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NATIONAL RESEARCH COUNCIL OF CANADA

PROCEEDINGS

OF THE

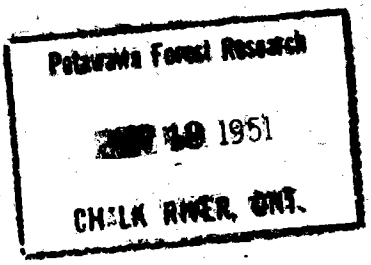
TWENTY-THIRD MEETING

OF THE

SUBCOMMITTEE ON FOREST TREE BREEDING

OF THE

ASSOCIATE COMMITTEE ON FORESTRY



OTTAWA

6 MARCH 1951

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NATIONAL RESEARCH COUNCIL

PROCEEDINGS OF THE TWENTY-THIRD MEETING OF THE

SUBCOMMITTEE ON FOREST TREE BREEDING

ASSOCIATE COMMITTEE ON FORESTRY

Held in Room 304, Langevin Block, Wellington and Metcalfe Streets, Ottawa on 6 March, 1951 at 2 P.M.

Attendance

Mr. H. D. Heaney, Chairman
Mr. A. Bickerstaff
Mr. S. J. Cook
Dr. W. H. Cram
Dr. N. H. Grace
Mr. J.D.B. Harrison
Mr. J. M. Holst
Dr. A.W.S. Hunter
Mr. A. W. McCallum
Dr. K. W. Neatby
Dr. H. A. Senn
Mr. J. Walker
Dr. C. C. Heimburger, Secretary

251. Introduction of Mr. Holst and Appointment of Secretary

THE CHAIRMAN introduced Mr. J. M. Holst who since the summer of 1950 has been employed in forest tree breeding at the Petawawa Forest Experiment Station, Chalk River, Ont., and appointed Dr. C. Heimburger to act as secretary, in the absence of Mr. Farrar.

252. Minutes

The Minutes of the twenty-second meeting were APPROVED.

253. Progeny of Superior Trees

The discussion of this item (see Min.244) was continued. The summary report to the Associate Committee was not prepared. Mr. Holst suggested using the paper by Richens (Richens, R.H. 1945, Forest Tree Breeding and genetics. Imperial Agricultural Bureaux, Joint Publication No. 8) as a basis for a report by going over it and picking up the details of interest to the Associate Committee. Dr. Grace suggested a collaboration resulting in a popular report to the Associate Committee suitable for publication. The Chairman suggested the appointment of a working committee on this report. Mr. Cook stated that the Associate Committee was still in a state of indeterminate suspense, because of the absence of its Chairman overseas and no action taken since the last meeting of this Sub-committee. Mr. Harrison briefly outlined the history of the Associate Committee since its inception. In recent years the

Subcommittees on Forest Fire Research and on Forest Tree Breeding have been more active than the Associate Committee. Dr. Heimburger stated that the question of raising the Subcommittee on Forest Tree Breeding to the status of an Associate Committee had once been considered and might again become active. Mr. Cook explained various possible developments of the Associate Committee as a result of the Canada Forestry Act and the re-organization of the Forestry Branch, Department of Resources and Development. In a forthcoming meeting of Council this will be discussed and the Subcommittee on Forest Tree Breeding will be notified about the results. It was agreed to ask the Chairman to appoint a working committee for the preparation of a report on the value of the progeny of superior trees if the status of the Associate Committee will warrant this.

254. Dr. Cram's report on Tree Breeding at Indian Head

DR. CRAM read a report on tree breeding at the Indian Head Forest Nursery Station during 1950 (see Appendix "A"). The work comprised selection of Caragana, Scotch pine, Spruce and exploratory investigations in Poplar. In the discussion Dr. Heimburger stated that strains of Scotch Pine perhaps better adapted to prairie conditions than the 6 strains found at Indian Head, and growing on dry calcareous soils are found in the Russian steppes, but it is at present not possible to obtain such material directly. Northwest poplar has in former work at the Petawawa Forest Experiment Station shown rather poor rooting capacity from stem cuttings and the use of a good rooting cottonwood clone as a standard was suggested. Mr. Walker replied that such a cottonwood has not yet been found and that the cottonwoods found at Indian Head showed very poor rooting capacity from stem cuttings. Mr. Holst suggested survival tests with a fairly large number of strains of Scotch Pine and continued work with the strains showing most promise in such tests under prairie conditions.

255. Dr. Hunter's report on Breeding for Resistance to Dutch Elm Disease

DR. HUNTER reported on the progress of elm breeding for resistance to Dutch elm disease (see Appendix "B"). In the discussion Mr. Holst suggested using Ulmus japonica as an additional source of resistance to Dutch elm disease. Dr. Heimburger pointed out that in former work with plant growth hormones, in co-operation with Dr. Grace, softwood cuttings of elm had shown good response to indolyl preparations in rooting and the problem of vegetative propagation in elm appeared easier than with most hardwood species.

256. Mr. McCallum's report on Distribution of Dutch Elm Disease

MR. McCALLUM presented a short history of the distribution of Dutch elm disease in Canada (see Appendix "C"). During the discussion it was stated that the vector of the disease is not always the elm bark beetle, as this insect is lacking in Windsor, Ont., where recent outbreaks have occurred. Thus protection of valuable elm specimens by spraying with DDT is not always certain. Artificial

infection of elm seedlings, for purposes of testing for disease resistance, is now accomplished by injection of spore suspensions with a syringe.

257. Dr. Heimburger's report on Breeding of White Pine and Poplars

DR. HEIMBURGER reported on the work at Maple, Ont. (see Appendix "D") with breeding of white pine and poplars. In the discussion Mr.Walker inquired about the hardiness of the dwarf variety of trembling aspen found in Ontario as it possibly also could be used to advantage in poplar breeding at his Station. Dr. Heimburger replied that the dwarf aspen is probably a prairie biotype and a relic from the Xerothermic Period in southern Ontario. Similar biotypes have been observed in Michigan, Minnesota, North Dakota and the range possibly extends to Montana, along the southern fringe of the range of trembling aspen. It may possibly also be found growing native at Indian Head.

258. Mr. Holst's Report on Work at Petawawa Forest Experiment Station

MR. HOLST is continuing the work initiated by several members of this Subcommittee at the Petawawa Forest Experiment Station and has outlined it in a brief report (see Appendix "E"). Mr. Harrison, Associate Chief, Forest Research Division, elaborated on this in outlining the present policy in this respect of the Forestry Branch, Department of Resources and Development. Spruce breeding, to satisfy the needs of the pulp and paper industry in eastern Canada, will be the main project, and other work will include hard pines, spruce of western origin and larch.

259. Mr. Moore's Report on Cytogenetics of Caragana

DR. SENN read a report prepared by Mr. R. J. Moore, of the Division of Botany and Plant Pathology, Science Service, Department of Agriculture, on the cytogenetics of Caragana in co-operation with Mr. Walker and Dr. Cram (see Appendix "F").

260. Membership

The five names proposed for membership in this Subcommittee (see Min. 247) were forwarded to the Council by Mr. Cook but no action was taken because of the present status of the Associate Committee. Mr. Cook promised to forward the recommendations of this meeting to Council. The Chairman proposed to add Mr. Holst to the list of members and announced that Mr. Farrar had submitted his resignation because of studies abroad.

It was MOVED by Mr. Walker and SECONDED by Dr. Senn,

That Dr. Heimburger be appointed to act as secretary for 1951. CARRIED.

Dr. Archibald has resigned from the Associate Committee because of retirement and Mr. M. B. Davis was nominated in his place. The Chairman further proposed Dr. E.S. Hopkins instead of Mr. Davis, and Dr. Neatby for membership. Dr. Grace suggested that both Dr. Hopkins and Mr. Davis be appointed as members. Mr. Mulloy has resigned from the Associate Committee because of retirement and is replaced by Mr. Bickerstaff. Mr. Cook suggested the Subcommittee consist of working members and their chiefs. After much discussion it became evident that the ultimate membership of this Subcommittee will depend on the status of the Associate Committee and its activities in the future. The situation needs to be clarified and Mr. Cook promised to bring this matter to the attention of the President of the National Research Council. Dr. Senn asked if other people could be invited to the meetings of this Subcommittee and Dr. Neatby answered that such was the practice with other Associate Committees of the National Research Council. The Secretary asked to be notified by Mr. Cook about the status of the Associate Committee as soon as this becomes clarified. Mr. McCallum reported the resignation of Dr. C.G. Riley, because of the nature of his present work.

261. Equipment for Tree Breeding Work

MR. WALKER presented a report on the construction of an extension ladder with a platform for work in tops of trees (see Min. 249) and described the most recent model constructed (see Appendix "G"). It was decided to publish an illustration of the ladder in the Minutes of this meeting. The ladder is mounted on a 2-ton truck and is suitable for the work of 2 men.

262. Acquisition of Plant Material from Foreign Countries

As outlined in Min. 238 it was found desirable to obtain seeds and scions of exotic white pines for the work of Dr.Heimburger, from Japan and Pakistan. Mr. Harrison reported that the Department of External Affairs has given a high degree of co-operation. Contacts have been established through the Canadian Liaison Mission, Tokyo, with the Japanese Ministry of Agriculture and Forestry to collect scions and seeds of the wild form of Japanese white pine (Pinus parviflora) from northern Japan, and through the High Commissioner for Canada in Pakistan, with the Pakistan Forest Research Institute to collect scions of Himalayan white pine (Pinus excelsa) from elevations above 11 thousand feet. The shipments will be made by air and involve a considerable expenditure of energy. The Department of External Affairs very kindly agreed to arrange for immediate notification of individual packages by cabled advice from the embassies so as to reduce the time of the parcels in Canada to the lowest possible amount. These shipments should also provide valuable experience for the acquisition of living plant materials from other distant parts of the world for the work of other members of this Subcommittee. Dr. Senn mentioned the work of the Committee on Plant Introduction of the Department of Agriculture, which is also concerned with the acquisition of tree seeds that might be of value in this connection. Mr. Harrison mentioned that the Headquarters of the F.A.O. will shortly be in Rome, which might facilitate the acquisition of plant materials from Italy. According to Dr. Heimburger this has been disappointing recently.

263. Strain Tests of White Pine

DR. HEIMBURGER mentioned his current work in strain tests of white pine and the desirability of co-operation between the Forestry Branch of the Department of Resources and Development and the Research Division of the Ontario Department of Lands and Forests. An area of about 5-10 acres will be required for test plantations to be established during this coming spring at the Petawawa and Valcartier Forest Experiment Stations. Mr. Harrison stated that areas and labour will be available for this and promised positive action in this enterprise by the Forestry Branch, Department of Resources and Development.

264. Co-operation Between Various Organizations at Connaught Ranges

MR. BICKERSTAFF reported that Dr. Archibald had made the necessary arrangements (see Min. 242) for the maintenance of the Connaught Range disease garden for white pine, and the weeds were cut down there in 1950. Dr. Hunter agreed to arrange for further maintenance. There are now about 2000 living white pine of different origins planted on this area and the Chairman proposed that a plant pathologist should inspect the material. Dr. Heimburger briefly outlined the method used in Wisconsin for artificial inoculation of large planted white pine with blister rust, as natural infection is insufficient in our dry climate with Indian summers. Mr. McCallum agreed to look into this matter. Dr. Neatby pointed out that a stand of white pine very heavily infected with blister rust, is found on the experimental farm at Ste. Anne de la Pocatière, Que., and trees free from disease there might possibly be inherently resistant. Dr. Heimburger explained the exceptionally favourable infection conditions at Pointe Platon and believed the situation at Ste. Anne de la Pocatière might be similar in this respect and warrant further investigation.

265. Representation at International Conferences

DR. HEIMBURGER opened a discussion about the representation of the Subcommittee at international meetings dealing with forest tree breeding. During the discussion it was the unanimous opinion that such representation would greatly benefit the activities of the Subcommittee by establishing contacts and making arrangements for the exchange of breeding materials and ideas. It was pointed out, however, that a Federal Department would not be in a position to supply funds for this purpose to an employee of a Provincial Government. Dr. Grace asked the Chairman to request Council for funds for this purpose. Dr. Senn suggested that wood-using industries might also enter the picture insofar as forest-tree breeding was in their best interests. It was decided to submit a letter about this to Mr. Cook to be presented to Council at its next meeting.

266. Breeding of Ribes for Tests of Resistance of White Pine to Blister Rust

DR. HUNTER mentioned previous correspondence about this matter with Dr. Heimburger. It is desirable to produce a sterile Ribes, highly

susceptible to white-pine blister rust and easily propagated by vegetative means. This would be inter-planted with white pine in test plantations and should not be distributed by birds to localities where its presence might be undesirable. Several sterile Ribes hybrids are in existence that may be suitable. Dr. Hunter mentioned a cross between the Viking variety of the red currant, which is resistant to white-pine blister rust, and the black currant, which is highly susceptible. This cross had yielded a few plants that were completely sterile but also resistant to the rust. He promised to repeat the cross this year, using a susceptible variety of red currants as one of the parents. The forthcoming hybrids might possibly be susceptible to blister rust and suitable for the purpose outlined.

267. Effects of 2-4 D.

MR. WALKER briefly mentioned that boxelder shows symptoms of abnormal growth after use of 2-4D in fields near his Station. Apparently this species is more susceptible than other trees and shrubs in his area to this growth hormone used as a weed killer.

268. Adjournment

The Meeting adjourned at about 5 P.M.

APPENDIX "A"

REPORT OF 1950 TREE BREEDING AT INDIAN HEAD

by W. H. Cram
Forest Nursery Station, Indian Head, Sask.

As previously reported the tree breeding work at the Forest Nursery Station, Indian Head, comprises 3 main projects: (1) caragana, (2) pine, (3) spruce; and exploratory work in poplar.

Caragana Improvement

The object is to produce hybrids within C. arborescens manifesting superior vigor under drought and chinook conditions. As caragana has proven to be the most widely adapted and versatile species for shelterbelt planting in the prairies, this project has been given prime consideration to date. In fundamental studies, the relationships of seed size, cross- and self-pollination and self-fertility to seedling vigor have been investigated. Vigorous trees exhibiting self-sterility, or low self-fertility, and a high degree of open-fertility, are being selected for polycross tests. It appears necessary to propagate selections into clonal observation nurseries to obtain precise and comparable data on vigor, fertility, and phenological characteristics.

Vegetative propagation methods for caragana have been briefly explored. It appears that softwood cuttings offer the most practical and economical method. Seed maturity studies indicate that seed of this species may be harvested 15 days prior to natural dehiscence of the pods without materially affecting seed viability, using germination capacity as the criterion.

Pine Improvement

The aim of this project is to evaluate, via open-pollination, existing material of six geographic strains (Aberdeen, Finnish, German, Rigensis, Russian, Scotch) of Scotch Pine (Pinus sylvestris), as to reliability of seed bearing, viability of seed, survival of seedbed and transplant seedlings, yield of transplants per cone, and progeny trials carried to maturity.

Seed harvested from all bearing trees in 1947, 1948, 1949, 1950 and 1951 is being used to obtain the desired information. In this way it is hoped to select superior seedtrees for future evaluation by controlled pollinations, when the desired equipment is available.

Out of 94 trees from which cones were harvested in 1947, 50 proved adequate seedbearers for inclusion in the 1948 germination tests. Of these 45 trees produced sufficient seedlings for transplanting in 1950. In 1948, 121 of the 253 seedtrees available produced adequate seed for the 1949 germination test. Of these it would appear that some 80 to 90 will have large enough progenies for transplanting in 1951.

Spruce Improvement

The principle activity of this project has been the determination of effective methods of stratification to ensure adequate germination of seed from 4 species of Spruce (Picea pungens, P. abies, P. glauca, and P. g. albertiana). This project was initiated in 1949, as a result of exploratory germination studies conducted in 1947-48 with open pollination seed of seedtrees. These studies demonstrated the existence of a seed viability problem in spruces. The solution of this problem was given precedence over seedtree evaluations.

The results obtained with seed from 2 trees of each species stratified for two months at 41-45°F. are summarized (on a table) for reference. Results to date suggest: (1) stratification increased germination of seed of all species of spruce; (2) treatment applied approached the optimum condition for Norway spruce seed, but not for seed of the other species; (3) seed from different trees of Colorado and Blackhills spruce exhibited varying degrees of dormancy (see table); (4) seedbed management is not a factor contributing to the low germination of spruce seed (average seedbed germination for all species was 57.3% cf. to 62.3% in the greenhouse).

Summary of the Germination for Stratified and Non-stratified Seed from Two Seedtrees of each of 4 Species of Spruce.

Picea Species	Seed Tree	Germination Stratified	Germination Non-Stratified
		(%)	(%)
P. abies (Norway)	N-14	95.1	62.3
	N-15	91.0	52.6
P. pungens (Colorado)	C-10	35.6	16.6
	C-27	85.8	75.6
P. glauca (white)	W-421	54.7	3.8
	W-446	60.0	9.0
P.g. albertiana (Blackhills)	B-91	8.8	1.3
	B-93	83.0	6.1
Means		64.2	28.4

Poplar Investigations

Exploration studies are in progress to determine the rooting capacity of promising poplar clones (hybrids and species), as well as the relationship of size of cuttings and type of storage to rooting. Under prairie conditions, a high rooting capacity is an essential prerequisite for all potential distribution and breeding material. Northwest poplar is used as a standard for comparison. Rooting tests are being designed

so as to present comparative information as to vigor, disease reaction, hardiness, etc. of clones.

Although favored by climatic conditions, the 1950 tests were reduced in scope by pipeline construction in the experimental area. Nevertheless, the data obtained could be summarized as follows:

(1) Two natural hybrids of P. deltoides (No.5 and No.63) which appear rust-resistant, demonstrated equal rooting capacity and shoot development (height) to Northwest; while a third (No. 76, or 44-52) exhibited equal rooting and superior growth.

(2) Basal diameter (4-10 mm.) failed to show any relation to rooting capacity or shoot growth.

(3) 56% of the cuttings 'heeled-in' outdoors rooted, while only 36% of those carried-over in moist sand in the storage cellar rooted.

APPENDIX "B"

REPORT for 1950 on Breeding for Resistance to Dutch Elm Disease at the Division of Horticulture, Central Experimental Farm, Ottawa, and on the Propagation of Ulmus americana at the Dominion Experimental Station, L'Assomption, Que.

by A.W.S. Hunter,
Division of Horticulture,
Central Experimental Farm,
Ottawa, Ont.

Crosses were made at Ottawa on an enlarged scale in 1950 between Ulmus americana and the highly resistant species U.pumila using cut branches in water in the greenhouse. No seed was obtained. This method gave one seedling in 1949 and appeared to have some promise. In 1951 it is planned to make this cross outdoors on the trees themselves.

Under the project set up at L'Assomption for the propagation of U. americana, cuttings were collected during 1950 and treated as outlined. The cuttings callused fairly well in some treatments but none rooted. This work was again conducted under rather difficult circumstances since no one had been appointed to have charge of the work, and proper greenhouse and propagating facilities had not yet been provided. However, in October 1950 Mr. C.E.Ouellet was appointed to the staff at L'Assomption. This project and any further extensions of it, will be his sole responsibility. Since his appointment, Mr. Ouellet has been making himself familiar with the work done elsewhere on the subject. He will continue the experiment laid down in the original project outline and, in order to speed up the testing of supposedly resistant U. americana trees, he proposes to begin the propagation of several such trees by budding or grafting. This would not be an economic method from the standpoint of the nurseryman, but it will enable a stock to be built up for artificial inoculation tests.

The facilities for conducting this work at L'Assomption will be much improved with the completion this spring of a special propagation greenhouse which is at present under construction.

APPENDIX "C"

DUTCH ELM DISEASE

by A. W. McCallum
Division of Forest Biology
Science Service
Department of Agriculture
Ottawa, Ontario.

Dutch elm disease was first found in Quebec in 1944 and is now firmly established in the valley of the St.Lawrence River from the city of Quebec to Montreal and up the north shore of the Ottawa River as far as Argenteuil County. In 1950 there was no important extension of the infected area although diseased trees were found for the first time in 4 counties towards the International Boundary.

In Ontario a single infected tree was found in Prescott County in 1946. In 1947 no disease was found but in 1948 there were 14 cases in eastern Ontario. None was found in 1949 but in 1950 infected trees were located in 9 counties from the Quebec border to Windsor in Essex County. In 5 of the 9 counties only a single affected tree was found in each but in Essex County 91 infected trees were discoved in Windsor and vicinity. Evidently the original infection there had occurred some years ago. A total of 106 infected trees were found in Ontario last year and arrangements were made to have them all removed. The reason for the sporadic and widespread occurrence of the disease so far from known sources of infection is not apparent.

APPENDIX "D"

Report for 1950 on Forest Tree Breeding at Maple, Ont.

by C. Heimburger
Ontario Department of Lands and Forests
Southern Experiment Station, Maple, Ont.

The work has, as in former years, been divided into three main projects: (i) white pine, (ii) poplars, and (iii) arboretum.

White Pine As in former years the main efforts in this project were concentrated on the assembling of breeding materials and their testing and evaluation. The completion of the greenhouse construction in 1949 has for the first time allowed its full use for grafting of various white pine in 1950. A method was developed to thaw out potted pine stock stored in coldframes outside by means of an electric heating cable. The material was then brought into the greenhouse, forced to produce new growth and grafted according to methods already well developed during previous years. After grafting, the plants were placed in closed frames inside the greenhouse and left there until union of stock and scion was accomplished. The following table illustrates the progress of white pine grafting since its beginning at this Station in 1947:

Season	Clones grafted	Plants grafted	Successful grafts at end of first summer No.	%
Spring 1947	5	143	92	64%
Fall 1947	19	380	162	43%
Spring 1948	12	289	151	52%
Spring 1949	21	356	187	52%
Spring 1950	129	2447	2179	89%
Totals to date	186	3615	2771	77%

With better facilities and new techniques available it was thus possible greatly to expand the grafting of white pine and to improve the quality of the results. In this way much new and promising material has been assembled. The scions used have been received mainly from the following sources:

Highland Park, Rochester, N.Y.
Arnold Arboretum, Jamaica Plain, Mass.
Institute of Forest Genetics, Placerville, Calif.
Dr. A. J. Riker, University of Wisconsin, Madison, Wis.
Dr. R.R. Hirt, College of Forestry, Syracuse, N.Y.

In addition, scions have been collected from all the trees in the plantation at Pointe Platon, Que., and from all the trees selected 1947 and free from weevilling in the plantation near the water tower at Midhurst, Ont.

Some seedling lots of western white pine and Pinus flexilis inoculated with blister rust in the fall of 1948, during their first year in the seed beds, were transplanted in the spring of 1950 and showed blister rust infection. It has thus been possible definitely to infect seedlings during their first year in the seed beds. The fall weather of 1950 was very favourable to infection with blister rust and all pine grafts suitable for this were inoculated. The plantation of black currants established in the nursery to provide

inoculum showed very heavy infection and a lath house was constructed over some of it, to preserve infected leaves for fall work. This was quite successfully accomplished. A small plantation of black currants was established at the bottom of the ravine in partial shade on a cleared spot, to provide inoculum for infection in the future, when dry fall weather destroys most of the currant leaves in the nursery.

Outside grafting, developed in 1948 and perfected in 1949, was now used for mass propagation of some Mugo pine and Japanese red pine (Pinus densiflora), which were grafted into a plantation of Scotch pine established in the fall of 1947. Scions were also collected from some seedlings of Pinus cembra growing at Angus and successfully grafted into the crown of a mature white pine at this Station. It is hoped, in this way, to investigate whether Burbank's method of inducing early flowering of seedlings by grafting them into crowns of trees of flowering age, can be applied to white pine and related species. The method of outside grafting developed here is gradually receiving wide recognition and has been used successfully for grafting other pine species in Sweden and California, and is being found superior to the method of bark grafting used previously.

The experiments with outside grafting in the fall, started in 1949, gave some valuable results. It was found that outside grafting during September is unsuccessful. Grafting during October, when cool weather sets in, is quite feasible with white pine. It was also possible to graft hard pines in October, but only if one of the partners was a white pine. Thus, it was possible to graft white pine on Scotch pine and Mugo pine on white pine in October, while grafting of Mugo pine on Scotch pine was unsuccessful. This last graft succeeds very easily in the spring. The findings were immediately applied to fall grafting on a fairly large scale of scions from selected western white pine received from British Columbia.

The hybrid white pine seeds obtained in 1949 were sown in pots in the greenhouse, using acid sand of granitic origin for covering the seeds, to prevent damping off. The pots were later placed in a coldframe for cold treatment during the winter and the seeds germinated promptly in the spring. The seedlings were transplanted into a seed bed early in July when current growth was about finished. This, in combination with watering and shading after transplanting, stimulated new growth and most of the seedlings produced another set of shoots, and now have the appearance of 2/0 stock.

The artificial hybridization undertaken in 1949 in the plantation at Pointe Platon in Quebec yielded some 3000 supposedly hybrid seeds. This is the first time that hybrid white pine seeds have been obtained with both parents resistant to blister rust. Artificial hybridization was continued in 1950 using the very vigorous white pine in Harrison Park, Owen Sound, as female parents. Pollen was collected previously from some very good Pinus excelsa and P. Peuce in Highland Park, Rochester, N.Y. These crosses have previously been found quite feasible and yielding very promising and vigorous hybrids, and were now repeated, using parents of different origin, to study their combining ability. Some of the pollen collected in Rochester was sent to Idaho, to be used there on western white pine. Pollen of white pine was again collected during

hybridization work in Owen Sound and sent to California for use there on western white pine on a fairly large scale.

The experiments in the fall of 1949 in potting white pine transplants to be used as stock for grafting, into various kinds of pots were decidedly in favour of using clay pots in the future. The different kinds of paper pots did not stand up in greenhouse forcing and their use has been discontinued. The experiment in strangulation and partial girdling of young white pine to induce flowering was continued. Thus far, flowering has been irregular and with no apparent beneficial effects of the treatments as compared to the untreated controls. Grafting on suitable stock followed by root pruning, appears more promising with this species, and several of the young grafts again flowered abundantly in 1950.

Several seedling lots of white pine, of different origin, were shipped to the nursery in Orono, which kindly undertook to transplant and maintain them until ready for setting out in plantations. This material was tallied and measured later in the summer.

The breeding work with white pine carried out at this Station has now grown to such an extent and produced such results that it begins to receive international recognition. In recent years we have had visitors working in the same field from the United States, Sweden, France, Denmark, Norway and Finland at this Station and have received many favourable comments on our achievements. It is especially our method for outside grafting and other propagation techniques that are being adopted elsewhere. As the collection of breeding materials grows and is being evaluated for its resistance to blister rust and weevil, it is becoming of increased interest and value to other workers also. An exchange of scions of the most valuable clones for the purpose of testing and evaluation on a much wider scale than it is possible here, is gradually developing, chiefly in cooperation with the Bureau of Agricultural Administration of the U.S. Department of Agriculture.

Poplar. The aim of the poplar breeding project is the acquisition and testing of cottonwood hybrids for use in windbreak planting in southern Ontario, and the production of aspen hybrids adapted to the climate and soils of southern Ontario and easy to propagate from stem cuttings. Recent requests from wood using industries for poplar material suitable for planting in southern Ontario have given the work new impetus and the accelerated propagation of varieties on hand has been the immediate result thereof.

Some of the most promising cottonwood hybrids acquired recently are the so-called Black Italian Hybrids produced by the Institute of Poplar Cultivation in Casale Monferrato. Unfortunately, it has thus far not been possible to obtain any poplar cuttings from there in a living condition, because of transportation difficulties. Through the British Forestry Commission it has, however, been possible to obtain cuttings of some of these varieties after they have been successfully introduced and grown in England. More such material

was received in 1950 and is being propagated as rapidly as possible, as it seems to be exceptionally well suited to our growing conditions.

In work with the aspen group it has been possible gradually to assemble a fairly large collection of silver poplar materials from several parts of its native and cultivated range in Europe. Material is now at hand from the United States, England, Denmark, Sweden, Poland, Czechoslovalia, Hungary, Italy and Spain. Most of this has been propagated up to a volume making it possible to start a fairly comprehensive rooting capacity test from stem cuttings. A method has been found for rapidly building up stock of this kind, by grafting it on vigorously growing aspen suckers. Instead of bark grafting used formerly with a rather low percent of take and restricted to a relatively short period in the spring, cleft grafting has been tried, and with excellent results. The percent of take has almost doubled and the working period is much longer. As an example, it has been possible out of a handful of scions received from Czechoslovakia, to build up material yielding over 800 cuttings from side-branches alone in one growing season. Following the promising results of budding in 1949, new budding material was collected on a fairly large scale at Harvard Forest, where a good collection of native aspens from a wide range of localities is available. Two species of Chinese aspen, P. tomentosa and P. adenopoda, were found growing in Rochester, N.Y., and grafting materials were incorporated in our collection. Scions of a new form of triploid aspen from Sweden were also received. This clone does not seem to slow down its growth in our short-day climate and promises to become a very valuable introduction. Work with induction of early flowering by using the dwarf variety of trembling aspen occasionally found in southern Ontario, is beginning to yield tangible results. In the spring of 1949 some scions made of root suckers of Polish aspen were grafted into the crown of such a dwarf at this Station. During 1949 the material produced juvenile, sucker-like growth. In 1950 this changed into an adult type of foliage and flower buds were formed in the axils of some leaves. It is expected that more flower buds will be formed this year and it thus becomes possible to induce flowering of aspen sucker material in 3 years. The dwarf aspen variety was used quite extensively in budding experiments on various kinds of rooted poplar cuttings, in order to produce small trees for top grafting in the future, to induce flowering of varieties found desirable for breeding. Following the example of workers at Harvard University, a variety of basket willow, Salix purpurea, was propagated and budded with dwarf aspen in a further attempt to produce dwarfing stock for flowering induction purposes.

Poplar hybridization was again undertaken on a fairly large scale, using mostly pollen of European aspen received by air mail on trembling aspen ans silver poplar. Unfortunately, most of the pollen was spoiled in transit and produced only a very few seedlings. The most successful cross was P.alba, C.E.F., Ottawa x alba Czechoslovakia and P. alba C.E.F. Ottawa x (alba x grandidentata) Rosedale golf crouse. The male parent of the last cross is an exceptionally vigorous tree of good form and is being

propagated for use in test plantations also.

Arboretum. After much administrative conversation extending through several years it now appears that land necessary for the establishment of an arboretum as outlined in previous reports, will not be available at this Station. Therefore, the acquisition of seeds and other plant material of different tree species has been curtailed and efforts are now concentrated on the building up of a breeding arboretum of white pine and poplars. Much poplar material has now reached the size for moving it into an arboretum and an area has been found for this. Much new poplar material as well as several white pine grafts will also require land for setting out in the future and it is hoped that an area can be found for this.

The experiment in partial girdling of red pine to induce flowering in a plantation in Vivian Forest has been continued. The girdled trees again flowered more abundantly this year than the untreated controls and the frequency of trees with flowers was again greater among the treated trees than among the untreated controls. Several grafts of Mugo pine and Japanese red pine on Scotch pine were made for the purpose of investigating their value as dwarfing stock for red pine, to induce flowering in young grafts of this and allied species.

APPENDIX "E"

Report of the Work at Petawawa 1950-51

by Mark Holst
Forest Geneticist
Petawawa Forest Experiment Station
Chalk River, Ont.

Most of the work at Petawawa Forest Experiment Station, has been concerned with maintaining the material already on hand and preparing a report summarizing the work done in the past years.

As the future work is to be concentrated on spruce breeding, seed from approximately 75 single trees has been collected, mainly inside the boundary of the Experiment Station, to study the variation in growth vigour and within the biotype. 2/1 and 2/2 seedlings of Norway spruce and white spruce were picked in September for grafting of domestic and foreign material in the spring of 1951.

Plans have been made for the building of a propagating greenhouse. Main efforts for the time being will be concentrated on building up a collection of good trees from many biotypes. Plans have been made for the location of stands and single trees of superior growth vigour.

Considerable material has been exchanged with Denmark, Norway and Finland. From these sources the Station expects to obtain seed and scions of P. sylvestris, Picea abies and Larix decidua originated in eastern and south-western Europe but now grown in provenance experiments in Scandinavia.

APPENDIX "F"

Cytogenetics of *Caragana*

by

R. J. Moore- Division of Botany and Plant Pathology, Science Service, Department of Agriculture, O t t a w a, Ontario.

During the past three years a study of *Caragana* has been undertaken with regard to determination of chromosome number, taxonomy and hybridization experiments.

The *Caragana* collection in the Dominion Arboretum has been enlarged by plants raised from seed obtained from as many foreign sources as possible. Chromosome number of the plants has been determined and as soon as the plants flower, the identification has been verified according to the treatments of the Russian botanists Komarov and Pojark.

Determination of chromosome number has resulted in the following species being established as a diploid, ($2n = 16$): *C.ambigua* Stocks, *C. arborescens* Lam. (also the varieties *lorbergii* Koehne, *pendula* Carr., *sophoraefolia* Tausch and several horticultural selections) *C. aurantiaca* Koehne, *C. boisii* Schneider, *C.chamlagu* Lam., *C. conferta* Benth., *C. densa* Kom., *C. decorticans* Hemsley, *C. fruticosa* Besser, *C. jubata* Poir., *C. maximowicziana* Kom., *C. microphylla* Lam. (several varieties). Two species are tetraploid, $2n = 32$, *C. frutex* Koch (several var.)and *C. spinosa* DC.

Crosses involving the species arborescens, frutex, maximowicziana, aurantiaca, boissi in most combinations have been attempted without success. It appears that the clearly defined species are genetically well isolated and that interspecific hybridization is not a promising line of research in this genus. Some intervarietal arborescens crosses have produced a few seedlings which are yet very small.

Considerable time has been devoted to a taxonomic study, particularly of the species related to *C.arborescens*,-i.e. *C.boisii*, *C. fruticosa*, *C. microphylla*. Intermediate forms are common and it seems doubtful that *sophoraefolia* (suspected natural hybrid) and *boisii* and perhaps *fruticosa* are more than varieties of *C.arborescens*. Many plants received from various sources as *C. pygmaea* have been identified as *C. aurantiaca* Koehne. These related species are easily separated.

APPENDIX "G"

EQUIPMENT FOR TREE BREEDING - LADDER

John Walker, Superintendent,
Forest Nursery Station,
INDIAN HEAD, Sask.

Ideas concerning a suitable ladder were submitted on March 11, 1950, to: - Renfrew Light Alloys, Renfrew, Ontario. Letter was passed on to: - Lintet Metal Industries, Limited, Renfrew, Ontario.

Reply was received March 17, 1950, from Lintet Metal Industries Limited, requesting further information on certain requirements. A sketch was submitted by this firm - exhibit. Advice of Mr. J. L. Thompson, Agricultural Engineering Division, Experimental Station, Swift Current, Saskatchewan, was sought. I quote from his reply:-

" I have gone over the letter and the drawing from the Lintet Metal Industries Limited very carefully, and it would seem to me that this type of a ladder would do your job quite adequately."

Mr. Thompson suggested more overhang to allow the basket to reach the working area at all times. He also recommended a trap door to cover the ladder well in the floor, and a safety chain across the gap in the safety rail. With these improvements he recommended the ladder for trial. After a trial some changes may have to be made.

These suggestions and others were forwarded to Lintet Metal Industries Limited. Information was also sought on:

1) means of raising and lowering, and extending the ladder by windlass, etc.

2) whether it could be equipped to revolve on its base.

3) the possibility of mounting the ladder on a tractor.

Information was supplied in answer to these questions on June 30th, 1950. Answers were in the affirmative with one or two exceptions, e.g. Maximum angle 70°; equal to 13 feet of an overhang.

Ladder base can be revolved to allow basket to cover a circle 32 feet in diameter.

Platform size 3 feet square.

Maximum height from platform 45'5".

Maximum static load capacity 500 lbs.

Collapsed length 24'.

Mounting area 8 1/2' diameter circle.

Weight - not including swivel base - 155 lbs.

Quotation submitted follows:-

a) Special extension ladder model X-8318 - 54' long 3 - 18' trussed sections	- $550.00
b) Steel swivel base, equipped with ball bearings and locking device	- $265.00
Total	$815.00

Note: Ladder to be attached to flat platform of 2-ton Ford truck.

On July 27, 1950, an order for this ladder was placed with Lintet Metal Industries Limited.

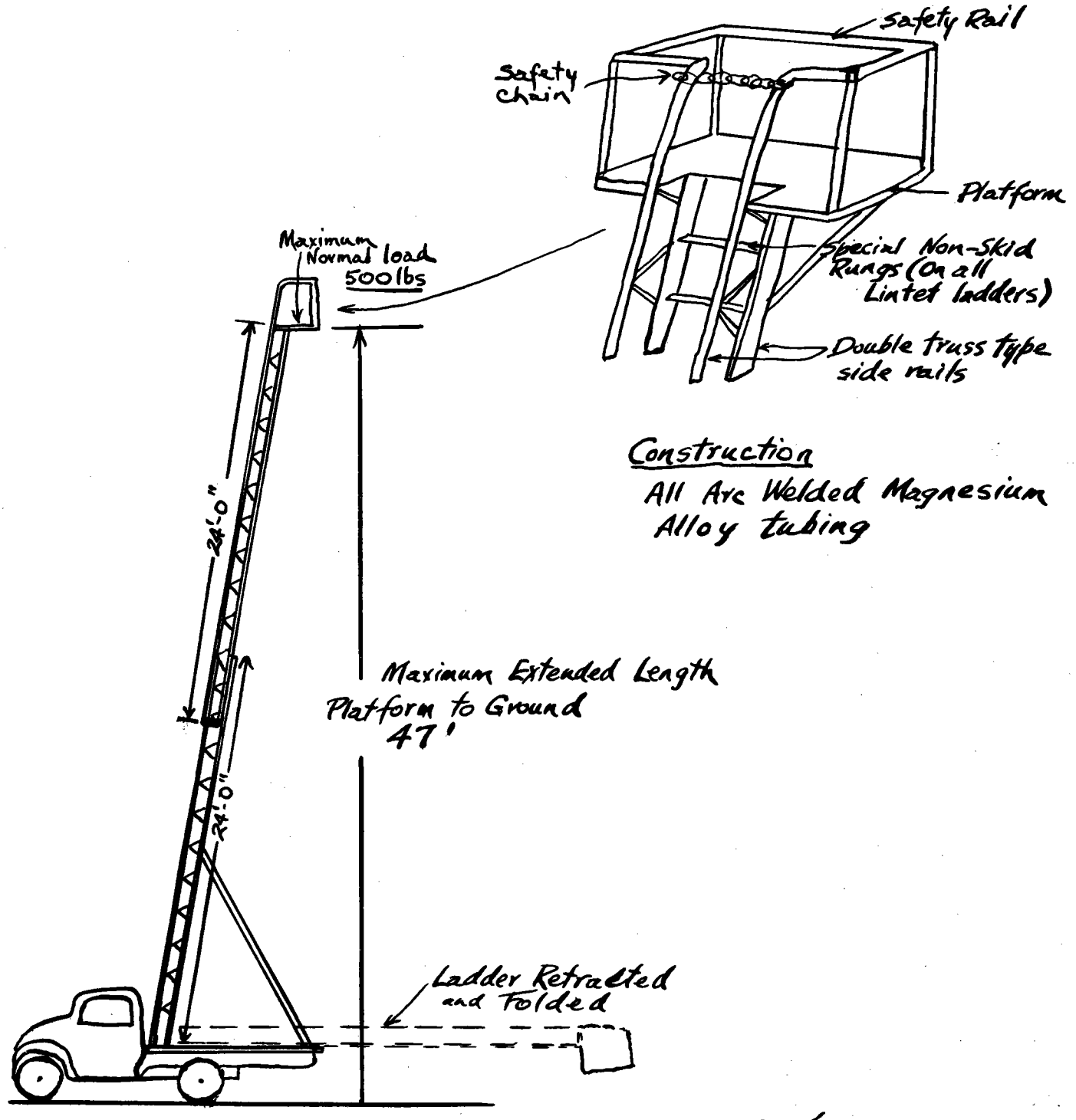
Ladder was two-thirds completed November 21, 1950. Tests were to be made before shipment. The ladder had excellent rigidity fore and aft, but exhibited some lateral flexibility. This was being eliminated.

Mention was made of a ladder 54 feet long, in six sections, which was constructed for Mr. Heaney, F.E.S., Petawawa, Ontario.

Reply to our latest enquiry dated February 1, 1951, has not been received.

SPECIAL 48 FOOT EXTENSION LADDER

FULL CANTILEVER TYPE - NO TOP SUPPORT REQUIRED
APPROXIMATE WEIGHT 105 lbs.



Construction

All Arc Welded Magnesium Alloy tubing

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