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Proceedings of the Sixth Meeting
OF THE
COMMITTEE on FOREST TREE BREEDING
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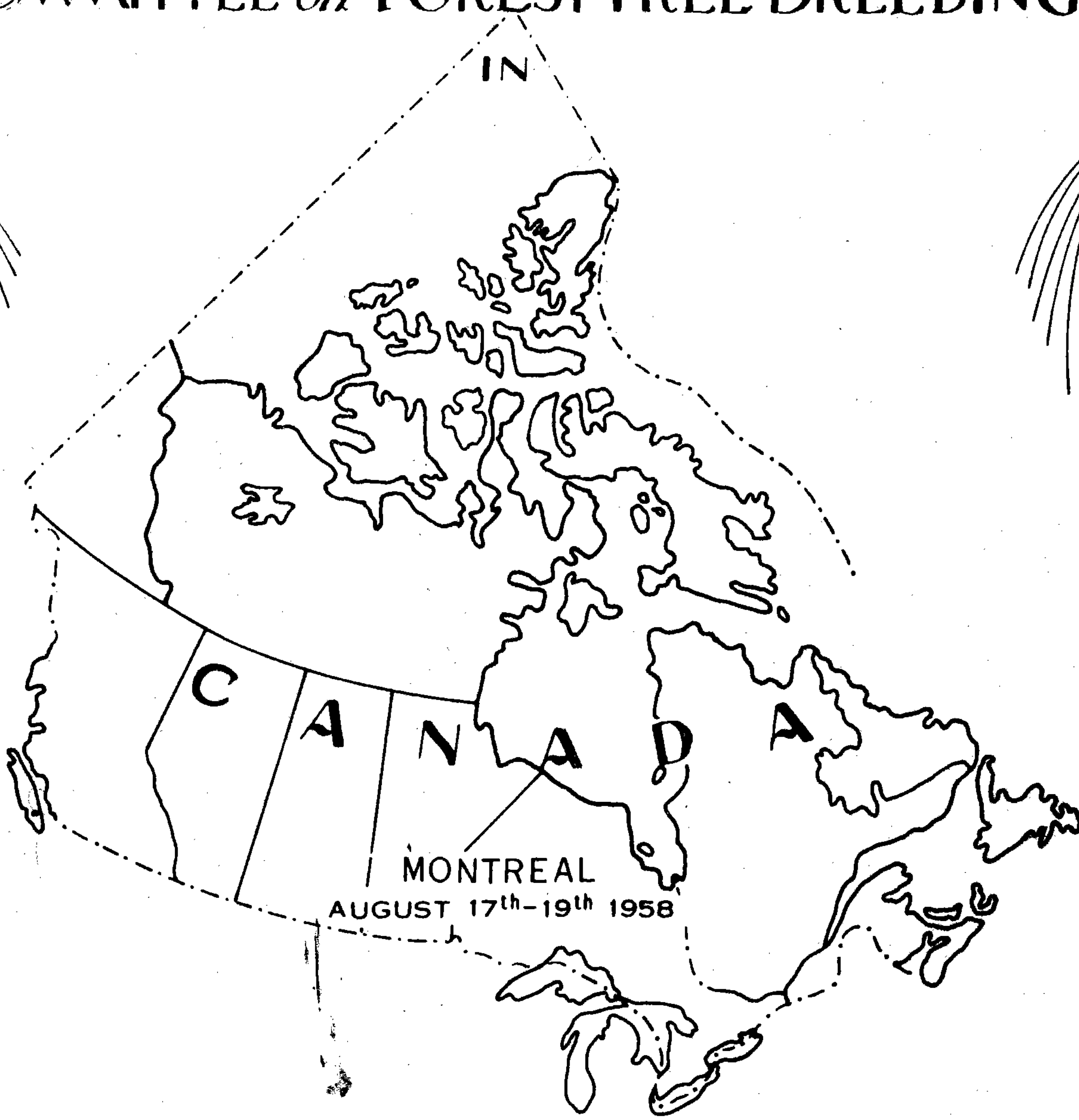

Part II
Reports and Papers

PROCEEDINGS OF THE SIXTH MEETING OF THE COMMITTEE ON FOREST TREE BREEDING IN CANADA

Held at Macdonald College, Ste. Anne de Bellevue, Que., on August 17th, 18th and 19th, 1958.

PART II

PROGRESS REPORTS, PROGRAMME REVIEWS AND PAPERS PRESENTED AT THE MEETING

Part I of the Proceedings, including Minutes of the Business Meeting and the Discussions of Reports and Papers, received restricted distribution to Committee Members only.

Part II, in addition, is distributed for information to persons and organizations outside of Canada who are actively engaged in forest tree breeding and forest tree improvement.

The Proceedings are prepared and distributed by the

Forest Research Division

Forestry Branch

Canada, Department of Northern Affairs and National Resources

Ottawa

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List of Active Members of

The Committee on Forest Tree Breeding
in Canada.

August, 1958

Mr. A. Beckwith.	Dept. of Lands and Forests, Southern Research Station, Maple, Ontario.
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Mr. A.J. Carmichael.	Dept. of Lands and Forests, Tree Seed Plant, Angus, Ontario.
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Dr. A.L. Orr Ewing. (Chairman)	B. C. Forest Service, Research Division, Victoria, British Columbia.
Dr. R. Pomerleau.	Dept. of Agriculture, Forest Biology Division, c/o Laval University, Quebec City, P. Q.
Mr. W.A. Porter.	Dept. of Agriculture, Forest Biology Division, Victoria, British Columbia.
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Dr. E.C. Smith	Acadia University, Wolfville, Nova Scotia.
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Mr. C.W. Yeatman. (Secretary)	Dept. of Northern Affairs and National Resources, Forestry Branch, Petawawa Forest Experiment Station, Chalk River, Ontario.

1. MEMBER PROGRESS REPORTS

REPORT TO COMMITTEE ON FOREST TREE BREEDING
July, 1958

A. J. Carmichael
Ontario Tree Seed Plant, Angus

I General

A change in the program for seed production has resulted in the full time employment of A. J. Carmichael and G. B. Withers on a Seed Production and Improvement Project. This project will be concerned with the verification of the seed zone system in use in Ontario and with the development of improved seed collection methods, to include the thinning of selected natural stands and the establishment of seed orchards. The work will be designed not as a research project but as a production unit to improve the quality and quantity of seed available. This will be done by adopting the practices and principles made available by research organizations. Headquarters for this work will remain for the present at Angus, Ontario.

II Provenance Tests

Routine maintenance and refill planting was carried out for existing test plantings. No growth measurements were made of test trees.

Red pine and white spruce provenance tests were established for the Dominion Forest Service in three locations. In each case the wedge method of hand planting in furrows was used and trees were placed at a spacing of 4' x 4'.

III Seed Orchards and Seed Production Areas

A. General

An analysis has been made of the size, number and general location of seed orchards and seed production areas required for each species in each seed zone for an annual production of 100,000,000 trees. This has been used to develop a work program co-ordinating the efforts of five nurseries in the production of grafted seed orchard materials.

The majority of the work will be concerned with the northern part of the province where the emphasis will be on spruce and red pine. The 1959 seed orchard grafting program will include 2500 white spruce, 2000 black spruce, 4000 red pine and 2000 white pine.

B. Red Pine Seed Production Area - Lynn Tract

The test area of red pine at Lynn Tract, Simcoe County (13 yr. age, 12' x 12' spacing), has been re-examined for flower production. A detailed description of the 15 sites selected was given in the August 1957 report to the committee.

There were no 2 year old cones present in 1958, but a small crop of 1 year old cones was found. This crop is described in Table 1.

A comparison of the 1957 and 1958 cone counts, indicates that a few trees had a higher production in both years. These trees possibly differ genetically in their flowering pattern. They are found in general on those sites where the red pine have good growth rather than on those sites supporting slower growing trees. The counts would indicate that several cone crops must be examined before individual tree differences became definite.

The great variation in cone production between individual trees on the same site would indicate that there are great differences in the inherent capacity of the trees to produce cones, or that some trees are at their low ebb in the cycle of cone production while others are at their peak, or that the sites as selected are not uniform. When further counts are available, these factors might be resolved. Until then no attempt will be made to increase flower production by means of fertilizer treatments.

Foliar analysis tests were carried out for three trees in site F, a depressed flat with good growth (Table 2) samples were taken in September 1957 from each wherl on the trees, air-dried and analysed for nitrogen, phosphorous and potassium, by Donald Inspection Ltd., Toronto. Plotting of these values singly and in ratio did not show a correlation with the production of 2 year old cones.

Grafts of trees F2 and F9 were made and will be observed to determine whether variations in cone production are genotypic. When tests in the induction of buds in needle fascicles have been completed for red pine, plants might be reared and used on various sites, to explain further the variation in cone production between these trees. This is of interest since the two trees have a similar phenotype.

Table I   Red Pine - Lynn Tract - 1958

Average of 1 Year Cones - Trees 1 - 16, Site A - O

Tree #	Site A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	TOTAL
1	12	8	1	1	2	67	3	14	3	0	0	0	0	0	0	111
2	5	11	20	1	3	25	5	6	14	1	0	0	5	0	1	97
3	19	1	5	37	1	7	17	34	2	10	0	33	0	2	0	168
4	40	29	9	28	2	53	1	6	4	0	4	28	0	4	6	214
5	21	2	38	1	20	13	45	0	9	2	0	0	6	2	0	159
6	37	34	27	0	9	2	31	105	5	10	0	13	18	0	0	291
7	31	3	48	0	1	30	9	40	8	2	3	0	0	11	0	186
8	1	9	17	8	1	0	95	0	4	0	1	1	0	6	0	143
Total	166	97	165	76	39	197	206	205	49	25	8	75	29	25	7	1369
Avg.	20.7	12.1	20.6	9.5	4.8	24.6	25.7	25.6	6.1	3.1	1.0	9.6	3.7	3.1	.8	171.1
9	2	6	35	5	0	15	2	8	8	16	3	6	3	7	1	117
10	4	8	20	0	0	17	14	0	17	0	2	1	1	11	0	95
11	2	0	17	0	5	6	37	2	0	13	0	8	0	0	0	90
12	3	3	85	0	21	35	6	6	20	25	0	25	3	24	0	256
13	59	15	138	6	0	0	5	3	0	0	1	6	7	0	20	260
14	1	56	1	0	1	0	14	215	10	0	3	5	7	0	29	342
15	0	12	0	5	1	0	9	15	0	5	40	18	3	11	0	119
16	0	3	0	37	2	10	24	13	0	0	0	2	11	2	0	104
Total	71	103	296	53	30	83	111	262	55	59	49	71	35	55	50	1383
Avg.	8.8	12.8	37.0	6.6	3.7	10.3	13.8	32.7	6.8	7.3	6.1	8.8	4.3	6.8	6.2	172.8
Grand total	237	200	461	129	69	280	317	467	104	84	57	146	64	80	57	2752
Avg.	14.8	12.5	28.8	8.0	4.3	17.5	19.8	29.1	6.5	5.2	3.5	9.1	4.0	5.0	3.5	172.0

Table II

Foliar Analysis for N. P. K. for Red Pine Trees F2 and F9, Lynn Tract

Whorl No.*	No. 2 Yr. Cones		N.% Oven Dry Wt.		P.% Oven Dry Wt.		K.% Oven Dry Wt.	
	F 2	F.9	F 2	F 9	F 2	F 9	F 2	F 9
0	-	-	-	-	-	-	-	-
1	-	-	1.67	1.67	0.17	0.18	0.62	0.62
2	14	0	1.56	1.67	0.14	0.16	0.43	0.56
3	31	0	1.59	1.55	0.15	0.15	0.48	0.72
4	43	2	1.67	1.73	0.16	0.15	0.59	0.37
5	27	2	1.78	1.62	0.15	0.15	0.44	0.46
6	15	3	1.43	1.67	0.15	0.15	0.50	0.51
7	1	2	1.55	1.67	0.16	0.14	0.37	0.68
8	0	0	1.50	1.40	0.15	0.16	0.18	0.41
9	0	0	1.55	1.51	0.14	0.14	0.40	0.41
10	0	0	1.40	1.67	0.14	0.15	0.52	0.37
Total	131	9						

* The current seasons growth at the top of the tree is designated as whorl 0.

IV Scotch Pine Christmas Tree Test

It is common practice to prune the branches of Scotch Pine to develop a denser and better formed tree. Since the sources of Scotch pine planted in test plantations differ in the number of lateral buds surrounding the terminal bud, it was necessary to determine what number of buds would be produced in the needle fascicles after pruning. Trees which had good form, were pruned in each seed source in test plantations near Ottawa and Sault Ste. Marie. The average number of buds is given for the three trees pruned in each seed source. (Table 3)

Table 3

Number of Lateral Buds on Terminal Shoot before and after Pruning
Scotch Pine

Seed Source	Number of Lateral Buds on Terminal Shoot Ottawa Plantation Before Pruning	Ottawa Plantation After Pruning	Sault Ste.Marie Plantation Before Pruning	Sault Ste.Marie Plantation After Pruning
France-Haute Loire	7.0	34.0	5.1	17.6
-Auvergne	8.2	32.2	4.0	15.0
-Cevennes	8.1	33.1	6.2	20.6
West Europe	8.1	24.2	6.2	22.6
Lower Austria	7.1	29.1	4.5	22.6
Lower Austria	8.0	24.2	5.1	22.0
West Baltic	8.1	42.0	5.1	24.0
East Baltic	8.0	26.0	6.2	16.0
Sweden	7.2	34.3	6.1	15.6
Finland	5.2	18.0	6.1	9.6
S. Finland	6.0	20.2	3.1	11.3
Adirondacks	8.2	25.2	6.1	19.0

A further examination of these trees will be necessary to determine the number of shoots which have developed from the available buds. Northern sources produced in general minute buds, whereas Southern sources produced very large buds.

V. Shoot Moth Test

A comparison of Pinus nigra cebennensis from Cevennes, France, and red pine from Douglas, Ontario is being made on two areas, to determine any difference in the attack of European Pine Shoot Moth (Rhyacionia buoliana) on these species. Previous measurements have indicated that Pinus nigra cebennensis is not attacked as frequently as red pine and that attacked trees tend to develop a single stemmed form more frequently than red pine.

Specimen trees have been transplanted by the Forest Biology Division of the Department of Agriculture, to their field station at Elmira, Ontario, for detailed examination to determine if any physical factors of tree growth inhibit the development of shoot moth larvae.

An attack of Formes annosus on both species in the Site Region 6 plantation at Mansfield may disrupt the test. If not, further growth measurements will be made.

Snow depth measurements were made at Mansfield during the winter of 1958 to determine whether pockets of heavier infestations were due to snow protection. This data has to be examined as yet.

VI Rooting Leaf Bundle Cuttings

Mr. H. J. Jeckalejs of the Division of Research, Ontario Department of Lands & Forests will be extending his earlier studies on rooting leaf bundle cuttings to develop a means for the production of plants by this method.

In order to define the correct time of pruning required to induce buds in needle fascicles, a test was established in which white pine, red pine and Scotch pine were pruned at monthly intervals commencing on March 17 and at weekly intervals commencing on June 16, and extending to July 21. Trees of approximately 3 ft. and 20 ft. heights have been used for each species. One-third of the past seasons growth was removed up to June 9, after which one-third of the current seasons growth has been removed. The terminal, first and second whorls have been pruned on 3 ft. trees and the first, second and third whorls on 20 ft. trees.

1957 REPORT ON BREEDING AND NURSERY RESEARCH

W. H. Cram

Forest Nursery Station,
Indian Head, Sask.

Introduction:-

Improved facilities for breeding and nursery research were provided by the new headerhouse, and an adjoining greenhouse in 1957-58.

Weather:-

Climatic conditions were favorable for field breeding and nursery operations in 1957. The frost-free period was 120 days from April 26 to August 25, with only 9.8 inches of precipitation. An early and dry spring permitted field operations to start on May 2, when Russian poplar began to bloom. Dry weather, which was ideal for field operations presisted to the end of July. August was a relatively wet month with 3.3 inches of rain. The months of May and July were exceptionally warm as indicated by average mean daily temperature of 55.0 and 70.0°F, respectively. A dry open fall was experienced from September until snowfall on November 25.

Caragana Breeding:-

Information on the inheritance of two characters of *Caragana arborescens* was derived from the progenies of three compatibility determinations. Data for an 'albino' character were obtained in 1954 from the greenhouse germination of the 1953 inbred [S_1] and hybrid [F_1] seed. Data for the so-called "pendulant" character were recorded in 1957 from the 1954 plantings. Segregation data for the two characters in three F_1 progenies are presented in Table 1. It would appear that the 'albino' and the 'pendulant' characters are both inherited as simple recessive and independent factors. This information confirms the value of N-19 as a tester in the breeding program to determine the genotype of self-incompatible selections for the pendulant and albino characters.

Table 1. Segregation for Albino and Pendulant Characters in F_1 Progenies of Caragana arborescens

Progeny ♀[1]		♂	Segregation for albino green	yellow	ratio	X^2	Genotype of ♀ Parent
			(No)	(No)			
N19	x	N19	77	17	3:1	2:40	Aa
A-1	x	N19	88	0	88:0	-	AA
V16	x	N19	131	0	131:0	-	AA
			Segregation for pendulant Upright	pendulant			
N19	x	N19	0	14	0:14	-	pp
A-1	x	N19	21	25	0:1	0:35	Pp
V16	x	N19	75	0	75:0	-	PP

[1] N19 is a pendulant, A-1 and V16 are upright in habit

Self-compatibility determinations for Caragana accession material was initiated in 1957. Only 90 of the vigorous selections were sexually mature. These selections were found in four accessions, which were field planted in 1953. The original seed came from Botanical Gardens in Europe and the United States. Results of the fertility determinations have been tabulated in Table 2.

Table 3. -Frequency distribution for Self-Compatibility Values[1] of 57 Vigorous Selections from Four Caragana Accessions

Fertility classes	C microphylla A-109	Average	C arborescens D-11	D-13	D-14	D-16	Average
(%)	(No)	(%)	(No)	(No)	(No)	(No)	(%)
0-20	2	18.2	3	2	6	12	50.0
21-40	5	45.4	4	1	2	0	15.2
41-60	3	27.3	3	3	2	1	19.6
61-80	0	0	3	0	3	0	13.0
61-100	0	0	0	0	1	0	2.2
101-120	0	0	0	0	0	0	0
121-140	0	0	0	0	0	0	0
141-160	1#	9.1	0	0	0	0	0
Selections (No.)	11		13	6	14	13	
Fertility - range (%)	4 to 145		0 to 67	12 to 52	0 to 83	o to 46	
- mean	40		37.8	34.8	37.5	7.4	

[1] Self-compatibility or fertility as % of tripped flowers

Autogamous plant exhibits self tripping

Self-fertility of the one accession of C. microphylla was somewhat similar, although greater, than any of the C. arborescens accessions. Seven selections from accessions of C. arborescens demonstrated self-incompatibility. One accession, D16, from Cheyenne, Wyoming, contained five of the seven incompatible plants. We hope to incorporate genetic diversity and increased vigor into the caragana breeding program, with these self-incompatible selections.

Maple & Ash Seed Maturity

Seed was harvested from four trees of Green Ash and of Boxelder Maple at three tri-weekly intervals in 1956. It was dried in the greenhouse for one week, then stored under room and cellar conditions until sown outdoors October 16. Moisture Content of the seed was determined at time of harvest and at time of sowing 1957 germination records and results are summarized in Tables 4 and 5.

Table 4. Moisture Content in 1956 and Germination Capacity in 1957 of Green Ash Seed

Date of	Moisture content of seed[1]			Seedbed germination[2]	
	at	when sown			
harvest	harvest	cellar	room	cellar	room
	(%)	(%)	(%)	(%)	(%)
Aug. 22	51.6	14.7	6.6	0.1*	5.0*
Sept.12	48.8*	13.2*	6.7	12.2	13.0
Oct. 3	12.9**	10.3**	6.8	12.1	15.5

[1] Moisture content as % of wet weight after 24 hours of 100°C;
[2] Germination in 1957 as % of seed sown for 5 reps of 100 seed;
*, **, Significantly less than for other dates at 5%, and 1% levels.

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Table 5. Moisture Content in 1956 and Germination Capacity in 1957 of Maple Seed

Date of	Moisture content of seed[1]			Seedbed germination[2]	
	at	when sown			
harvest	harvest	cellar	room	cellar	room
	(%)	(%)	(%)	(%)	(%)
Aug. 22	67.2	16.4	6.7	28.8**	30.2**
Sept.12	57.1*	15.7*	7.2**	4.1	38.8
Oct. 3	10.8**	9.3**	7.8**	40.5	40.0

[1] Moisture content as % of wet weight after 24 hours of 100°C;
[2] Germination in 1957 as % of seed sown for 5 reps of 100 seed;
*, **, Significantly less than for other dates at 5%, and 1% levels.

From these tables it is evident that neither Ash nor maple seed should be harvested in August, and that storage conditions from harvest to sowing had little influence on viability of fresh seed.

Ash seed, which was prematurely harvested in August, demonstrated over 50% moisture content and little viability. Seed, as harvested in September and October, exhibited a high degree of dormancy. Apparently some pre-sowing seed treatment is required to ensure adequate germination of ash seed especially if it must be sown in a dry fall.

Viability of Maple seed increased from 30 to 40%, when allowed to mature on the tree from August to September. Maple seed would also appear to require special treatment to increase germination especially if sown in a dry fall.

Storage of Poplar Cuttings:

Investigations on the winter storage of dormant poplar cuttings was initiated in 1956 to overcome a serious nursery problem. Cuttings were collected on October 22 from stooling beds of three clones, cut into 10 inch lengths, segregated into diameter size classes and tied into bundles of 25. Five pre-storage treatments were applied by dipping the bundles into solutions of fungicides. The five treatments involved Captan, Tersan, check (water), Semesan and Oxyquinolene Sulphate. The cuttings were stored on October 25 under five different conditions (as listed in Table 6). On May 7, 1957, the cuttings were removed from storage and planted in the field to evaluate the results. The design involved three replications of five treatments and five storages with 25 cuttings per plot. Records for field stand were compiled on September 25 with the results listed in Table 6.

Average stands for the five fungicidal treatments as listed above were: 42, 36, 36, 35 and 30%, respectively. The Captan treatment (150 grams per gallon) was evidently beneficial to rooting of poplar cuttings. It significantly increased the stand of one clone and appeared to increase that of another. Toxicity of the Oxyquinolene treatment (25 grams per gallon) caused a significant decrease in the stand of two clones.

Table 6. Stand for Poplar Cuttings of Three Clones After Five Storages.

Storages			Clones			Means for Storage
Place	Medium	Temp.[1]	N.W.	Sask.	44-52	
			(%)	(%)	(%)	(%)
Cellar	Sand	41°F	9.9	16.0	13.6	13.2
Cellar	Poly	41°F	23.5	14.0	9.1	15.5
Cellar	Poly	31°F	40.3	31.6	29.1	33.7
Cellar	Sand	31°F	52;5	42.8	25.9	40.4
Outdoors	Soil	?	89.6*	68.4*	69.6*	75.9*
Means for clones			43.2	34.6	29.5	

[1] Cellar temperatures were 31.8 ± 11°F and 41.2 ± 7°F

Outdoor or 'heeling-in' storage proved vastly superior to any of the four types of indoor storage as evident from the stands for cuttings listed in Tables 6. Regretably, temperatures of the cellar storages varied greatly (31.8 ± 11°F and 41.2 ± 7°F), due to absence of insulation and temperature control facilities. Nevertheless, it would appear that indoor storage of poplar cuttings at low temperatures of approximately 31°F is superior to storage at higher temperatures.

Stand of poplar cuttings was improved when moist sand was placed with the cuttings being stored in polyethylene bags for the following pathogenicity study. This treatment increased the stand from 38 to 77%, when the cuttings were stored at 31°F. and from 8 to 53% when stored at 41°F.

Studies to determine the pathogenicity of isolates from diseased cuttings were initiated in 1956 in cooperation with Dr. O. Vaartaja of the Forest Biology Division. Cuttings of two poplar clones were collected sized and tied in bundles of 25 in 1956 as for the storage study. These bundles of cuttings were inoculated by dipping the basal and upper ends in suspensions of the isolates. Sixteen isolates were supplied by Dr. Vaartaja, for this study. Each inoculum was applied to four bundles of cuttings, which were then sealed in polyethylene bags with sterile and moist sand. The packages were covered with moist sand and stored in the cellar at 31 ± 11°F and 41 ± 7°F for the winter. In the spring of 1957, the cuttings were planted to evaluate pathogenicity of the isolates in terms of the rooting capacity or field stand of the cuttings so inoculated.

Only one of the 16 isolates proved highly pathogenic to poplar cuttings. This was a *Pythium spp.*, isolate (#2058), which had been obtained from diseased willow cuttings. Cuttings of only one clone, 44-52, proved susceptible to this isolate when the cuttings were stored at 41 ± 7°F temperature.

Publication in 1957:-

Research papers:-

1. Cram, W. H. and O. Vaartaja. 'Rate and timing of Fungicidal Soil treatments'. Phytopath. 47:169-172. 1957.

2. Cram, W. H. and H. A. Worden, 'Maturity of white spruce cones and seed'. For. Sci. 3:263-269. 1957.

REPORT TO COMMITTEE ON FOREST TREE BREEDING
July, 1958

B. W. Dance
Division of Forest Biology
Canada Department of Agriculture

General

The Laboratory of Forest Pathology, Canada Department of Agriculture, Maple, is participating in a joint programme with the Division of Research, Ontario Department of Lands and Forests for the purpose of evolving disease-resistant hybrid poplars. In this programme, the writer has been assigned responsibility for assessing the degree of susceptibility of hybrids, both presently available and to be developed, to the fungal flora of *Populus* in Ontario.

This project entitled "Pathological Considerations in the Development of Hybrid Poplar" (No. SFB 50.06) was reviewed in the spring of 1958 by senior officers of the Division of Forest Biology and the Division of Research. As a result of the review, the responsibilities were re-defined. This revision became feasible when it was concluded that, of all hybrid poplars evolved to date, *Populus alba* L.x *grandidentata* Michx. has the most significant economic potentialities. The assessment was made despite knowledge that this hybrid is seriously and even fatally affected by a leaf and twig blight which has been described (1,2). Justification for the conclusion was founded in observations of apparent high resistance to the disease by a few clones.

In view of the potentialities of P. alba x grandidentata it was decided that the main immediate investigative effort should be placed on the biology of the pathogen responsible for the leaf and twig blight condition.

Judged to warrant next priority in attention, was final resolution of the biology of Fusicladium tremulae Frank - a prevalent, destructive, long-misunderstood and hitherto misidentified pathogen of aspen. Specifically, it was intended to relate F. tremulae to an ascomycete, believed to be its ascigerous stage. This ascomycete, identified as Venturia tremulae Aderh., has only rarely been observed in Ontario. It seemed likely that attainment of this goal would yield a fairly complete understanding of the taxonomy of that group of fungi, including Pollaccia elegans Serv., that cause leaf and twig blight of poplar in Canada.

In addition to the foregoing lines of investigation, it was felt that a watch should be maintained for evidence of other pathogenic activity on hybrid poplar. It was concluded that the responsibilities of the Forest Pathology Laboratory in this project should be delimited as follows:

(1) Studies on the biology of currently and potentially important pathogens of hybrid poplars. At the present time close attention will be paid to pathogens that appear significant in the development of P. alba x grandidentata. The pathogen to receive foremost attention will be Gloeosporium sp. Of lesser interest are Cytospora spp. Hypoxylon pruinatum (Klotzsch) Cooke, Dothichiza populea Sacc. and Briard and Melampsora sp.

(2) The conduction of periodic surveys and assessments of disease problems in test plantings established by the Tree Breeding Section of the Division of Research.

(3) The provision of identifications and advice in respect to disease materials submitted by Dr. Heimburger, of the Division of Research, from breeding stock, test garden stock, and other related sources.

In the report to the Committee on Forest Tree Breeding submitted in 1957, the investigations underway on poplar diseases were outlined. Some phases of