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NATIONAL RESEARCH COUNCIL OF CANADA

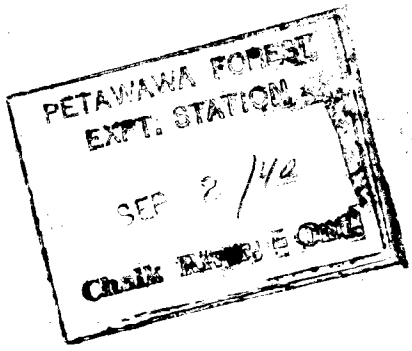
PROCEEDINGS

OF THE

SECOND MEETING

OF THE

SUBCOMMITTEE ON FOREST TREE BREEDING



OTTAWA

28 NOVEMBER, 1939

CONFIDENTIAL

NATIONAL RESEARCH COUNCIL OF CANADA

PROCEEDINGS

OF THE

SECOND MEETING

OF THE

SUBCOMMITTEE ON FOREST TREE BREEDING

OTTAWA

28 NOVEMBER, 1939

NATIONAL RESEARCH COUNCIL

P R O C E E D I N G S

of the

Second Meeting

of the

SUBCOMMITTEE ON FOREST TREE BREEDING

Held at the National Research Laboratories, Ottawa.
28 November, 1939.

Present:

Members: Dr. R. Newton (chairman)
Dr. N. H. Grace
Dr. C. Heimburger
Dr. L.P.V. Johnson
Mr. C. G. Riley
Mr. W. M. Robertson
Dr. H. A. Senn
Dr. F. H. Peto (secretary)

Visitors: Dr. J. W. Boyes
Mr. J. L. Farrar
Mr. A. W. McCallum

- -

20. Minutes — The minutes of the first meeting of the Subcommittee on Forest Tree Breeding were read and approved after Dr. Heimburger had drawn attention to the omission of facts relating to preliminary fibre tests on poplar species and hybrids. This omission is rectified in Minute 33.

21. Nurseryman — Mr. Robertson reported that provision has been made in the 1940 estimates for the appointment of a nurseryman who would be competent to deal with all nursery problems and would be employed at Petawawa during the summer and at the National Research Laboratories during the winter. It was agreed that Dr. Heimburger, Dr. Grace and Mr. Farrar should draft the necessary specifications for this appointment.

22. Resistance to white pine blister rust

Mr. Riley reported that he and Mr. McCallum had inspected a white pine plantation at Point Platon, Que., on 3 August. This plantation, established in 1908, had been considerably reduced as a result of blister rust. A number of trees appeared to have escaped the disease. They will be carefully inspected at the time of aecial fructification next spring, the trees will be marked and notes taken on their degree of freedom from the disease. A plantation near Orono, Ont., is reported with a similar history. This will also be inspected as well as the Kirks Ferry stand.

The Secretary read a letter from Dr. Riker of the University of Wisconsin promising to send us seed from reputedly resistant pine trees. An abstract of a paper presented to the American Phytopathological Society by Dr. Riker was also read.

Mr. Robertson stated that a small quantity of western white pine seed had been obtained from Mr. Berkeley, Departure Bay, B.C. Dr. Mounce had reported that the parent plants possess resistance to white pine blister rust.

After considerable discussion covering the programme to be undertaken in the immediate future the following points were agreed upon:

(a) The secretary was instructed to write Dr. Syrach Larsen and Dr. Riker and request information on methods of grafting pine.

(b) Messrs. McCallum and Riley agreed to inspect the Point Platon pine stand in the spring and mark the resistant trees.

(c) Dr. Johnson agreed to make controlled pollinations at Point Platon if circumstances permitted.

(d) Dr. Johnson agreed to attempt to induce fruiting in very small trees by taking scions from seed bearing trees and grafting these on young seedlings.

(e) Dr. Grace and Mr. Farrar also agreed to undertake grafting studies to determine the fundamental factors involved if preliminary enquiries indicated the necessity for this investigation.

(f) Mr. McCallum and Mr. Riley agreed to undertake controlled inoculation studies when suitable material becomes available.

23. N.F.P.Unit at Annex

Mr. Robertson reported that the National Forestry Programme will be functioning again next year and that attempts will be made to have a unit operating next summer at the new annex.

24. Project Organization

The Secretary reported on the meeting of the group assigned the work of completing the outline. The outline presented is included in Appendix A. Mr. Robertson stated that what the administration desired was a cumulative statement of the scope and status of the committee's research activities. This could be presented in outline at the spring meeting and included in the minutes for future reference.

25. White spruce breeding

Mr. Robertson outlined the need for testing the inherent qualities of native white spruce biotypes and determining the correlation of such characters as needle colour and growth form with drought resistance, etc. Dr. Johnson explained that such tests were now in their initial stages.

26. Characteristics of red, white and black spruce

Mr. Robertson was of the opinion that some uncertainty existed regarding the genetic relationship of red, white and black spruce.

The Secretary pointed out that they all had the same chromosome number and that cytological studies might be of little value in resolving the difficulty.

Dr. Heimburger was of the opinion that these three spruce species were readily distinguishable although there was some natural crossing.

Dr. Johnson reported that he had crossed white and black spruce and a study of the characteristics of the progeny should contribute towards overcoming the difficulty.

27. Progress report on tree breeding

Dr. Johnson outlined briefly the progress in breeding since the June meeting. The results from hybridization in elm, birch and spruce are very gratifying. Several hundred elm hybrids involving Ulmus americana U. effusa, U. Heyderi and U. racemosa are now growing in the Annex nursery. Seed setting from cross pollinations in birch was very abundant, but conclusions as to the hybrid nature of the seed cannot be drawn until after seedling emergence. Good seed setting was also obtained from cross pollinations in spruce, the seeds being considered hybrid but of low germinability. Hybrid seed of birch and spruce were fall sown at

the Petawawa nurseries. Work on new accessions of Oxford hybrid poplars and on damping-off control was mentioned, the meeting being referred to progress reports for details.

Plans for the future consis very largely of the continuation of work already started. During the winter, hybridization in poplars will continue on a fairly extensive scale, colchicine treatment of seed will be repeated, and the preliminary phases of damping-off control and wood technology studies completed.

28. **Progress report on vegetative propagation**

Mr. Farrar reported on the vegetative propagation studies conducted by Dr. Grace and himself. Norway spruce, set out in November 1938 at the Petawawa Forest Experiment Station rooted 82% after treatment with talc containing 5000 p.p.m. indolylacetic acid. Controls rooted only 48%. Peat-sand was superior to sand as a medium, but only for the treated cuttings. This experiment is noteworthy in that a high rooting percentage was obtained outdoors with comparatively inexpensive facilities, and in that the hormone gave decidedly beneficial results. A similar high concentration of indolylacetic acid used in the greenhouse resulted in damage.

Norway spruce cuttings taken in spring before bud development were almost a total failure. Cuttings taken just as the buds were breaking rooted fairly well, but after new growth was well along, rooting dropped off again.

White pine cuttings taken in September 1938 planted in peat-sand, rooted 4%.

Work during the summer of 1939 has dealt mainly with seasonal collection of Norway spruce, white spruce, white pine, basswood and trembling aspen. Work has also been done on media and on cuttings from different parts of the branch. A start has been made on the multiplication by cuttings of selected Norway spruce trees.

The seasonal collections are being continued this winter both for immediate planting in the greenhouse and for planting outdoors next spring. The latter will be stored as cuttings in flats in an outdoor shelter. Populus canescens is being substituted for P. tremuloides because of its closer relationship to the valuable P. alba - grandidentata hybrids which it is desired to propagate.

Experiments to obtain further data on the beneficial effect of organic and inorganic nutrients will be carried out this winter.

Dr. Heimburger reported that rooting of P. alba x P. grandidentata hybrids did not exceed 40% which was unsatisfactory for commercial propagation. He was of the opinion that tests of the rooting response with the aid of hormones should be undertaken. Dr. Grace stated that such an experiment would be undertaken.

29. Nursery work at Petawawa

Dr. Heimburger outlined the nursery work at Petawawa and referred especially to the following items: (1) Co-operative tests of strains of Scotch pine and Norway spruce which originated in Europe from Lapland to Rumania are being conducted. (2) Poplars were procured from Manchuria and are being grown in the test nursery and their rooting capacity is also being determined. (3) Several collections of white spruce have been made in Western Canada but so far it has been difficult to obtain similar collections in Eastern Canada. (4) Seeds of Douglas fir, lodge pole pine, basswood and birch have been collected and are being tested.

Dr. Heimburger outlined a system of propagating stem cuttings of poplars by burying the cuttings upright in the ground just before freeze up. He also described the root cutting method of propagating poplars.

Plans have been made for testing the susceptibility of poplars to septorial canker by growing them in close proximity to susceptible Russian poplars.

30. Arboretum problems

Dr. Heimburger outlined three requirements of an arboretum to enable it to be of greatest value in forest tree breeding: (1) Plantations of clones or populations to be grown on a variety of soil types and environments. (2) Single specimens of trees of indirect use in breeding. (3) Groups of trees composed of several individuals of each biotype.

Dr. Senn stated that they plan on planting about six individuals of each species in additional plantings at the Arboretum, Central Experimental Farm.

It was agreed that Dr. Heimburger should present a written statement of arboretum requirements and that this shall be used by the Secretary in drafting a letter to Dr. Swaine which would indicate the possible role of the Arboretum at the Central Experimental Farm in our present and future tree breeding programme.

The Secretary pointed out that the establishment of test plantations in various regions and soils would not normally be considered an arboretum problem, although their establishment is vital to progress in forest tree improvement.

31. Nursery labour requirements

Dr. Heimburger referred to the shortage of labour at Petawawa during the rush seasons in early spring and late autumn. Mr. Robertson stated that the total labour supplied exceeded the anticipated needs but that the flexibility of supply was not adequate to meet unusual demands.

32. Tree disease problems

Mr. Riley described the results from the samples taken from young trees previously inoculated with the heart rot organism. The results were largely negative but the information was of value in developing improvements in technique. New inoculations were started this summer.

Mr. Riley examined poplars in the nursery for diseases. His report on these observations is found in Appendix B.

Future plans include: (1) Additional studies on heart rot. (2) Inspection of the nursery and the disease garden as required. (3) Observations on white pine blister rust at Point Platon, Que.

33. Wood quality tests

Dr. Johnson reported that wood quality studies on rapid growing poplar hybrids had been started and that materials had been collected for continuing the work during the winter. The method involves the calculation of growth-vigor indexes, based on the annual growth increment on hybrids and parents covering the natural range of variability in growth rate. The vigor index of each tree is then compared with data on specific gravity and fibre characteristics obtained from cores or discs collected from the same tree. The work is not sufficiently advanced to warrant presentation of results. At present 42 individuals of Populus alba x P. grandidentata, P. alba x P. tremuloides and parental species are being studied.

Supplementary to the above work, entire trunks of P. alba x P. grandidentata and P. grandidentata have been sent to the Forest Products Laboratory, Montreal, for pulping tests.

In the previous meeting Dr. Heimburger reported that logs were obtained of P. canescens, P. alba x P. grandidentata, and P. alba. Fibre dimensions were taken and the wood tested for match splints at the Canada Splint and Lumber Co., Pembroke, Ont.

34. Cytology of poplars

Dr. Heimburger agreed to supply the Secretary with a list of poplar hybrids which required further cytological study. Pollen-mother cell observations would be made sometime during the winter. Trees C4 and C13 were especially referred to.

35. Tree breeding problems in Western Canada

Dr. Heimburger visited Western Canada last summer and was greatly impressed with the urgency for tree breeding to meet the needs for shelter belts and prairie wood lots. He noticed an invasion of western and eastern tree species into the marginal prairie regions and suggested that valuable drought hardy stock might be found here. He also stressed the point that different growth habits are required for the dry plains. For example, a low wide branchy type is needed whereas a tall straight branchless bole is preferred in the timber and pulp producing areas.

36. Blister rust and bronze birch borer survey

A report by Mr. K.M. Mayall on the blister rust and bronze birch borer survey was read by the secretary. Mr. Mayall was unsuccessful in detecting natural resistance to either of these infestations.

37. Forest tree breeding in Denmark & Sweden

The Secretary reported briefly on his visit to the Forest Tree Breeding Institutes in Scandinavia. The following items were discussed and photographs displayed: (1) Grafting to induce fruiting in very small trees. (2) Construction of overhead shade for propagation frames. (3) Home made soil sterilizer.

38. Nursery & greenhouse development at the Annex

The Secretary described the progress made in developing the nursery at the Annex. A laborer was employed for the summer season. Through the use of a garden tractor, after the initial cultivation was done by a man and team, it was possible to summerfallow and free several acres of couch grass so that it will be ready for planting during the 1940 season.

Preliminary plans have been completed for the construction of an 84' greenhouse and head house, and for the removal of the Bonfield cottage to its new site adjacent to the proposed greenhouse. This work will be proceeded with if the necessary funds are made available.

The meeting adjourned at 5 p.m.

APPENDIX "A"

Project Outline

I.	Breeding	- Dr. Johnson
II.	Cytogenetics	- Dr. Peto
III.	Wood Technology	- Dr. Johnson
IV.	Vegetative Propagation	- Mr. Farrar and Dr. Grace
V.	Pathology	- Mr. Riley
VI.	Entomology	- Dr. Attwood
VII.	Equipment and Facilities	-
G.	General	-

I. BREEDING

A. Selection and breeding of natural types

1. Testing of select native types
2. Testing of select exotic types
3. Controlled-pollination progeny tests
4. Pure-line breeding
5. Intercrossing of pure lines
6. Selection of parental types
7. Selection of seed trees for natural regeneration

B. Hybridization

1. Intervarietal crosses
2. Interspecific crosses
3. Intergeneric crosses
4. Technique

C. Nursery tests and increase blocks

1. Routine preliminary tests
2. Disease garden tests
3. Routine increase of selected material

D. Plantation tests

1. Routine preliminary tests
2. Zonated regional tests
3. Commercial-type managed plantations
4. Conservation plantations

E. Reforestation and Afforestation

1. Large-scale cutting production
2. Large-scale seed production
3. Large-scale nursery stock production
4. Reforestation by cuttings
5. Reforestation by seed spotting
6. Reforestation by seed trees
7. Afforestation by cuttings
8. Afforestation by seed spotting

F. Genetics

1. Inheritance of morphological characters
2. Inheritance of physiological characters
3. Character intensification
4. Autosomal linkage
5. Sex linkage

G. Breeding (general)

1. Correlation of juvenile and mature characters
2. Self-sterility studies
3. Testing prospective parents for inherent rooting capacity
4. Dichogamy

H. General

1. Seed germination
2. Seed storage
3. Pollen storage
4. Pollen germination
5. Pollen transport
6. Damping-off control
7. Phenology
8. Seed extraction

II. CYTOGENETICS

A. Production of polyploid forms

1. Heat treatments to produce triploid hybrids in Populus
2. Colchicine treatment of seeds

B. Cytology

1. Populus
2. Pinus
3. Picea

III. WOOD TECHNOLOGY

A. Comparative studies on the properties of hybrid and parental wood

1. Relation of growth rate to wood properties relative to pulping quality in Populus
2. Special chemical properties
3. Special physical properties
4. Histological observations

B. Pulping tests

1. Chemical process
2. Mechanical process

C. Experimental manufacture

1. Pulp and plastic products
2. Matchstock

IV. VEGETATIVE PROPAGATION

A. Stem cuttings

1. Relation of the cuttings to the parent plant
2. Nature of the cuttings
3. Treatment of cuttings
4. Horticultural problems
5. Miscellaneous

B. Root cuttings

1. Relation of the cuttings to the parent plant
2. Nature of the cuttings
3. Treatment of cuttings
4. Horticultural problems
5. Miscellaneous

C. Grafting

1. Multiplication of stock
2. Induction of early flowering
3. Production of flowering branches near the ground

D. Layering

E. Development of vegetatively propagated material

V. PATHOLOGY

A. Observations on freedom from disease in parental or selected stock

   1. Freedom from blister rust in native white pines

B. Determination of degree of resistance and susceptibility to specific diseases

   1. Systematic observations on diseases occurring naturally in nurseries and plantations

   2. Artificial inoculation of selected clones or populations under controlled conditions

APPENDIX B

Diseases of Poplar in the Nurseries at Petawawa Forest Experiment Station, 1939

C. G. Riley

The poplars in the two nurseries were examined three times (Aug. 19, Sept. 13, Oct. 16) in order to determine - (a) what diseases were present, and (b) the relative effect of these diseases on each of the numerous clones present.

(a) Diseases present

The most conspicuous, and apparently the most serious disease present, was caused by a rust fungus of the genus Melampsora, which commonly kills the lower leaves, and causes severe defoliation. As shown by the following table, there was a striking contrast among the numerous poplar clones and individuals, with regard to the degree to which they suffered from this disease. While some were seriously defoliated early in the season, others remained entirely free of rust. On poplar leaves, the fungus produces, first, its orange-colored uredinial pustules, and later, the darker, crust-like telia. The uredospores serve to disseminate the fungus among the poplars in summer, and the telia carry it over winter on the fallen leaves, and produce sporidia the following spring. The sporidia can only infect the alternate host on which aeciospores are produced. These carry the fungus back to poplars, causing the primary infection there. It has been stated that this rust can be carried through the winter on the poplar host, and can, therefore, attack the new poplar leaves of the following summer, without having to pass through the stage on the alternate host. This is a matter to be investigated further. The definite identification of the species of rust concerned, is also a matter for further study.

A die-back disease caused by Napicladium tremulae was responsible for serious injury to a few clones, and negligible injury to others throughout the nurseries. The disease attacks young growing tips, causing them to turn black, and wither.

Septoria leaf-spot was present throughout the nursery. This disease, capable of spreading into stems and branches and causing cankers in certain species of poplar, did not appear to be causing appreciable injury in the material examined.

Other kinds of leaf diseases were observed, none of which appeared to be causing more than negligible injury.

The Strathglass stock in Compartment 6 suffered somewhat from the attacks of aphids. This was called to the attention of Mr. D.E. Gray of the Division of Entomology, who made an inspection.

(b) Severity of disease as related to clones

Following is a list of the poplar clones and other groups examined, together with observations concerning each. The occurrence of Melampsora and its degree of severity are indicated by the numbers 0 to 4 in the three columns headed by the dates of the three respective examinations. The numbers refer to the following ratings as defined by E.J. Schreiner, North-Eastern Forest Experiment Station, in his letter of Sept. 21, 1939, to D.R. Cameron, Dominion Forester:

0. No rust found.
1. Slight rust; a few pustules found on up to 25% of the leaves.
2. Medium rust; a few pustules found on up to 50% of the leaves, or 25% of leaves heavily infected.
3. Badly rusted; practically all of the leaves with at least medium heavy infection.
4. Very badly rusted; practically all of the leaves heavily infected; leaves often dead or dying.

A dash (-) in place of one of the above numbers indicates that no inspection was made, on account of the trees having been removed, cut back, or defoliated before the date of the final inspection.

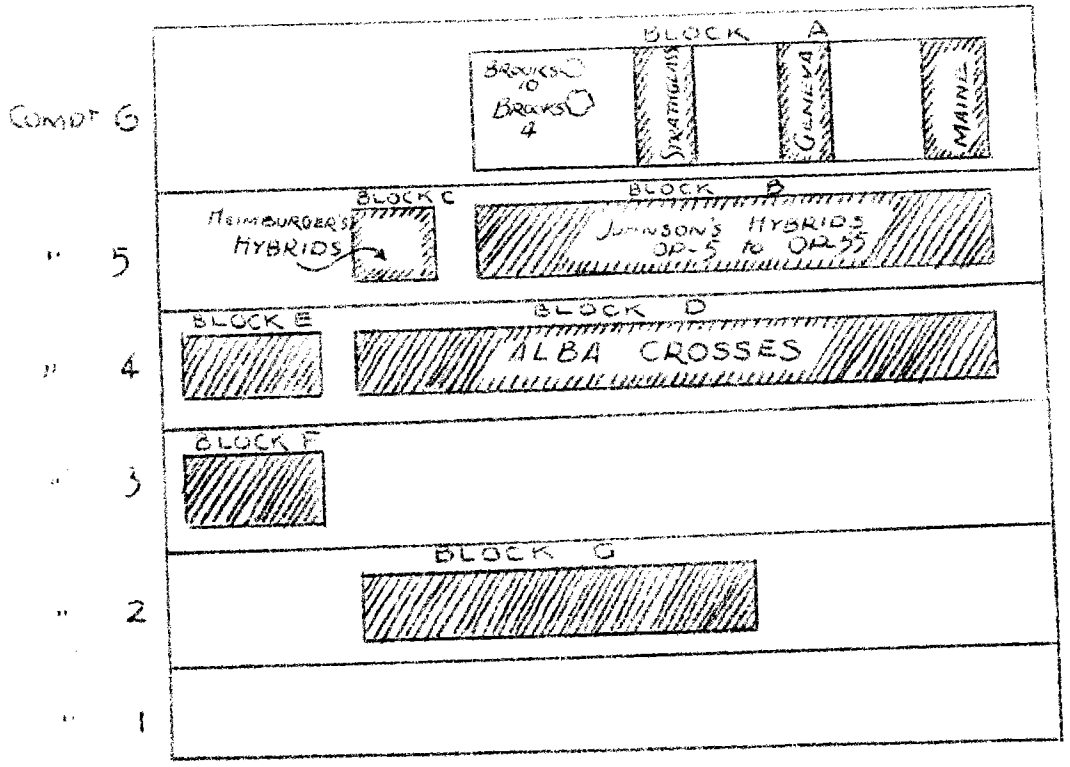
In Nursery No. 2 is a large section in which each tree bears an individual number (CxW1 to CxW 1500). These were not all examined and noted individually, but a careful general examination was made instead. With the exceptions noted below, these trees were heavily rusted. The outstanding exception was CxW 475. Although surrounded by heavily rusted trees, this individual was conspicuous on Sept. 15 for the reason that it still possessed all its foliage while its neighbours were mostly defoliated, principally as a result of rust. The lower leaves of this tree were moderately rusted. Other individuals which suffered from rust to a lesser degree than the general run were: CxW 122, 208, 642, 1134, 1264, 1509, and 1515. The latter two trees bore no number tags, but were in a continuation of the last row following No. CxW 1500. The numbers were established by continuing to count from No. 1500. Septoria leaf-spot was present to a minor degree throughout this section, as elsewhere.

Compartment 5, Nursery No. 1 contains two lots of similarly numbered material planted in duplicate. These have been designated Blocks B and C. Both were examined on the same morning, and the results are here tabulated side by side for purposes of comparison. It is at once apparent that infection was heavier in Block C than in Block B. This might be explained by the assumption that the disease incidence has been affected by local circumstances. The particular circumstance involved may be the fact that Block C lay nearer to the heavily rusted Northwest and Calgary clones in Block E, than did Block B. Whatever may be the explanation, the facts support the principle that too much emphasis should not be placed upon the results of observations on the incidence of disease under uncontrolled circumstances. This method can, no doubt, yield useful indications, but final evaluation of disease resistance must be based on tests under controlled conditions. For purposes of evaluating the disease reaction when two lots of similar material give different results, it is probably safer to accept the higher disease rating.

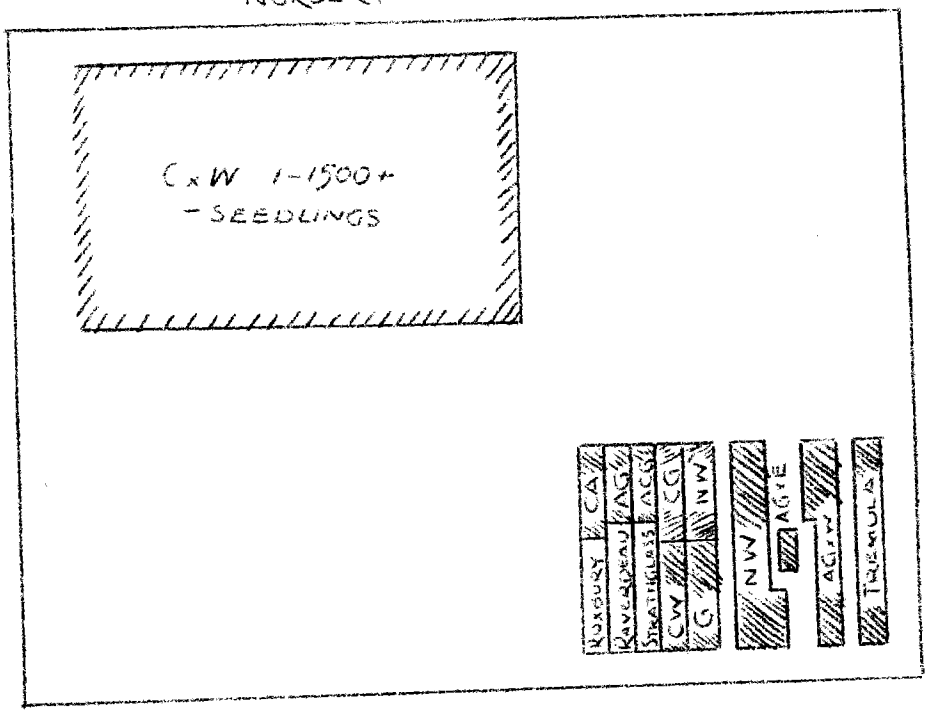
Compartment 5

Block B				Block C			
Clone	Aug.19	Sept.13	Oct.16	Clone	Aug.19	Sept.13	Oct.16
OP - 5	0	0	1	As in	0	0	2
OP - 6	0	0	1	Block B	0	0	2
OP - 7	0	0	2		0	0	2
OP - 10	0	0	0		0	0	0
OP - 14	0	0	1		0	0	1
OP - 16	0	0	0		0	0	1
OP - 23	0	0	1		0	0	1
OP - 26	0	0	1		0	0	1
OP - 27	0	0	1		0	0	1
OP - 30	0	0	1		0	0	1
OP - 38	0	0	1		0	0	2
OP - 41	0	0	1		0	0	0
OP - 42	0	0	1		0	0	2
OP - 44	0	0	0		0	0	0
OP - 45	0	0	1		0	0	1
OP - 46	0	0	0		0	0	0
OP - 47	0	0	0		0	0	1
OP - 48	0	0	0		0	0	0
OP - 49	0	0	0		0	0	1
OP - 50	0	0	0		0	0	0
OP - 51	0	0	1		0	0	2
OP - 52	0	0	1		0	0	1
OP - 53	0	0	1		0	0	2
OP - 54	0	0	0		0	0	1
OP - 55	0	0	1		0	0	0

NURSERY 1 DFES



NURSERY 2 DFES



Clone	Aug.19	Sept.13	Oct.16
Compartment 6 - Block A			
Maine	0	0	0
Geneva	0 0	0	0
Strathglass	0	0	1
Brooks $4	0	0	-
Compartment 5 - Block C (Part) (Remainder of Block C recorded in table with Block B)			
Generosa	0	0	1
22 - 11	0	0	1
Laurifolia-5	0	0	2
Moscowiensis	0	2	4
Acuminata 1	0	3	3
Suaveolens 1	0	2	-
Compartment 4 - Block D			
AG - 21	0	0	-
AG - 2	0	0	-
CG - 17	0	0	-
AG - 15	0	0	-
AG - 22	0	0	-
ACG - 12	0	0	-
ACG - 27	0	0	-
AG - 20	0	0	-
ACG - 28	0	0	-

Clone	Aug.19	Sept.13	Oct.16
Compartment 4 - Block E			
N W	4	4	-
Calgary 1	3	4	-
Calgary 6	3	4	-
Calgary 4	3	3	-
Calgary 16	3	3	-
Acuminate 1	0	2	-
TG - 2	0	0	0
TG - 3	0	0	0
TG - 4	0	0	-
TG - 5	0	0	-
Tremula	0	0	1
Roxbury	0	0	1
Rochester	0	0	1
CxW branchy	0	0	-
CxW ruff	0	3	-
Calgary 17	0	2	-
Compartment 3 - Block F			
TG - 2	0	0	1
TG - 4	0	2	1
Trichocarpa victoria (Trees No. 6 & 8 from N. end heavily rusted. Others free)	0	0	1
D 4	0	3	-
D 1	0	0	4
D 2	0	3	4

Clone	Aug.19	Sept.13	Oct.16
Compartment 3 - Block F (cont.)			
T x S	0	3	1
TG 5	0	0	1
TG 3	0	0	2
Tremula	0	0	1
Gelrica	0	0	2
Acum.xEugenie (Some trees free, others heavily rusted)	0	4	-
P x NW	0	4	-
Angulata erecta D 4	0	0	3
Koreana 1	0	0	2
Koreana 8	0	0	3
Cathayana 13	0	0	2
Koreana 5	0	0	2
Cath. 20	0	0	2
" 18	0	0	3
" 19	0	0	2
" 14	0	0	2
" 16	0	0	2
AT 2	0	0	0
AG 7	0	0	0

Clone	Aug.19	Sept.13	Oct.16
Compartment 2 - Block G			
Verni rubens	0	2	-
Trichocarpa	0	1	-
Masson	0	4	-
Calgary 23	0	0	-
Jackii 1	0	4	-
Calgary 23	0	1	-
Jackii 2	0	3	-
Riverdeau	0	0	-
Nursery #2	Aug.21	Sept.15	
CxW Nos. 1-1500 See text.			
Ca - 1	0	0	-
AG - 8 (Single pustule found on Aug.21)	0	0	-
AGC - 17	0	0	-
CG - 28	0	0	-
AG - 22	0	0	-
AG - 12	0	0	-
N W	2	4	-
G - 1	0	2	-
C W	2	3	-
N W	1	2	-
AGxE	1	3	-
AGxW	1	3	-
Tremula	1	2	-

The occurrence of Napicladium die-back in both nurseries is recorded as being "light", "medium" or "severe" as follows:

Compartment	Clone	Napicladium
6	Strathglsss	light
4	T G 2	severe
	T G 3	"
	T G 4	"
	T G 5	"
3	T G 2	"
	T G 4	"
	T G 5	"
Lower-Nursery	AGC 17	light
	C G 28	"
	A G 22	"
	A G 12	"
	G - 1	"

Initial Distribution List

Copy No.	
1	Dr. R. Newton
2	Dr. C. E. Atwood
3	Mr. D. Roy Cameron
4	Dr. N. H. Grace
5	Dr. C. Heimburger
6	Dr. L.P.V. Johnson
7	Mr. C. G. Riley
8	Mr. W. M. Robertson
9	Dr. H. A. Senn
10	Dr. F. H. Peto (secretary)
11	Dean C. J. Mackenzie
12	Mr. S. P. Eagleson (office copy)
13	Mr. S. J. Cook (Board Room copy)
14	Dr. J. M. Swaine
15	Mr. J. L. Farrar
16.	Mr. A. W. McCallum
17	Dr. J. W. Boyes
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