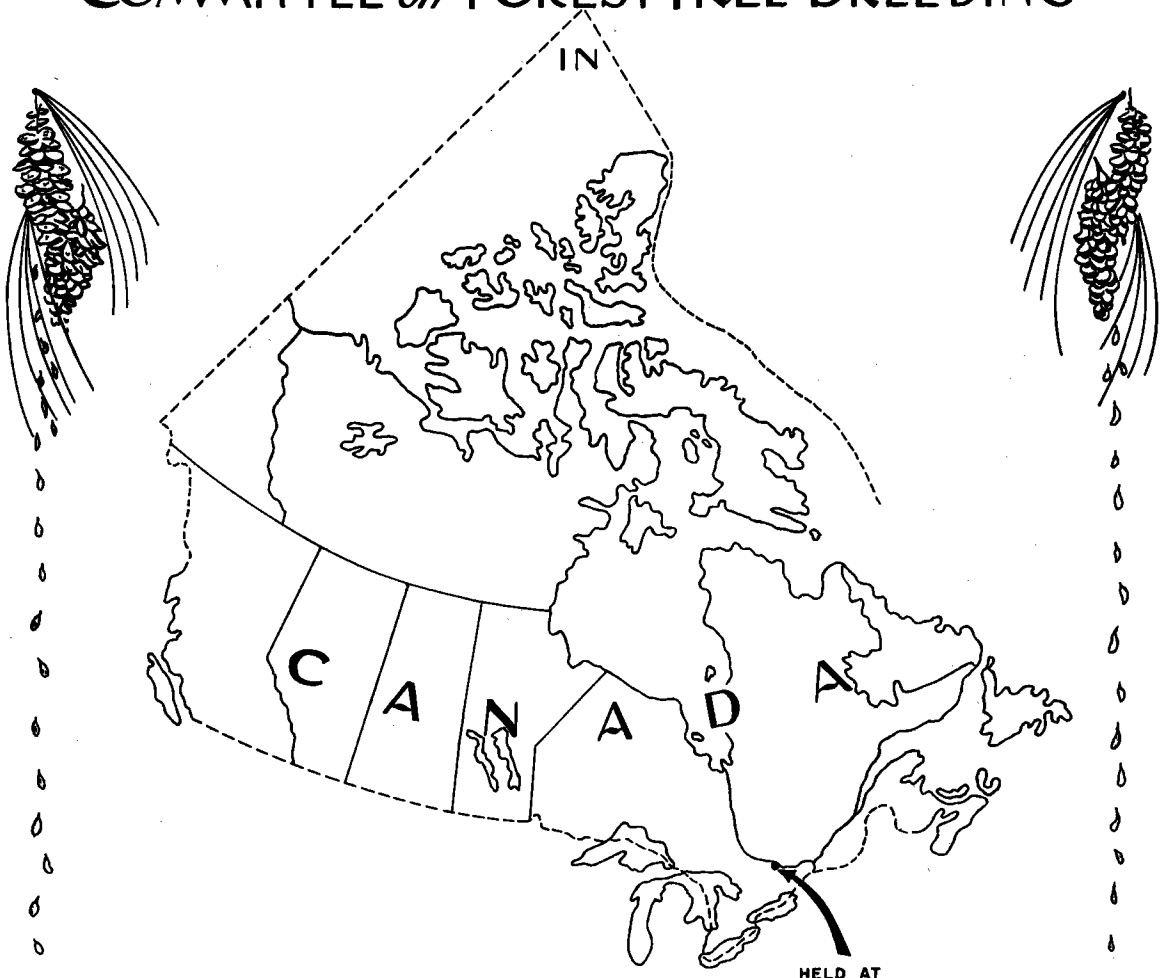
Proceedings of the Ninth Meeting

OF THE

COMMITTEE *on* FOREST TREE BREEDING

IN



HELD AT
PETAWAWA FOREST EXPERIMENT STATION
SEPTEMBER 16th.– 18th.
1964

Part I

Minutes and Discussions

PART 1

MINUTES AND DISCUSSIONS

CONTENTS

Prepared and distributed by the
Forest Research Branch,
Department of Forestry, Canada,
Ottawa

A. ATTENDANCE

Dr.	H.I. Baldwin	Center Road, Hillsboro, New Hampshire, U.S.A.
Miss	Inga Berg	Plantkultur, Rörsiögatan 18, Malmöl, Sweden.
Dr.	T.C. Brayshaw	Department of Forestry, Canada, Forest Research Branch, Petawawa Forest Experiment Station, Chalk River, Ontario.
Mr.	A.J. Carmichael*	Ontario Department of Lands and Forests, Research Branch, Southern Research Station, Maple, Ontario.
Dr.	E.H. Castellani	Poplar Research Institute, Casale Munferrato, Italy.
Dr.	K.E. Clausen	Lake States Forest Experiment Station, Institute of Forest Genetics, Rhinelander, Wisconsin, U.S.A.
Dr.	J.R. Clements	Department of Forestry, Canada, Forest Research Branch, Petawawa Forest Experiment Station, Chalk River, Ontario.
Mr.	J.M. Conway*	Consolidated Paper Corporation Ltd., Grand'Mere, Qué.
Dr.	W.H. Cram*	Canada Department of Agriculture, Tree Nursery, P.F.R.A., Indian Head, Saskatchewan.
Mr.	A. Demers	Department of Forestry, Canada, Forest Research Branch, Valcartier Forest Experiment Station, P.O. 35, Sillery, P.Q.
Mr.	D. Dorn	New York State College of Forestry, at Syracuse University, N.Y., U.S.A.
Dr.	D.J. Durzan	Department of Forestry, Canada, Forest Research Branch, Petawawa Forest Experiment Station, Chalk River, Ontario.
Mr.	W.G. Dyer	Ontario Department of Lands and Forests, Timber Branch, Reforestation Section, Toronto, Ontario.
Dr.	Carin Ehrenberg	The Royal College of Forestry, Stockholm 50, Sweden.
Mr.	E.J. Eliason	Head, Forest Research Unit, New York State Conservation Department, Albany, New York, U.S.A.

*Member attending the business meeting, September 16 a.m.

Prof.	J.L. Farrar	University of Toronto, Faculty of Forestry, Toronto, Ontario.
Dr.	D.P. Fowler*	Ontario Department of Lands and Forests, Research Branch, Southern Research Station, Maple, Ontario.
Dr.	D.A. Fraser*	Department of Forestry, Canada, Forest Research Branch, Petawawa Forest Experiment Station, Chalk River, Ontario.
Dr.	H.H. Hattemer	Institut für Forstgenetik und Forstpflanzenzüchtung, Schmalenbeck/Holstein, Germany.
Mr.	W.T. Hauck	New York State College of Forestry, at Syracuse University, N.Y., U.S.A.
Dr.	C. Heimburger*	Ontario Department of Lands and Forests, Research Branch, Southern Research Station, Maple, Ontario.
Mr.	M.J. Holst* (Chairman)	Department of Forestry, Canada, Forest Research Branch, Petawawa Forest Experiment Station, Chalk River, Ontario.
Mr.	R.W. Hummel	Ontario Department of Lands and Forests, Timber Branch, Reforestation Section, Toronto, Ontario.
Mr.	E.R. Humphreys	Kimberly-Clark Pulp and Paper Co., Longlac, Ontario.
Dr.	A. Hyppel	Royal College of Forestry, Stockholm 50, Sweden.
Mr.	N.H. Kreiberg	Ontario Department of Lands and Forests, Tree Seed Plant, Reforestation Section, Angus, Ontario.
Dr.	H.B. Kriebel	Ohio Agricultural Experiment Station, Wooster, Ohio, U.S.A.
Mr.	C.H. Lane*	Ontario Department of Lands and Forests, Timber Branch, Reforestation Section, Toronto, Ontario.
Prof.	D. Lester	University of Wisconsin, Forestry Department, Madison, Wisconsin, U.S.A.
Dr.	H. Nienstaedt	In-Charge, Forest Genetics Research, Institute of Forest Genetics, Lake States Forest Experiment Station, Rhinelander, Wisconsin, U.S.A.
Prof.	L. Parrot*	Laval University, Faculty of Forestry, Quebec, P.Q.
Mr.	J.A. Pitcher	U.S. Forest Service, North Central Region, 710 N. 6th St., Milwaukee, Wisconsin, U.S.A.

Dr.	I.C.M. Place	Officer in Charge, Petawawa Forest Experiment Station, Department of Forestry, Canada, Chalk River, Ontario.
Dr.	K.J. Roller	Department of Forestry, Canada, Forest Research Branch, Manitoba-Saskatchewan District, Winnipeg, Man.
Dr.	J.S. Rowe	Department of Forestry, Canada, Forest Research Branch, Ottawa, Ontario.
Dr.	P.O. Rudolf	Lake States Forest Experiment Station, St. Paul, Minnesota, U.S.A.
Dr.	T.D. Rudolph	Lake States Forest Experiment Station, Institute of Forest Genetics, Rhinelander, Wisconsin, U.S.A.
Mr.	J. Salm	Canadian International Paper Co., Harrington Forest Farm, Calumet, P.Q.
Mr.	B. Søegaard	Royal Veterinary and Agricultural College, Hørsholm, Denmark.
Prof.	G.R. Stairs	New York State College of Forestry at Syracuse University, Syracuse, N.Y., U.S.A.
Dr.	C.R. Sullivan*	Department of Forestry, Canada, Forest Entomology and Pathology Branch, Sault Ste. Marie, Ontario.
Mr.	H.S.D. Swan*	Pulp and Paper Research Institute of Canada, 3420 University St., Montreal, P.Q.
Prof.	O. Sziklai*	University of British Columbia, Faculty of Forestry, Vancouver, B.C.
Prof.	J.W. Wright	Michigan State University, Forestry Department, East Lansing, Michigan, U.S.A.
Mr.	C.W. Yeatman* (Secretary)	Department of Forestry, Canada, Forest Research Branch, Petawawa Forest Experiment Station, Chalk River, Ontario.

B. BUSINESS MEETING

Morning, September 16.

104. Welcome

Mr. Holst called the meeting to order at 9.30 a.m. and welcomed members to the Ninth Meeting of the Committee. Thirteen members (as noted above) attended the business meeting.

105. Minutes of the Last Meeting

The minutes of the last meeting had been distributed to all members by mail and were taken as read. The minutes were adopted unanimously. On behalf of the Committee, the Chairman thanked Dr. Heimburger and Mr. Morgenstern for submitting a report on the 8th meeting to the Forestry Chronicle. (For. Chron. 39(4):480-481).

106. Membership

(a) Deceased. Mr. Arne Rosholm died on June 14, 1964 at Grand'Mere. Mr. Holst had written a letter of consolation expressing the loss felt by himself and other members of the Committee who had known him.

(b) Resignations. Letters of resignation were received from the following members:

Dr. C.J. Bishop
Mr. W.V. Hancock
Dr. R.J. Moore
Mr. R.W. Thompson

(c) Changes in Membership. The following changes are recorded:

Dr. G.S. Allen from 'sponsoring' to 'corresponding'
Mr. J.T. Dorland, from 'active' to 'corresponding'
Dean T.G. Wright, from 'corresponding' to 'sponsoring'.

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

Mr. J.E. Beamish	Sponsoring	Chief, Water Development Service, P.F.R.A., Canada Dept. of Agriculture, Regina, Sask.
Mr. G.H.D. Bedell	Corresponding	District Forest Officer, Ontario District, Dept. of Forestry, Canada, 4 Yonge St. South, Richmond Hill, Ont.
Mr. J.M. Conway	Corresponding	Consolidated Paper Corporation, Grand'Mere, Que.
Mr. A. Demers	Active	Forest Research Branch, Dept. of Forestry, Canada, Sillery, Québec.
Mr. H.D. Heaney	Corresponding	District Forest Officer, Maritimes District, Dept. of Forestry, Canada, P.O. Box 428, Fredericton, N.B.
Mr. E.R. Humphreys	Active	Kimberly-Clark Pulp and Paper Co. Ltd., Longlac, Ont.
Mr. C. Larsson	Active	Research Branch, Ontario Dept. of Lands and Forests, Southern Research Station, Maple, Ont.
Dr. A. Linteau	Corresponding	District Forest Officer, Québec District, Dept. of Forestry, Canada, P.O. Box 35, Sillery, Québec.
Mr. J.L. McLenahan	Corresponding	District Forest Officer, Alberta District, Dept. of Forestry, Canada, 721 Public Building, Calgary, Alta.
Mr. D.E. Nickerson	Corresponding	District Forest Officer, Newfoundland District, Dept. of Forestry, Canada, Sir Humphrey Gilbert Bldg., St. Johns, Newfoundland.
Mr. V.H. Phelps	Corresponding	District Forest Officer, British Columbia District, Dept. of Forestry, Canada, Victoria, B.C.
Dean E. Porter	Sponsoring	Dean, Faculté d'Arpentage et de Genie Forestier, Université Laval, Québec, Qué.

Mr. L. Roche	Active	Research Division, British Columbia Forest Service, Victoria, B.C.
Dr. K.J. Roller	Active	Forest Research Branch, Dept. of Forestry, Canada, P.O. Box 6300, Winnipeg, Man.
Mr. R.L. Schmidt	Active	Research Division, British Columbia Forest Service, Victoria, B.C.
Mr. E.R. Sexsmith	Sponsoring	Chief Forester, Woodlands Dept., Kimberly-Clark Pulp & Paper Co. Ltd., Longlac, Ont.
Mr. C.C. Thompson	Corresponding	District Forest Officer, Manitoba-Saskatchewan District, Dept. of Forestry, Canada, P.O. Box 6300, Winnipeg, Man.
Mr. J.F. Walker	Corresponding	The Ontario Paper Co. Ltd., Thorold, Ont.
Mr. J.E.D. Whitmore	Corresponding	Canadian Seed Growers Association, P.O. Box 455, Ottawa 2, Ont.

107. Co-operative Studies of Wood Properties

The resignation of Mr. W.V. Hancock from the Committee gave rise to a discussion concerning wood property investigations in relation to tree breeding. Mr. Hancock's resignation followed the conclusion by the Forest Products Laboratory (F.P.L.) of their co-operative arrangement with the Tree Improvement Sub-Committee in British Columbia (See Proceedings 7th and 8th Meetings). The termination of this agreement was thought to be regrettable. Mr. Holst said he has attempted to obtain the co-operation of the F.P.L. in Ottawa for genetic studies, but they are reluctant to do so unless the money and man-power can be provided by the tree breeders.

Dr. Sziklai outlined the history of the evaluation of wood properties of plus trees selected on the West Coast. Four years ago the F.P.L. agreed to make analyses of specific gravity and fibre length in wood cores taken from plus trees. A large motorised boring machine was developed by the F.P.L. for the collection of suitable wood samples. Subsequently, conflicts arose

concerning the selection of trees to be sampled, in which it became clear that the F.P.L. was not able to act as a service agency for routine testing of wood properties because of research policy and lack of staff. The co-operative agreement was concluded in 1963[1]. The Tree Improvement Sub-Committee of the Tree Farm Forestry Committee secured money from industry to continue the work for a further year, but this grant terminated in March 1964. The program is shelved for the moment, although standard cores continue to be collected and are in storage pending the availability of technical assistance.

Dr. Heimburger commented that so long as the wood using industries are not able to make rigid specifications of desirable wood properties in the raw material, the basic determinations of specific gravity and fibre length can be accomplished with simple equipment and may be carried out by technical assistants, e.g. students employed by the tree breeders.

Mr. Holst agreed that simple standard procedures could be adopted but he emphasized that the volume of material involved in these studies was very great.

In further discussion, the importance of adopting standard procedures for both sampling and evaluation was noted. The characteristics to be studied must be agreed upon, and it was suggested that a central laboratory might best carry out the service of analysis.

It was agreed that a sub-committee be formed to prepare a brief on wood quality studies in relation to tree breeding, to include a review of the requirements for such studies and to present proposals of ways and means to accomplish the set objectives. This brief will be submitted at the earliest opportunity to the appropriate authorities for consideration and action. A report on progress will be made at the next meeting.

Members of the "Wood Properties Sub-committee" include: A.J. Carmichael, M.J. Holst, O. Sziklai, H.S.D. Swan.

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[1] See also report by J.C. Heaman, Proceedings, Part II.

Prof. Parrot suggested that Dr. Marcel Goulet, Faculté d'Arpentage et de Genie Forestier, Université Laval, be invited to join the sub-committee.

In conclusion, Dr. Heimburger emphasized that to be effective, any recommendations made by the sub-committee to federal or provincial forest service authorities must have the support of the wood using industries.

108. New Business

Dr. Cram raised the question of the availability in quantity of superior material developed by the tree breeders. The discussion centred on the immediate need for a certification system for tree seed in Canada. This matter is to be the subject for discussion on October 6 during a meeting of Canadian Seed Growers Association to be held in Victoria, B.C., in conjunction with a meeting of the International Crop Improvement Association. Mr. Holst is to deliver a paper at the Seed Growers meeting and he invited comments from Tree Breeding Committee members. In November 1963, Mr. Holst attended a meeting in Paris organized by the OECD (Organization for Economic Co-operation and Development) entitled "Experts' Meeting on the Certification of Tree Seeds and Plants Moving in International Trade". A broad system of classification was agreed upon. This included the basic category of primary importance, that of specifying and certifying the exact origin of tree seed as "source identified". Standards of certification currently in use for grain seed are not suitable for tree seed and the Canadian meeting is being held to establish a basic and simple framework suitable for the certification of tree seed.

Dr. Cram suggested that the standards adopted for alfalfa, a cross-fertilising species, might in part be relevant to tree seed certification.

Since large quantities of seed and sums of money are involved, buyers must have confidence in any certification scheme that may be adopted. An extreme example of incorrect labelling was given, in which a specific order for spruce seed was made to a European source; the seed sent in reply was not even spruce! In Canada, the provincial government services provide small lots of seed

to outside agencies for research purposes, and they also control seed collected for their own needs. Thus the question of certification or warranty of tree seed, particularly as to origin, is largely the problem of the buyer of commercial lots, i.e. buyers in foreign countries, mostly European. The opinion was expressed that it is in Canada's interests to have a reputation for giving reliable information on commercial seed lots and that it should also be of direct concern to this committee. Another example of misrepresentation was cited in which Douglas fir seed of inland origin was twice supplied to the United Kingdom marked as being of coastal-origin.

The problems of certification posed by the seed dealers include possible delays caused by the procedures, and the very limited season available for seed collection. However, it was thought that a practical solution could be found and that although a certification scheme would have to be policed, the additional cost per pound for large lots would not be excessive. Two basic concerns of certification are 1) origin, and 2) quality. Certification might be made the responsibility of a combined government and dealer association. It was suggested that C.I.F. (Canadian Institute of Forestry) members might be asked to co-operate, and further, that the Vancouver section of the C.I.F. in particular take up the question. It was also suggested that a certification authority might issue licences to qualified seed dealers. Dr. Sziklai said that Bernard Rogers and George Allan ought to be contacted as they had worked out a seed certification program for British Columbia two years ago.

The following motion was moved by Cram and seconded by Sziklai:

That the Chairman be a sub-committee of one to represent this Committee in Victoria and that he report back at the next meeting.

Carried.

109. Reviews of Canadian Literature for Silvae Genetica

Mr. Yeatman informed the Committee that he had agreed to submit abstracts to Silvae Genetica of papers concerning forest genetics and

related subjects published in Canada, beginning in 1964. Several members have agreed to abstract regional publications: Dr. Orr-Ewing for the West; Dr. Cram for the Prairies; Dr. Fowler for Ontario; Dr. Parrot for Québec; and Dr. Chiasson for the Maritime Provinces. Mr. Yeatman will review articles appearing in national journals and those published by the Department of Forestry of Canada. To date, reviews of 23 papers have been forwarded to Prof. Langner. Mr. Yeatman said it would be helpful if Committee members and others would forward reprints of relevant papers to himself or to one of the regional reviewers to facilitate a more complete and up-to-date coverage of the field.

110. Name of the Committee

Dr. Cram suggested that the term "Tree Breeding" in the title of the Committee was too specific and that the term "Improvement" might be substituted or included. After a brief discussion it was agreed that no change should be made.

111. Location and Date of Next Meeting

Dr. Sziklai invited the committee to meet at the University of British Columbia in Vancouver in 1966. This offer was gratefully accepted on a motion by Fowler, seconded by Swan. It was agreed that the meeting be held during the second half of August, with the specific dates to be set by the new chairman of the Committee.

112. Election of Officers

Nominations for the positions of chairman and secretary were called for. Dr. Sziklai was elected chairman and Mr. Yeatman elected secretary.

113. Miscellaneous Items

a) Dr. Cram requested that members be advised of the date of the 10th Meeting of the Committee by July 1965 to facilitate administrative requests to attend.

b) The committee gave a unanimous vote of thanks to Mr. E.K. Morgenstern for his work as secretary of the Committee from 1961 to 1964.

c) A second vote of thanks was given to the Chairman, Mr. Holst, for his management of the Committee affairs, including the organization of the current meeting.

C. TECHNICAL MEETING

Afternoon and Evening, September 16

Morning and Evening, September 17

Nineteen members and 26 guests from Canada and abroad attended the technical sessions that included: 1) discussions of biennial reports submitted by members; 2) the presentation of informal illustrated talks by some of the guests and members; 3) a panel discussion on "Red Pine Breeding"; and 4) an informal discussion of "The Influence of Pre-conditioning on Provenance Test Results", a thesis submitted by Dr. Rowe.

WELCOME

Mr. Holst introduced Dr. I.C.M. Place, Officer in Charge, Petawawa Forest Experiment Station, who welcomed the Committee and guests and outlined briefly the work at the Experiment Station.

1) Discussion Arising from Members' Progress Reports

Only the reports of those members present (*) were open for discussion. A list of those submitting reports is given below.

M.G. Boyer
A.J. Carmichael*
L.P. Chiasson
W.H. Cram*
W.G. Dyer*
L.F. Ebell
J.L. Farrar*
D.P. Fowler*
D.A. Fraser*
B.G. Griffith
J.C. Heaman
C. Heimburger*
M.J. Holst*
H.G. MacGillivray
R.J. Moore
A.L. Orr-Ewing
L. Parrot*
J.K. Roller*
J.H.G. Smith, G. Blom
C.R. Sullivan*
O. Sziklai*
R.W. Wellwood, P.G. Haddock, and J. Walters
C.W. Yeatman*

The members' reports are published in the Proceedings, Part II.

A.J. Carmichael

Dr. Stairs noted that processes have been developed for the separation of early-wood and late-wood fibres after pulping micro samples of

wood and that this technique might be of interest to tree breeders. Mr. Carmichael said that this had not been done in the studies reported and furthermore the distinction of early and late wood is not as clear in spruce as in pine.

In reply to a question from Dr. Nienstaedt, Mr. Carmichael said some work has been done with the wood of red pine, but black spruce was the primary species dealt with to date. Dr. Nienstaedt commented further that a correlation had been found between needle weight and plant height in white spruce.

Mr. Holst questioned the choice of black spruce for these initial studies of variability in wood quality because this species has a small ring width and consequently a high density and also frequently a high proportion of compression wood. Mr. Carmichael defended the choice on the basis of the quantitative importance of black spruce as a pulpwood species, about 50 per cent of the total, and the fact that variations in wood properties do occur, whether of heritable or environmental origin.

W.H. Cram

In his introductory remarks, Dr. Cram emphasized the problem of mass reproduction for practical use of proven valuable hybrids.

Dr. Heimburger commented that selecting within Caragana for vigour may lead to a loss of hardiness, which is the important attribute of this species in the prairies. Dr. Heimburger questioned whether "toughness" should not be the main criterion of selection. In reply, Dr. Cram said that tree height in a shelter belt is important for land protection. Losses in material planted as 2:0 seedlings do not exceed one per cent a year. The only way to get rid of established Caragana is with a bulldozer! The species is hardy and proven to be adequately "tough".

In further comment, Dr. Heimburger noted that selections had been made for self-incompatibility, and that some self-incompatible clones were also cross-incompatible. He suggested that it may be possible to use a self-compatible type, and to induce incompatibility by irradiation. Dr. Cram replied that when a compatible clone and a self-incompatible clone were planted together

in a seed orchard, the compatible type would provide the pollen only, the seed coming from the self incompatible clone. Dr. Sziklai asked when and how compatibility can be assessed. Dr. Cram replied that there are two types of incompatibility, 1) pollen incompatibility associated with "S" alleles, and 2) pollen abortion, so that the time of evaluation depends on the type of incompatibility involved.

Dr. Cram was non-committal in reply to Dr. Fowler's question whether a completely self-incompatible spruce could be found. Dr. Roller asked whether Norway spruce had been tested extensively. It is generally not hardy and Dr. Cram emphasized the value of Colorado spruce on the calcarious prairie soils.

W.G. Dyer

Mr. Dyer commented that large quantities of seed are required each year to supply 10 provincial nurseries that produce a total of 62 million seedlings for planting each year. To meet this demand for seed, seed production areas and seed orchards are being established by the Ontario Department of Lands and Forests.

In reply to a question, Mr. Dyer explained that "whalehide" pots are made of impregnated felt paper.

Referring to the listing of seed production areas on page 27, Mr. Eliason enquired about the age of the stands. Mr. Dyer replied that the ages of the current generations vary from 10 to 35 years and that the ages of the original crop trees are 100 years and more.

In seed production areas, cones are collected from the standing trees by climbing with ladders and the tree bicycle. No top pruning is contemplated. Mr. Eliason commented that in New York his group is topping seed production trees to keep the height down. Dr. Fowler remarked that commonly a higher incidence of selfing occurs in the lower crown, and, based on evidence from red pine trees topped by porcupines, topping tends to eliminate the separation of the sexes within the crown and it would therefore lead to increased selfing.

In reply to a question from Dr. Cram, Mr. Dyer said progeny tests were not planned for seed production trees. Diseased and damaged trees are removed.

Answering Mr. Holst, Mr. Dyer said that in 9 out of 10 cases in which plantations have been selected for seed production, the site region of seed origin is known, but not the specific stand of origin.

J. L. Farrar

No discussion arose concerning this report.

D. P. Fowler

Dr. Fowler commented that much of the work with red pine would be dealt with at the panel discussion the following day.

In reply to Dr. Clausen, Dr. Fowler confirmed that true hybrids in the Lariciones group could be distinguished in progeny arising from pollinations in which pollen mixtures had been used.

In reply to Dr. Nienstaedt, Dr. Fowler said the marker gene found in red pine was evidenced as a chlorophyll deficiency factor.

Mr. Holst asked if resistance to shoot moth might be related to the vigour of the root system. Dr. Fowler commented that red pine grafted on to Scots pine, which has the better root system, is not more resistant.

In reply to Dr. Cram, Dr. Fowler said that estimates of relative proportions selfing and out-crossing were made by using the marker genes.

D. A. Fraser

Dr. Fraser reviewed the work in the tree physiology section pertinent to floral initiation in spruce. Anatomical studies were initiated in 1955, and subsequently physiological studies have been emphasized. Dr. W.H. Vanden Born carried out histochemical studies of enzyme distribution in the shoot-tips of white spruce. Seasonal bud respiration has been determined. Dr. D.J. Durzan is studying the nitrogen metabolism of shoot apices.

C. Heimburger

Dr. Heimburger commented that Korean pine is highly

resistant to blister rust and that recent flowering of trees of this species had permitted a number of crosses to be made with pollen of other species. Seedlings of Pinus koraiensis were frost resistant in southern Ontario; they turn red in the early spring but are hardy.

In reply to Dr. Cram, Dr. Heimburger said breeding in poplars is not directed at pulp quality; the first objectives are to develop healthy trees of good form. Dr. Cram suggested that rooting tests should not be based on the first shoots of a poplar seedling, with which Dr. Heimburger agreed, adding that he uses the current shoot of a 1-1 transplant at the end of the second growing season.

Dr. Heimburger agreed with Dr. Nienstaedt that the results of tests of rooting capacity were relative to the conditions under which the tests were made and that selections would have to be tested in other situations before broad conclusions could be reached.

M. J. Holst

Mr. Holst drew attention to the importance of wood density studies in terms of increased pulp yields.

In further comments, he noted that provenance hybridization is a promising method of increasing genetic diversity, and this is especially true of jack pine which is early flowering in plantations, and continues to flower abundantly if planted on wide spacing. Mass cross-pollinations can be made on open flowers in the initial female-flowering-stage if the plantation is reasonably isolated from other flowering jack pine.

Dr. Wright asked what patterns were being used in making provenance hybrids - how many male parents and how many female parents were involved. Mr. Holst replied that population mixtures of pollen were used on any number of females, depending on the amount of material available. No selection of the phenotypes is exercised.

Mr. Swan questioned whether both volume and wood density could be increased simultaneously by breeding, at least, not up to the limits of

variation of each factor taken singly.. He also asked how well wood density could be estimated by eye. Mr. Holst explained that he had separated a series of increment core samples by ocular estimation into three categories, dense, medium and light, and that the correlation with the subsequently determined density values had been very good.

L. Parrot

Dr. Parrot explained that black walnut and butternut provenances were being tested for use in the reforestation of farm land where these species have been cut out since colonisation.

In reply to Dr. Rowe, Dr. Parrot said the adaptability of progeny was evaluated by recording the incidence of frost scars on the main stem of young trees.

In reply to Dr. Stairs question, Dr. Parrot said he was co-operating with Dr. Dave Cook in the New York Conservation Department.

Mr. Holst commented that the Northern Nut Growers Association met in Ontario in August. This group, chiefly from the United States, may be of interest to Dr. Parrot.

K. J. Roller

Dr. Roller explained that he had just recently moved to the Manitoba-Saskatchewan district and so far he has an office, desk and a car and has spent the summer making a survey of the forestry problems in his area. The principal species are white spruce, jack pine and the poplars, and the latter may be of particular importance because of their potential industrial value.

Dr. Roller mentioned the interesting red pine outlier on Black Island in Lake Winnipeg, some distance from the western extension of the red pine range in the Sandilands Forest Reserve. He emphasized the importance of the apparent differences in drought resistance between red pine provenances. Dr. Roller drew attention to a typographical error in his report as presented at the meeting: the specific name of balsam fir is correctly A. balsamea.

Replying to a question by Dr. Cram, Dr. Roller said he was not taking over the poplar tests for the prairie region as he was concentrating his effort in the northern forested areas.

To a question from Mr. Holst, Dr. Roller replied that the red pine results from the Sandilands provenance tests had been compared with the results from similar plantations in Ontario, and although the statistical analysis had not yet been completed, the Raco, Mich., source was always the best and the Stanley, N.S., provenance always the poorest. The absolute difference between them varied with the plantation.

Dr. Roller informed Dr. Rowe that the same red pine provenances were planted in the east (Maritimes), but the data are not immediately available.

C.R. Sullivan

Mr. Holst commented that the type of co-operation between technical experts and tree breeders exemplified by Dr. Sullivan's report is most valuable.

In reply to Mr. Carmichael, Dr. Sullivan said that grafting of white pine did not affect the degree of resistance to weevil attack. The test was valid since scions from old trees were rejuvenated on large, vigorous rootstocks. It is known from Mirov's work that the constituent resins are not affected by the root stock, although water relationships may be affected. Seedling tests of blister rust resistant types will be made in due course.

O. Sziklai

Dr. Sziklai reviewed briefly the B.C. Forest Service program under the direction of Dr. Orr-Ewing and Mr. Heaman. Dr. Orr-Ewing is concentrating on basic research in Douglas fir, with particular emphasis on controlled self- and out-breeding of selected individuals. Mr. Heaman is responsible for the plus tree selection program and progeny testing. Mr. Lawrence Roche is a Ph.D. student at U.B.C. working with interior white spruce. Mr. R.L. Schmidt is studying the provenance problem in Douglas fir. He has selected a number of

representative stands and is looking forward to a good seed year to make the cone collections.

At the University of British Columbia, Dr. Haddock and Dr. Griffith are working on provenance problems in Douglas fir, using half-sib and full-sib progeny analyses. Information is gathered on the characteristics of the soil, parent trees, cones, seed and seedlings. Seedlings will be grown in controlled environments.

An east-west provenance transect has been made and this is to be extended to the north.

In his own work, Dr. Sziklai is carrying on the full-sib progeny studies initiated by Drs. Allen and Orr-Ewing in the 1950's. Four trees on the campus were used to make a polyallel cross including all 16 combinations.

Replying to a question from Mr. Salm concerning the report by Smith, Walters and Blom, Dr. Sziklai said the poplar experiments referred to were planted in the early 1950's and are therefore 10 years or more of age. This work is being carried on by Mr. Blom.

C. W. Yeatman

Mr. Yeatman outlined the information contained in the report on his thesis research into natural variation between seedlings of jack pine provenances when grown in controlled environments. He drew attention to the apparent suppression of shoot extension of the seedlings grown in artificial light of a relatively high and constant intensity (ca. 2000 ft.c.), even when grown under long days (15 and 20 hours). The shoot growth of the seedlings grown in the greenhouse under the same light durations was adequate. Mr. Yeatman emphasized that considerable work needs to be done to determine the conditions leading to optimal, reproducible environments for growing coniferous seedlings.

In reply to a question, Mr. Yeatman said he grew the jack pine seedlings in a standard soil mixture of sand, peatmoss and loam, 1: 1: 1 by volume with additional soluble fertilizer applied uniformly to all treatments.

The possibility of growing the seedlings in a standard nutrient solution had been considered but rejected because of the mechanical complications and lack of the time required to establish the system.

2) Informal Illustrated Talks

The following guests and members gave informal papers illustrated with lantern-slides.

Notes submitted by the authors are included in the proceedings, Part II.

J. Burley (Title read in absentia)
A.J. Carmichael
K.E. Clausen
Carin Ehrenberg
E.J. Eliason
A. Hyppel
H.B. Kriebel
H. Nienstaedt
T.D. Rudolph
B. Söegaard
G.R. Stairs
O. Sziklai

3) Red Pine Breeding

A Panel Discussion.

M.J. Holst, Moderator
D.P. Fowler
D. Lester
H. Nienstaedt
J.W. Wright

The papers presented by the members of the panel are published in the Proceedings, Part II, together with some notes of the ensuing discussion. The following résumé covers some of the points raised in the papers.

Dr. Rudolf reviewed the red pine provenance studies that have been carried out in the Lake States and Pennsylvania over the past 33 years. He concluded that although red pine is generally a remarkably uniform species, significant variation in growth characteristics does exist. More detailed and carefully planned studies are needed, including single tree progeny tests and seed source collections from the complete range of the species.

Dr. Nienstaedt discussed the results of recent measurements made in single-tree open-pollinated progeny tests of red pine planted in 1931 and 1933. He concluded that the magnitude of improvement possible in red pine is relatively small, but that when these figures are transformed into financial

terms, the research effort needed is well justified. In our present state of knowledge, Dr. Nienstaedt recommended that seed collected in bulk should be kept within the region of collection. Single tree progenies from within or beyond a particular region may eventually prove to be more productive. It will be necessary in single tree progeny tests to start with a very large number of progenies and select from these a few of the very best for further breeding.

Dr. Lester presented summary tables and concise statistical analyses of data concerning the height and diameter growth of 9- to 10-year-old red pine. He agreed with Dr. Nienstaedt that further testing and exploration are advisable, especially with the use of open-pollinated 1-parent progenies. Dr. Lester suggested that southwestern Wisconsin should be sampled, an area so far neglected.

Dr. Wright described some experimental methods employed in handling seedlings rather than the results of his experiments, since his work in red pine at Michigan State University is not very old. The methods dealt with included labelling, bundling, randomising and machine planting of experiments containing large numbers of distinct seedling lots.

Dr. Fowler admitted that genetic variation exists in red pine, but on the basis of his own experience and the work of others, he strongly questioned whether the magnitude of this variation is sufficient to warrant the expense involved in improvement within the species. Inter-specific hybridization would appear to be promising, but in spite of the many attempts at many stations, only one hybrid with red pine is known to exist, that of P. nigra x resinosa produced once at Placerville, California.

4) The Influence of Preconditioning on Provenance Test Results

Discussion led by Dr. J.S. Rowe.

Dr. Rowe discussed the interpretation of the results of provenance tests on the basis of his recently published article "Environmental

Preconditioning with Special Reference to Forestry" (Ecology 45:399-403, 1964). Dr. Rowe advocated that a skeptical attitude should be taken to the interpretation of provenance tests purely on a theoretical genetic basis, at least until the environment of parental plants under which the seed is developed can be shown to have no long-term "heritable" effects. A number of those present argued that the genetic basis was well established, and that although preconditioning influences may affect the seed and subsequent seedling growth to some degree, such influences, e.g. differences in seed size, have proven to exert a negligible effect on growth after a number of years.

It was further noted that most, if not all, preconditioning effects have been observed in cultivated annual plants of relatively homogeneous genetic background, grown on uniform agricultural soils, while forest tree species are usually genetically heterogeneous perennials, cross breeding, frequently through wind pollination, and subject to widely varying micro- and macro-site conditions.

D. FIELD TRIPS

Afternoon, September 17

Morning, September 18

Inspections of field experimental areas associated with tree breeding at the Petawawa Forest Experiment Station were led by Mr. Holst. A brief listing of the areas visited is included here for reference. Relevant data in graphical, tabular and descriptive form were displayed at each stop, where the objectives and results to date were described and discussed. Pine plantation areas were seen in the afternoon of September 17, and spruce material was dealt with the following morning.

a) Tree Breeding Nursery

Jack Pine nursery provenance test spot-sown in 1962, thinned or planted to a single plant per spot in 1963. Ninety-seven seedlots, randomised blocks with 10 replications, 10 tree single row plots, 1 x 1 ft. spacing. Serious effects of site variation evident in spite of care expended in preparation of the area. This is one planting of the same seedlots grown in laboratory, nursery and field experiments at a number of locations in Canada, United States and Europe.

b) Pine Graft Aboretum

Clones, grafted and seedling population samples of hard pine species for clone tests, clone bank, selection and breeding, and provenance and species hybridization.

An introgressant population of lodgepole pine - jack pine was seen. Large scale species and provenance hybridization of jack pine had been made on early female-flowering seedlings.

Scots pine clones selected for Christmas tree characteristics were observed.

Severe graft incompatibility between red pine (scion) and

Scots pine (root stock) appeared after some years in this environment.

c) Young Creek Road Plantation Area

Black spruce provenances in observation plots exemplified pure species and introgressant populations.

Growth differences between red pine provenances could be seen, but the far greater differences were caused by site variations on this site which is marginal for red pine.

Highly significant growth differences between Ontario jack pine provenances were observed. Two provenances of southern origin and relatively rapid growth had suffered severe damage due to snow and ice loads during the previous winter. Root systems were exacavated to illustrate differences in root form within and between provenances.

d) Grafting of Mature White Spruce

Best results for small suppressed scions were obtained by grafting on the leader of the rootstock rather than lower in the crown. Scion growth was thereby rejuvenated and the branch habit overcome.

e) Tree Physiology: Day-Length Control & Flowering

Dr. D.A. Fraser demonstrated the effect on the growth of white spruce of extended and normal day length applied over a number of successive years. Supplementary incandescent light applied during the growth period increased the height growth, especially in the first year of application. Some promotion of flowering occurred.

f) Nursery Plantations

Red and black spruce F_1 hybrid heterosis was demonstrated in comparison with red spruce and black spruce. Introgression of black spruce into red spruce was evident in a red spruce sample population.

White spruce provenances planted over 20 years ago showed the general superiority of the local provenance in comparison with those from distant sources, especially those to the North and West.

A white pine plantation of a similar age showed the ravaging effects of repeated weevil (Pissodes strobi)attack on the leaders.

g) Hudsons Place Plantation

Norway spruce (origin unknown) planted in 1924: 23 open grown trees selected for frost hardiness by Dr. Heimburger in 1934 from among the 1,500 trees originally planted. Differences were evident in crown form and weevil (Pissodes strobi)resistance.

h) Thomas Field Plantation

IUFRO Norway spruce provenance trial planted in 1943 to 1945, heavily selected for vigour and frost hardiness in the nursery. Thinned heavily in winter 1963 to eliminate unthrifty and weeviled trees. Progeny from cold hardy Hudson's Place trees are the tallest, followed by provenances of Baltic origin. Early nursery selection appears to have reduced the magnitude of differences between provenances.

i) Fuelwood Area Plantations

Norway spruce observation plots. A few individual trees of Polish origin stand out as being vigorous, frost hardy and weevil resistant.

Larix species observation plots. Comparison of European and Canadian larches, together with open- and control-pollinated progenies from Larix eurolepis growing at P.F.E.S.

White spruce replicated single tree progeny test. Important micro-site variations resulted in varying degrees of spring frost injury in 1964. A second white spruce progeny test on an adjacent area where the air drainage was more free escaped severe frost damage.

Red spruce replicated provenance test showed range from pure species populations of southern Appalachians to introgressed populations from eastern Canada. Pure red spruce had been severely injured by the 1964 frosts.