COMMITTEE *on* FOREST TREE BREEDING

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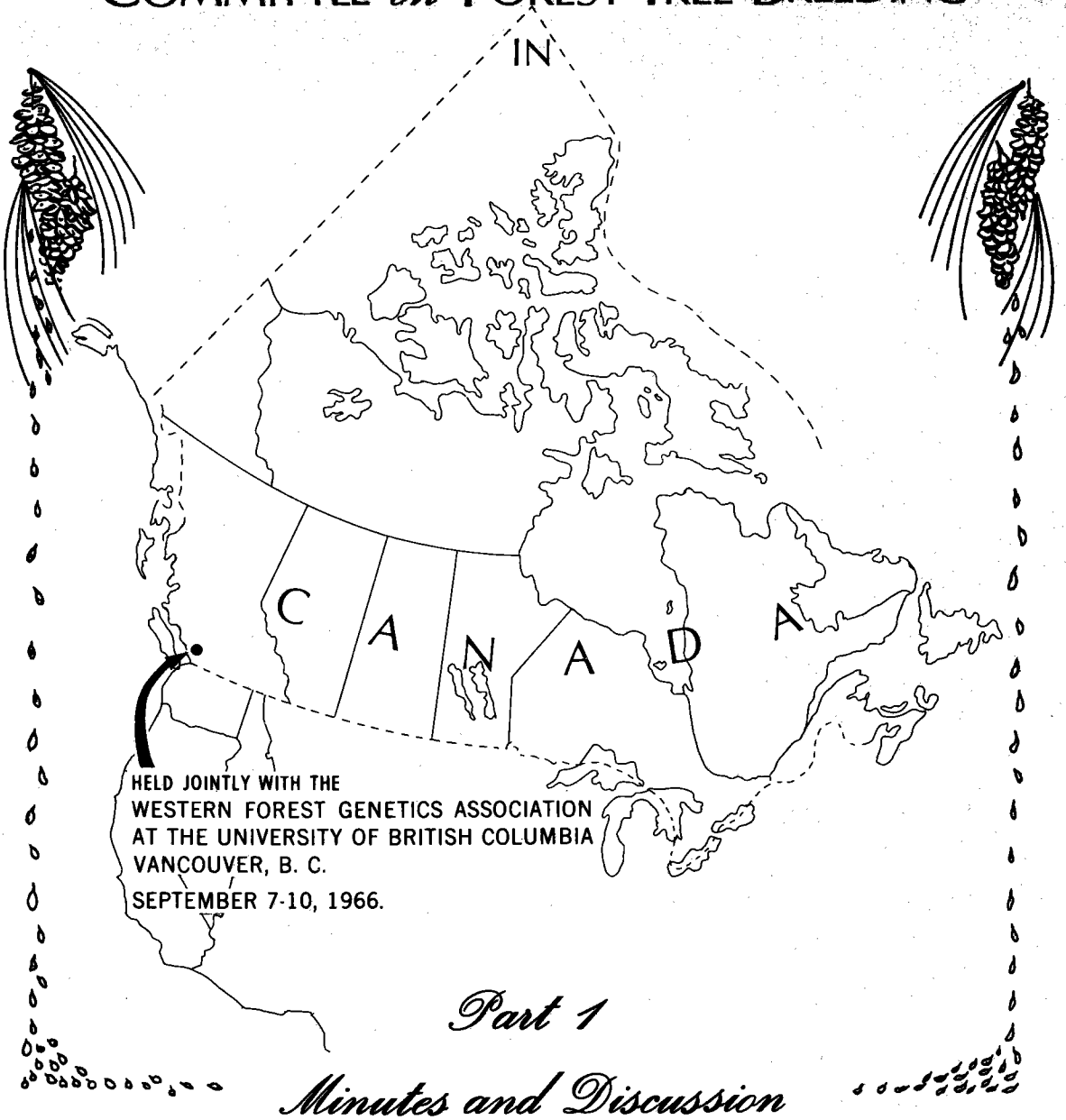

HELD JOINTLY WITH THE
WESTERN FOREST GENETICS ASSOCIATION
AT THE UNIVERSITY OF BRITISH COLUMBIA
VANCOUVER, B. C.
SEPTEMBER 7-10, 1966.

Part 1

Minutes and Discussion

PART 1

MINUTES AND DISCUSSIONS

CONTENTS

Prepared and distributed by the
Forestry Branch,
Department of Forestry and Rural Development,
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A. ATTENDANCE

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Mr. E.V. Allen	Forest Service, U.S.D.A., P.O. Box 520, Shelton, Washington 98584.
Mr. M. Auld	Rayonier Canada (B.C.) Ltd., Honeymoon Bay, British Columbia.
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Mr. J.E. Barker	University of California, School of Forestry, Berkeley, California.
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Mr. V. Robinson	Potlatch Forests Inc., Lewiston, Idaho.

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Dr. O. Sziklai* (Chairman)	University of British Columbia, Faculty of Forestry, Vancouver 8, British Columbia.
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Mr. G. Thomas	Oregon State University, Forest Research Lab., Corvallis, Oregon 97330.
Mr. R.K. Vivian	Rayonier of Canada (B.C.) Ltd., 5409 Greentree Rd., West Vancouver, British Columbia.
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Dr. Chi-Wu Wang	University of Idaho, College of Forestry, Moscow, Idaho 83843.
Mr. J.G. Wheat	Industrial Forestry Association, Rt. 2, Box 3226, Olympia, Washington.

Dr. B.C. Wilson	State of Washington Department of Natural Resources, Rt. 4, Box 424B, Olympia, Washington 98501.
Mr. J. Worrall	Yale University, School of Forestry, 370 Prospect St., New Haven, Connecticut.
Dr. C.W. Yeatman* (Secretary)	Canada Department of Forestry and Rural Development, Petawawa Forest Experiment Station, Chalk River, Ontario.

*C.F.T.B.C. member attending the business meeting, September 7, PM.

B. BUSINESS MEETING

Evening, September 7.

114. Welcome

Prof. Sziklai called the meeting to order at 8.00 p.m. Nineteen members and prospective members (as noted above) attended the business meeting.

115. Minutes of Last Meeting

The minutes of the last meeting were distributed to members as Part 1 of the Proceedings of the Ninth Meeting and were taken as read. The minutes were adopted unanimously.

116. Certification of Tree Seeds and Plants
(see item 108 of previous minutes)

Mr. Holst reported on progress made by the OECD sub-committee charged with developing a set of standards for the "Certification of Forest Reproductive Material Moving in International Trade". The members of the Organisation for Economic Co-operation and Development (OECD) are Austria, Belgium, Canada, Denmark, France, the Federal Republic of Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The sub-committee met during June 1966, in Paris, France, to prepare the final (sixth) draft of proposals to be submitted to the Committee for Agriculture of the OECD. On approval by the permanent committee, the proposals will be forwarded to the governments of the member nations for implementation. The scheme is voluntary, and any seed or plant materials carrying OECD certification labels must conform to the accepted standards.

117. Reviews of Canadian Literature for Silvae Genetica

Nine abstracts were submitted, including a résumé of the Proceedings of the Ninth Meeting of this Committee. No abstracts were received of papers appearing in university or other provincial publications. Abstracts of relevant articles appearing in regional publications should be forwarded to Dr. Yeatman for submission to Silvae Genetica.

118. Report by Wood Properties Sub-committee

A draft of a brief entitled "Breeding for Wood Characteristics" was tabled for consideration by the Committee.

Dr. Kennedy commented that the significance of 'improvement' in wood properties seemed to be overemphasized, in view of the rapidity of change in pulp technology. The present requirements in wood properties differ with species. For example, high wood density is not necessarily desirable. Ten years ago western red cedar was not utilized for pulp, whereas today it is a high quality pulp species. It has thin-walled tracheids - i.e. low-density wood.

A discussion followed concerning realistic goals that might be established in breeding for wood properties. The opinion was expressed that the need may not exist for work in this field. In reply, it was noted that background information on variation in wood properties was lacking. This information is essential if genetic control is to be considered at some future date.

It was concluded that the objective of present research effort in this field should be to gain knowledge of the heritability and range of variation of wood properties in commercial tree species. The present emphasis in breeding programs should be for efficiency of land use, including optimal volume production, form characteristics, hardiness, disease and insect resistance, etc.

Members of the sub-committee were asked to send their comments to Mr. Holst by October 1. The following brief was prepared for submission to forest research authorities in Canada.

BREEDING FOR WOOD CHARACTERISTICS

Brief prepared by

Sub-Committee on Wood Characteristics[1]

Committee on Forest Tree Breeding in Canada

THE PROBLEM

Most Canadian tree breeders are trying to improve growth rate and log quality by provenance testing or individual tree selection. A few Canadian tree breeders are breeding for disease and insect resistance. But not one Canadian tree breeder has been able to give full-time attention to studies of wood characteristics. We would like to draw attention to this rather sad situation in one of the world's leading wood producing countries. We advise that basic studies of wood characteristics should be initiated immediately for Canada's more important pulp and lumber species.

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[1]The Sub-Committee on Wood Characteristics has the following members: Mr. M.J. Holst, Chairman, Tree Breeding and Genetics Section, Petawawa Forest Experiment Station, Department of Forestry and Rural Development, Chalk River, Ont.; Mr. A.J. Carmichael, Wood Quality Unit, Research Branch, Ontario Department of Lands and Forests, Maple, Ont.; Dr. R.W. Kennedy, Wood Biology Section, Forest Products Laboratory, Department of Forestry and Rural Development, 6620 Marine Drive, Vancouver 8, B.C.; Mr. H.S.D. Swan, Division of Silviculture, Woodlands Research Department, Pulp and Paper Research Institute of Canada, 570 St. John's Road, Pointe Claire, Que.; Prof. O. Sziklai, Faculty of Forestry, University of British Columbia, Vancouver 8, B.C. The advice and criticism of Dr. J.L. Ladell and Dr. S.G. Reid, Ontario Research Foundation, 43 Queen's Park, Crescent East, Toronto 5, Ont., and of Dr. D.P. Fowler, Southern Research Station, Ontario Department of Lands and Forests, Maple, Ont., is gratefully acknowledged.

BREEDING FOR VIGOUR, HEALTH, AND LOG QUALITY

Any tree-breeding project should aim for fast-growing, well-adapted and healthy populations of trees which are resistant to environmental extremes. Some species have relatively well-adapted disease and insect free local populations which are suitable for selection and breeding. Other species have severe disease (or insect) problems, such as the blister rust on eastern and western white pine. Here it is only natural to concentrate first on the breeding of resistant varieties, and then to proceed with the selection for superior growth and quality. In some areas the local populations may lack vigour or quality or both, and better populations of the same species or exotics must be substituted. These introduced populations can then be exposed to further selection and breeding.

When breeding for log and timber characteristics the procedure is as follows. From populations of healthy vigorous trees individuals are selected that show superiority in these traits: growth rate (height being a better indicator than diameter); log quality (straight cylindrical stem with small taper, and no kinks, sweep or spiral grain); crown form (small horizontal branches with good self pruning); the wood should be sound and of high specific gravity, free of loose knots, compression wood and other defects. The selected trees are tested and may be propagated in seed orchards.

Research on provenance problems is carried out in a limited number of regions with a limited number of species. Selection and testing of single trees is even more restricted. Only a few species are bred for disease and insect resistance. Work on log characteristics has been confined to recording of quality traits of a relatively small number of plus trees and their comparison trees.

Recommendation

The present work should be continued and broadened. There are many regions in Canada that are not covered by this kind of tree-breeding effort. Due to lack of funds and personnel there are many tree species that have not as yet received attention.

BREEDING FOR PULP YIELD

There are only a few genetic studies of wood characteristics in Canadian tree species. However, a survey of world literature shows that some wood characteristics are heritable and therefore lend themselves to improvement by breeding. By the law of parallel variation it could be expected that important wood characteristics in Canadian tree species would also show enough variation to make selection and breeding profitable. How much improvement can be achieved depends very much on the natural variation of the quality traits within a species, on their heritability, on their economical and technical importance, on location (climate and soil), on propagation and breeding methods, and on money available.

The emphasis in pulpwood production is to produce the maximum amount of usable fibre by weight in the shortest possible time. So far only stem wood has been used, but with better logging and pulping techniques top and branch wood may also be utilized. The aim is to maximize the production of usable fibre per acre.

The important traits we want to improve are therefore: growth rate coupled with high wood density. For each species there may be an upper limit to density with a proper balance between thick-walled and thin-walled fibres. A straight stem is important to reduce compression wood, while branch and crown form may be of minor importance; the importance of core wood is not well understood.

If it is true that industrial technology is more than keeping pace with biology, many of the finer points in pulp and paper making are of only minor interest to the forester, as long as he can produce well-defined raw materials in the woods. This would be a very useful simplification because the breeding work could then be concentrated on height and wood density.

Recommendation

There is an immediate need for working out suitable techniques for assessing whole-tree specific gravity from cores taken from standing trees. This requires detailed and range-wide studies of the species to be considered for a breeding program.

Basic studies of variation in wood characteristics in all major pulp species in Canada are required. The significance of extremes in specific gravity should be studied from the viewpoint of pulp yield, product quality and economics. Heritabilities of wood characteristics should be determined. With such basic information at hand the tree breeders can plan suitable models to improve wood characteristics, or to make them more uniform. Uniformity, or reduced variation among succeeding generations of trees, may reduce problems of processing.

SUMMARY

Whether the aim is to produce lumber or pulp, tree breeders are fairly confident that volume production, log quality and wood characteristics can be improved by provenance research and single tree selection. Whether or not this improvement is economically feasible will depend on the natural production capacity of the environment and the natural variation within the species. Thus breeding may pay a higher return in regions with high natural productivity than in regions of low natural productivity; and some species will lend themselves to improvement to specific quality traits while others will not.

In Canada basic genetic studies of wood characteristics are almost non-existent. Intensified research in this economically important field is recommended.

GENERAL RECOMMENDATIONS

Canadian studies on the inheritance of vigour, log characteristics, and disease and insect resistance indicate that tree-breeding is an effective technique for raising the yield and improving the quality of the forest. A cooperative program between Industry, Provincial and Federal Forestry Departments and Universities is required to assure a practical improvement in the forest on a sound theoretical basis.

Range-wide studies of wood characteristics should be conducted in Canada's major pulpwood species to define range and kind of variation, so proper genetic models can be constructed for improvement or reduced variability of desirable quality traits. Growth rate and wood density should have high priority in these studies.

The Department of Forestry and Rural Development should take a lead in these studies through their Forest Product Laboratories and their expanding tree-breeding programs. To share the burden of routine work and to assure complete coverage of a species range it is suggested that Universities, Provincial and Industrial Research Organizations have technicians trained in the Forest Product Laboratories.

Heritability studies on wood characteristics should be initiated at all the major tree-breeding centres in Canada. Universities could contribute substantially through postgraduate programs.

Research studies on wood characteristics, such as those of the Research Branch of the British Columbia Forest Service, the Research Branch of the Ontario Department of Lands and Forests, the Ontario Research Foundation, the Faculties of Forestry at the Universities of British Columbia, Toronto and Laval, and of the Pulp and Paper Research Institute of Canada should be promoted and publicized.

119. Membership

(a) The death of Dr. ~~André Lafond, Laval University, was recorded with deep regret.~~ André Linteau, formerly District Forest Officer, Department of Forestry, Quebec District, was recorded with deep regret.

(b) Changes in Membership. Three men listed as active members had not replied to recent correspondence. The secretary was instructed to write them again to determine their interest in the Committee.

(c) New Members. The following were elected members of the Committee:

Mr. W.H. Brittain	Corresponding	J.D. Irving Ltd., 284 Union St., Saint John, New Brunswick.
Mr. J. Carlson	Corresponding	B.C. Forest Service, Cowichan Lake Experiment Station, Cowichan, British Columbia.
Dr. Yves Desmarais	Active	Jardin Botanique de Montréal, 4101 est, rue Sherbrooke, Montréal, Québec.

Dr. D.J. Durzan	Active	Petawawa Forest Experiment Station, Department of Forestry and Rural Development, Chalk River, Ontario.
Dr. A.G. Gordon	Corresponding	Forest Biology Lab., Ontario Department of Lands and Forests, P.O. Box 490, Sault Ste. Marie, Ontario.
Dean J. Gardner	Sponsoring	Faculty of Forestry, University of British Columbia, Vancouver, British Columbia.
Mr. D.L. Handley	Corresponding	Forestry Division, MacMillan and Bloedel Co. Ltd., Nanaimo, British Columbia.
Mr. Mats Hagner	Active	Alberta-N.W.T.-Yukon Region, Department of Forestry and Rural Development, Calgary, Alberta.
Dr. R.W. Kennedy	Active	Wood Biology Section, Department of Forestry and Rural Development, Forest Products Lab., 6620 Marine Drive, Vancouver 8, British Columbia.
Dr. J.F. Klein	Active	Manitoba-Saskatchewan Region, Department of Forestry and Rural Development, 25 Dafoe Road, Fort Garry, Winnipeg 19, Manitoba.
Miss R.M. Rauter	Corresponding	School of Forestry, University of Toronto, Toronto, Ontario.
Dr. A.H. Teich	Active	Petawawa Forest Experiment Station, Department of Forestry and Rural Development, Chalk River, Ontario.

The secretary requested that he be permitted to add or delete the names of 'corresponding' and 'sponsoring' members as relevant changes in personnel and positions occur.

Permission was granted.

120. Location and Date of Next Meeting

Dr. Heimburger noted that the Committee had not yet held a meeting in the Prairie Provinces and suggested that Dr. W.H. Cram be approached. Breeding for shelter belts and Christmas trees would be the principal topics of such a meeting and should also be of interest to research men in the Central States.

In the event that the meeting could not be held at Indian Head, it should be located in eastern Canada[1]. These suggestions were adopted by the Committee.

[1]After the meeting, Dr. Cram advised the Chairman that owing to pressure of administrative duties he is not able to chair the CFTBC for the coming two years. Dr. Heimburger accepted the position and has arranged for the next meeting to be held at Macdonald College from August 7 to 11, 1968. The Northeastern Forest Tree Improvement Committee has been invited to join the Committee for this meeting.

The date of the next meeting will be decided by the Chairman.

121. Position of Secretary to the Committee

Dr. Sziklai recommended that the title of 'Secretary' be changed to 'Executive Secretary' as being more in line with the responsibilities of the position. In view of the agreed policy of the Department of Forestry and Rural Development of publishing the biennial Proceedings, a member of the Department will normally be elected to this position. The Committee adopted these suggestions.

122. Election of Officers

Dr. Heimburger submitted names for the positions of Chairman and Executive Secretary on behalf of the nominating committee. Dr. Cram was elected Chairman subject to his acceptance. Alternatively, Dr. Heimburger agreed to serve for the Eleventh Meeting of the Committee. Dr. Yeatman was elected Executive Secretary, with Dr. Morgenstern as alternate.

123. Miscellaneous Items

(a) The Committee recommended that the proceedings of the present joint meeting be published as previously and that papers by members of the Western Forest Genetics Association be included.

(b) Dr. Sziklai thanked members for their co-operation during the course of both business and technical sessions of the meeting.

(c) A vote of thanks was extended to the Chairman and the Secretary for their work in running the affairs of the Committee.

C. TECHNICAL MEETING

Discussion

Morning	September 7
Morning and afternoon	September 8

The one hundred people who attended the meeting included members of the CFTBC and WFGA and guests from Canada, United States and abroad. The technical sessions included: 1) discussion by invited speakers on "Selection, Seed Orchard Establishment, Management and Flower Induction"; 2) discussions of reports submitted by Committee and Association members present. A seminar on Forest Genetics and Tree Improvement was conducted on September 9 by Professor W.J. Libby. The proceedings of this seminar have been edited separately by Professor Sziklai, University of British Columbia School of Forestry.

The papers presented at the meeting are published in Part 2 of these Proceedings.

The Chairman, Professor Oscar Sziklai, opened the meeting and introduced the President of the University of British Columbia, Dr. J. MacDonald. In his welcoming address, Dr. MacDonald noted the prime economic importance of the forest industry to British Columbia and emphasized the breadth of opportunity open to research and development.

1) Selection, Seed Orchard Establishment, Management and Flower Induction

After the formal presentations by Dr. J.W.F. Duffield and Mr. T.E. Greathouse and a short discussion of selection of plus trees by Dr. R.K. Campbell, further comment was invited from the audience.

Dr. Namkoong raised the question of the number of generations that could profitably be used after initial plus tree selection without the need to introduce new variability. It was considered that at least three generations would be safe and 20 to 30 clones were considered sufficient for long-term breeding. Mr. Bingham quoted estimates of inbreeding in a 24-clone orchard of western white pine as 6% in the F1, 13% in the F2 and 27% in the F3. Thus inbreeding does become an important factor and provides a sound reason for including a greater number of clones than is commonly considered necessary. Dr. Klein commented that in mice, variability remained after 20 generations of inbreeding, with large populations following the initial cross. Dr. Libby remarked that in relation to alternative methods of improvement - for example, in seed production areas - the level of inbreeding should not be excessive in the clonal seed orchard.

Dr. Snyder agreed with Dr. Duffield that advantage might be taken of high specific combining ability but cautioned against negative combining ability. He felt more data were needed to support this type of breeding. Mr. Bingham added that a 10% to 12% increase in rust resistance due to specific combining ability

had been found in western white pine, and that negative values had also been demonstrated.

The question was raised of panmictic pollination within an orchard and of contamination from pollen from outside. Dr. Duffield commented that research techniques using irradiated pollen had been developed by Dr. McElwie at North Carolina State University but that he was not aware of the results. Dr. Squillace described a test in a six-year-old 5-acre demonstration seed orchard in which male inflorescences were removed before pollen release. There was a 400-foot isolation strip around the orchard. The female flowers developed a normal seed set, thus demonstrating that there was no shortage of outside pollen. However, the results did not answer the question of pollen competition. Dr. Silen commented that Finnish investigations had demonstrated higher pollen counts some 300 feet above than within a stand. Higher pollen counts were obtained within a Norway spruce seed orchard than within nearby stands.

Dr. Fowler wondered what advantage could be taken of moving Douglas-fir outside the range of the species to provide isolation and induce prolific flowering. Mr. Burch commented that the British Columbia Forest Service had exchanged seed orchard material with France but that the objective was primarily one of identification of seed origin.

2) Members' Reports

Only the reports of the members present were open for discussion. Most of the time available was occupied by presentations of summaries by the authors. Some further discussion is reported below.

A.J. Carmichael

Replying to a question concerning uniformity of sampling, Mr. Carmichael said the first sample of black spruce was from an even-aged (90-year-old) merchantable stand growing on a site class 1. He said that wider ranges of sites and ages were to be sampled.

W.G. Dyer

Mr. Dyer commented further that scions are collected in winter when frozen and are thawed out slowly before grafting. Northern material for seed orchards is being established at southern locations both for convenience and in the hope of obtaining earlier flowering and pollen isolation.

E.R. Humphreys

Commenting on Mr. Humphreys' question concerning early progeny tests, Dr. Nienstaedt noted that in eastern hemlock there was a high correlation between fall frost injury and performance in growth chambers. However, volume production and growth rate are complicated characteristics and are not as readily subject to early tests. Mr. Holst reported positive parent/progeny correlations in white spruce and suggested

that in this species selection for height followed by progeny tests should be effective.

D.P. Fowler

Dr. Fowler confirmed that dead pollen was included in the pollen mixtures employed in attempts to induce interspecific hybrids with red pine.

D. FIELD TRIPS

A field trip to the U.B.C. Research Forest at Haney, September 7, included inspection of Douglas-fir provenance trials, clone tests, controlled-pollinated progeny tests and plus trees of Douglas-fir and western hemlock. A demonstration was given of a truck-mounted, high-lift platform suitable for controlled pollination.

On Saturday, September 10, Dr. Orr-Ewing conducted a field trip at the British Columbia Forest Service Experiment Station at Cowichan Lake, Vancouver Island. A large fenced area is provided for the clone bank where grafts are established of Douglas-fir and representatives of other Pseudotsuga species. The oldest clones are 10 years of age and have yielded large cone crops. Some of the younger grafts have borne sufficient female flowers for progeny tests using controlled pollination. A number of grafts have died from incompatability between scion and rootstock. Basic information on the physiology of graft unions is required, but an operative procedure developed by Mr. J. Carlson, nurseryman in charge of the clone bank, restores a failing union at least temporarily.

A new experimental nursery has been built close to the station headquarters. Differences between progenies and populations of Douglas-fir and white spruce were seen in one-year-old seedlings grown in specially constructed cold frames. Uniformity of site and optimal growth in the transplant beds was ensured by introducing high-quality soil and mixing it in situ with soil conditioners and fertilizer.