after transplanting.

3) Hardwoods

In the spring some elm, maple, oaks, and birches were transplanted with the usual good results. Fall transplanting

was this year tried with numerous birch seedlings, and older plants of ash and basswood, at the time of leaf-fall and before that time, with subsequent hilling of the transplants for the winter, to prevent frost-heaving. Some Caragana plants were lifted and heeled in for the winter in nursery #2 for early spring transplanting.

4) Soil Treatment

Soy beans were sown as a soiling crop in a small compartment in nursery #2, after inoculation with nodule bacteria and treatment of the soil with mineral fertilizer and sawdust. The results were rather poor, indicating that soy beans need a fairly rich soil to begin with before they can be used as a soiling crop. In the fall of 1944 hairy vetch was again used as soiling crop according to the method worked out before and described previously. It is thus far the best soiling crop under the existing conditions. Its only drawback is its trailing habit, making plowing-under difficult. An erect legume with similar soil and climatic requirements is still to be found. At one time Dalea alopecuroides was thought to fulfil these requirements, but thus far it has not been possible to obtain seeds of this plant from any source, even for a preliminary test. It is an annual plant, native to the sand dunes around Lake Michigan.

Project 52, Strain Testing of Spruce

In the summer of 1944, a detailed tally of all the spruce material received as seeds in 1939 from the International Union of Forest Research Organizations was made and the results forwarded to the Secretary, as an interim report. The same was the case with the Scotch pine material.

The following lots were sown and set out in test plantations in 1944:

(a) Sowings, fall 1944

Seed lot

- 443 Picea rubens, New Hampshire
- 448 Picea glauca, #14 x sitchensis, F1
- 449 Picea glauca, #15 x sitchensis, F1
- 450 Picea mariana x Omorika, F1
- 451 Picea rubens x excelsa, F1
- 452 Picea excelsa, from good trees in plantation #8.

(c) Material set out in test plantations, Spring 1944

- 81 Picea glauca, Kananaskis FES, 450 to plantation 53
- 84b Picea excelsa, Laurentide plantations, all available to plantation 59.
- 86 Picea excelsa, Latvia, all available to plantation 59.

Some plants of lots 84b and 86 were also sent to the Chief Forester of Nova Scotia for testing under different climatic conditions, as were some hybrid white spruce x Sitka spruce plants raised from Danish seed and not fully hardy at this Station during the previous winter.

Project 53. Strain testing of hard pines

Several lots of Scotch pine transplants were heeled-in in nursery #1 in the spring of 1943 because of lack of planting space in test plantations. The necessary planting space for this material was obtained in 1944 and the following material was set out in the spring of that year:

Seed lot

165	Pinus silvestris, Latvia, 15 to plantation 43
166	Pinus silvestris, USSR, 94 to plantation 43
170	Pinus silvestris, East Prussia, 31 to plantation 43
171	Pinus silvestris, Roumania, 42 to plantation 43
174	Pinus silvestris, Sweden, 24 to plantation 43
216	Pinus contorta latifolia, 39 to plantation 43

The following lots were sown in the fall of 1944:

447	Pinus banksiana, Petawawa FES
454	Pinus banksiana x contorta latifolia, Fl

A large number of pine seedlings was transplanted in the late summer and early fall of 1944, as already mentioned under Project 51, 2.

In the fall of 1944 a fairly large number of various pine transplants, ready for setting out in plantations were sent to the Chief Forester in Nova Scotia, where fall planting of pines is fully feasible. This was done in the interests of cooperative testing of some strains under different climatic conditions and was done in the fall to lessen the spring rush of similar work in 1945.

Project 54, Strain testing of soft pines

The winter of 1943-44 was very hard on several exotic species of this group in the nursery and many plants were culled in the spring. Several lots of pinen pines from the southwestern US were transplanted in the spring of 1944 after such a heavy culling. Some plants of a one-parent progeny lot of white pine were received from the Annex of the NRC for further growing and testing at this station. In the fall of 1944 the following lots were sown:

421	Ribes diacantha, Dropmore, Man.
453	Pinus Strobus x Peuce, Fl.