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NATIONAL RESEARCH COUNCIL OF CANADA

PROCEEDINGS

OF THE

TWENTY-SECOND MEETING

OF THE

SUBCOMMITTEE ON FOREST TREE BREEDING

OF THE

ASSOCIATE COMMITTEE ON FORESTRY

Petawawa Forest Research
APR 17 1950
CHALK RIVER, ONT.

OTTAWA

6 MARCH, 1950

NATIONAL RESEARCH COUNCIL

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ASSOCIATE COMMITTEE ON FORESTRY

Petawawa Forest Research
APR 17 1950
CHALK RIVER, ONT.

Held in Room 416 at 193 Sparks Street, Ottawa, on 6 March, 1950 at 2 P.M.

Attendance

Mr. H. D. Heaney, Chairman
Dr. N. H. Grace
Dr. J. E. Bier
Mr. G. A. Mulloy
Mr. A. Bickerstaff
Mr. G. Tunstell
Mr. W. E. van Steenburgh
Dr. A. W. S. Hunter
Mr. S. J. Cook
Mr. A. W. McCallum
Mr. John Walker
Dr. C. C. Heimburger
Mr. J. L. Farrar, Secretary

237. Minutes

The minutes of the twenty-first meeting were approved with the following changes:

In Minute 228, replace "suggested" by "stated"

In Minute 235, delete "hard pines".

238. Acquisition of Breeding Material from Foreign Countries

Dr. Heimburger stated that he is still desirous of opening up channels for obtaining breeding material from foreign countries (see Minute 235). Dr. Archibald stated that arrangements should be made through the Undersecretary of State for External Affairs. Mr. Farrar agreed to do this. Mr. Cook suggested that the High Commissioner from Pakistan would be glad to supply materials from that country. Dr. Hunter suggested co-operation with the U.S. Department of Plant Introduction.

Write & memorandum.

239. Dr. Heimburger's Report

Dr. Heimburger read a report on his work during the past year. (see Appendix "A"). Improvements have been made in the

technique of outside grafting of white pine. The use of grafting wax has been eliminated by substituting adhesive tape and friction tape. There are indications that the artificial innoculation of young white pine seedlings with blister rust has been successfully accomplished. A number of crosses has been made between P.stobus and related species. Several promising aspen hybrids have now been established. In this genus the photoperiodic response must be taken into account when moving a species geographically. In red pine progress has been made in inducing flowering by partial girdling and strangulation.

In the discussion, Mr. Bickerstaff stated that the thinned red pine plantations at Petawawa would be a good place to study the effect of stand density on cone production.

240. Mr. Walker's Report

At the forest nursery stations in the prairies, the Experimental Farms Service is concentrating its tree breeding activities in four genera: Populus, Pinus, Picea, and Carrigana. The desirable characteristics in poplar are: vigor, frost hardiness, rooting capacity, and resistance to rust and canker. About 100 promising clones are being propagated -- developed mostly from P. tremuloides, P. deltoides, and "Russian"poplar. Clone D-44-52 seems particularly good.

Spruce breeding is concerned mostly with selection of seed trees. One of the factors being sought is high seed production combined with a high yield of transplants per hundred seed. Promising trees will be propagated vegetatively to create seed orchards where wind pollination can occur between the selected clones. Induction of flowering, seed dormancy and sterility are other problems in which work is being done. The species are P. excelsa, P. pungens, and P. glauca.

Work in pine breeding parallels that of spruce. Some strain testing is being carried on.

Carrigana is one of the important genera for shelterbelts. Work is concerned with certain fundamental problems, such as effects of selfing and self-sterility.

241. Dutch Elm Disease

Mr. McCallum reviewed the situation with regard to the Dutch Elm Disease and the work of the Committee on the Dutch Elm Disease. Dr. Archibald stated that a greenhouse was being built at L'Assomption, P.Q., where work on this disease could be prosecuted. Dr. Hunter stated that he had produced elm hybrids on branches cultured in the greenhouse; and that tetraploid elms had been produced. (see Appendix "C").

242. Disease Garden at Connaught Ranges

Dr. Archibald suggested that more attention should be given to the maintenance of the Connaught Range Disease Garden. His organization is already looking after weed control. Mr. Farrar agreed to look into the matter and consult with Dr. Archibald about what should be done.

243. Mr. Farrar's Report

Mr. Farrar presented a brief report on his work for the past year (see Appendix "B").

244. Progeny of Superior Trees

There was considerable discussion concerning the available information on the progeny of superior trees. The consensus of opinion was that whereas we were certain that different trees would have different progeny, we could not tell from the appearance of a tree whether its progeny would be good or bad. The chances of trees with superior qualities producing progeny with superior qualities were better than in the case of trees with inferior qualities. Hence where seed tree cutting was practised, we should recommend that superior trees be left as seed trees; but where reproduction is from advance growth, we are not justified, from a genetic viewpoint, in recommending any changes from present procedure. Research to find and recognize trees with superior progeny should be prosecuted.

The Secretary was instructed to prepare a summary report for the Associate Committee.

245. Plus Stands for Seed Production

It was MOVED by Dr. Archibald and SECONDED by Mr. Mulloy,

That the Subcommittee recommend to the Associate Committee that organizations collecting tree seed (particularly the provincial forest services) be encouraged to acquire and set aside plus stands for the production of seed. CARRIED.

246. Lectures in Tree Breeding

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

That the Associate Committee be asked to arrange with the four Canadian Forest Schools to provide one lecture in tree breeding at each of the forest schools during the next four years; the lecturers to be outstanding forest geneticists, and the costs to be defrayed by the Associate Committee. CARRIED.

247. Membership

It was AGREED to recommend to the Associate Committee that the following be invited to become members of the Subcommittee.

Mr. A. Bickerstaff

Dr. L. P. V. Johnson

Dr. Chalmers Smith

Mr. W. H. Cram

Mr. R. S. Carman

Mr. Cook suggested that members be appointed for a specific term. The secretary was asked to look into this.

248. S.A.F. Committee on Grade Standardization of Forest Planting Stock

The Secretary outlined the aims and functions of this committee. The specifications for forest planting stock include seed origin which makes the matter of interest to this Subcommittee.

249. Tools and Equipment for Tree Breeding

Mr. Walker brought up the question of tools and equipment for tree breeding. He pointed out that future progress in the field will depend on the development of the special equipment required to enable a man to work in the tree tops where the tree flowers mostly occur. Mr. Walker mentioned the efforts at his station to develop a strong portable platform which would carry two men safely. Dr. Archibald offered the services of the Engineering Unit at Swift Current. The Chairman agreed to contact Renfrew Light Alloys. Mr. Walker was asked to bring in a report at the next meeting.

250. Adjournment.

The Meeting adjourned at 5 P.M.

J. L. Farrar,
Secretary.

APPENDIX "A"

Report on forest tree breeding in 1949

C. Heimburger

As in former years, forest tree breeding comprised 3 main projects: (1) White pine, (2) poplar, and (3) arboretum.

White pine The object of this project has been stated in the last report and remains the same. The main efforts are still concentrated on the assembling of breeding materials, and their testing and evaluation. The development of improved methods of vegetative propagation is still very important. The method of outside grafting of white pine developed in 1948 was improved still further in 1949 and it is now possible to substitute adhesive and friction tape for grafting wax with equally good results. This opens the possibility of topgrafting white pine to induce early flowering of seedlings and of maintaining the flowering capacity of scions collected from tops of trees. A fairly extensive series of experiments in outside grafting in the fall was started and their outcome should be available during this coming summer. Scions of various white pine and related species were again received by air mail from Denmark and California and successfully established on potted stock. Some very valuable scion material was also received from Dr. Scott Pauley at Harvard University of white pine from the southern part of its range in the Appalachian region. The results of artificial inoculation of young seedlings with blister-rust are believed to have been successful this time, although the untreated controls also showed some symptoms of infection. Western white pine seedlings were far easier to infect artificially and to get natural infection than several strains of eastern white pine, while seedlings of Pinus excelsa and P. parviflora showed less infection. This is in accordance with results obtained elsewhere with older stock of the same species. About 2000 seeds resulted from the artificial crosses made in 1948. The most abundant seed set resulted from the cross using pollen of blister-rust resistant white pine from Wisconsin on our white pine and from the cross of our white pine with P. Peuce x strobus from Denmark. The cross P. strobus x excelsa appears more difficult to effect. The young cones resulting from artificial hybridization were covered with paper bags in late summer, to protect them from squirrels and birds and loss of seeds, which proved very useful. The white pine in the plantation at Pointe Platon flowered abundantly this year and were utilized for collection of pollen that was sent to California and for various crosses with blister-rust resistant materials from California, Denmark and Wisconsin. About the same crosses were made as last year, but the mother trees were this time known to have resisted infection by blister rust for about 40 years. The pollen of P. Peuce x strobus from Denmark was used most extensively as it was collected from a tree showing a high degree of resistance to blister-rust. A similar cross made in 1948 yielded abundant good seeds and was repeated this year on a larger scale and using better mother trees. In the spring , some of the numerous seedlings

obtained from the seeds collected in the fall of 1946, were transplanted in the nursery at Maple and in Midhurst. The Midhurst material was later measured and tallied in detail. Great differences were found between various populations in the size and quality of the plants, their survival after transplanting and the reaction to the severe drought in the summer. In the fall, artificial inoculation with blister rust was again undertaken, this time mainly on the grafts of 1948 which had put out vigorous new growth and were in good condition for infection. The grafts of 1947 were also inoculated because the inoculation made in the fall of 1947 did not result in visible infection. A fairly large number of white pine transplants was obtained from the Midhurst nursery in the fall and potted for winter grafting in the greenhouse. Both earthenware and paper pots of different types were used to find which kind would best stand up to this treatment be most suitable for continued use in the future. One of the young white pine partially girdled in 1947 flowered abundantly this year, indicating that perhaps the material is reaching its natural flowering age and results of partial girdling and strangulation should become evident in a not too distant future. A natural hybrid of P. excelsa x strobus was located in a park in Toronto and scions of it used for grafting. It has the pendulous needles of P. excelsa and the hairy young shoots of P. strobus. It was found that the hybrids of P.Peuce x strobus obtained from Denmark and the Petawawa Forest Experiment Station had the glabrous young shoots of P. Peuce. A subsequent investigation of the hybrids P. strobus x Peuce at the Petawawa Forest Experiment Station also revealed the glabrous shoots of P. Peuce to be dominant in the reciprocal cross. Thus the glabrous young shoots of P. Peuce could serve as a useful marker in crosses of this species with white pine.

Poplar. The aim of the poplar breeding project was the same as last year. The construction of the new greenhouse was accomplished by the middle of January 1949 and the available greenhouse space was utilized for various phases of the poplar breeding project. This was caused by the fact that the white pine stock potted in the fall of 1948 and plunged in cold frames was not available for grafting until fairly late in the spring of 1949, as it was frozen solid and could not be moved into the greenhouse earlier during the winter. As the completion of the greenhouse was rather uncertain in the fall of 1948, only a small number of pine stock was potted for grafting at that time. Poplar pollen was again produced in fairly large quantities for shipment to Europe in exchange for which pollen, grafting scions and cuttings were received. It has now been established on a fairly broad basis of various crosses here and in Europe that of the 6 possible combinations of European aspen, our two native aspens and silver poplar the crosses P.alba x grandidentata, P.alba x tremula and P. tremula x tremuloides and their reciprocals yield promising hybrids. The other 3 combinations and their reciprocals have thus far failed to yield hybrids that are more vigorous than seedlings of the pure species. The cross P.alba x tremula has here yielded more vigorous hybrids than the cross. P.tremuloides

x tremula, probably because of the unfavourable photoperiodic response of the European aspen used in the crosses to our shorter days, which seems to be dominant in the latter cross and largely counteracts the hybrid vigour shown by hybrids of this parentage in Europe under photoperiodically more favourable conditions. Some of the grafts of northern P.tremuloides made in 1947 flowered this year and were subjected to open pollination by native southern P.tremuloides. The resulting seedlings also showed the unfavourable response of northern material to be dominant in crosses with southern biotypes. The situation thus is very similar to that found in crosses of northern and southern strains of aspen in Sweden. P.alba has thus far produced fairly vigorous seedlings when crossed with northern European aspen and thus seems to differ genetically in this particular respect from southern strains of both European aspen and trembling aspen. P.canescens materials obtained from Europe showed a wide diversity of growth rates indicating that in some cases the response to our shorter days was similar to that of northern European aspen while in other cases it resembles that of P.alba their putative parents. The most promising European aspen material for our conditions is thus far the triploid aspen from Lillö in Sweden, the best P.canescens material has been obtained from Denmark and Poland. Some very promising P.alba material has been obtained from cuttings received from England and from seeds received from Hungary. Some very promising materials of P. grandidentata have been received through the cooperation of Dr. Scott Pauley of Harvard University who collected scions in the southern most parts of the range of this species in the Appalachian region. The material is remarkably straight and vigorous, in marked contrast to the usual appearance of trembling aspen in the southern part of its natural range. The aim of this acquisition of new aspen materials is to obtain superior parent stocks for the production of the 3 promising hybrid combinations mentioned above. The grafting of aspens, carried out since the spring of 1947 has thus far shown rather conclusively that the two native aspens cannot be grafted onto each other while European aspen is compatible with both native aspens. A seeming exception are a few successful grafts of P.tremuloides from Kapuskasing and Colorado on P.grandidentata. The fact that the scions come from areas outside of the range of P. grandidentata might indicate the presence of a genetic barrier between the two species where their ranges overlap, manifesting itself in grafting incompatibility. The question needs further study and is of some importance to the breeding project because a dwarf strain of P.tremuloides is found in southern Ontario that flowers very early in life and indices early flowering in scions grafted on it. This dwarfing stock can thus far only be used to induce early flowering in P.tremuloides, P.tremula, P.alba and various hybrids between these, but not for work with hybrids involving P.grandidentata. Poplar budding was tried for the first time in August and was very promising. A far greater proportion of take was obtained than in bark grafting used in the spring and the period of work is also more favourable than spring grafting as it comes in a relatively slack season.

Arboretum A few grafted poplars were set out in their permanent location while seeds of a few pine species were sown in the nursery to produce additional material for an arboretum. Most of the new white pine and poplar materials will also eventually be set out in a breeding arboretum, if found worthy of this in current nursery tests.

Other work The results of partial girdling and strangulation of young red pine started in 1947, to induce flowering, were tallied. The treated trees had a significantly larger average number of cones per tree than the untreated controls and the proportion of trees with cones was significantly greater in the treated trees than in the controls. The proportion of trees with male flowers in the spring of 1949 was also significantly greater in the treated trees than in the controls. As a whole, partial girdling gave better results than strangulation. Outside grafting of red pine and other 2-needle pines was tried in the spring, using the methods previously developed for white pine. It appears that red pine lends itself less readily to outside grafting than white pine and some additional improvement in technique is needed to obtain comparable results. A strong indication of grafting incompatibility between red pine and jack pine was observed, while the grafting relationship between red pine and Scotch pine and Mugo pine, and between jack pine and Mugo pine appeared to be more normal.

APPENDIX "B"

FORESTRY BRANCH

Annual Report to the Subcommittee on Forest Tree Breeding

1949-50

There has been no change in the situation since our report last year. The position of forest geneticist is still vacant, and consequently the work is on a maintenance basis.

At the Petawawa Forest Experiment Station, the nurseries, arboreta, and plantations are being maintained and the trees are being looked after. The same applies to the disease garden at the Connaught Range.

J.L. Farrar.

Ottawa,
March 4,
1950.

APPENDIX "C"

Dutch Elm Disease Investigations

Dominion Experimental Station, L'Assomption, Quebec

Division of Horticulture, Central Experimental Farm, Ottawa

Report for Annual Meeting, Subcommittee on Forest Tree Breeding of the Associate Committee on Forestry, March 6, 1950.

A project was drawn up and approved in July, 1949, covering work to be undertaken on the vegetative propagation of the American elm (Ulmus americana) at L'Assomption, and the breeding of elms for resistance to Dutch elm disease at Ottawa.

Propagation - L'Assomption

It appears that trees of American elm may exist that are resistant to Dutch elm disease. This raises the problem of propagation , and testing for resistance under controlled conditions. Since these trees, if they are truly resistant and not merely escapes, are probably heterozygous for disease resistance, the best method of propagation is by vegetative means. This is true both from the standpoint of controlled inoculation experiments and the ultimate practical use of such selections by nurserymen. Propagation could be effected by grafting, but the procedure would be too expensive. The project referred to above was designed to investigate the propagation of American elms by cuttings. The following phases will be investigated: The use of softwood and hardwood cuttings; the time of collection of the cuttings; different rooting media; bottom versus no bottom heat; the treatment of the cuttings with plant hormones; and methods of maintaining the humidity over the cutting bed. A start was made on this project in 1949 but because of inadequate facilities and help no results were obtained. Money has been made available in the 1949-50 appropriations for the construction of a greenhouse at L'Assomption for this work.

Seed was collected from American elms in the diseased area that were not infected with Dutch elm disease. Some 300 seedlings are available for transplanting to the nursery in the spring of 1950. As soon as these have reached a suitable size they will be tested for resistance to Dutch elm disease. Seed collection will be continued in 1950.

Breeding - Ottawa

Since it is possible that no satisfactory source of resistance to Dutch elm disease will be found in U. americana, it may be necessary to resort to breeding. The Siberian elm, U. pumila, appears to be the most promising source of resistance. Most seedlings of this species are reported to be highly resistant to Dutch elm disease.

Unfortunately the American elm is a tetraploid (2n = 56) and all other species, including U. pumila are diploids (2n = 28). Hybrids between the American and Siberian elms would be triploids and would be highly sterile. If these hybrids should be resistant to Dutch elm disease, and of a suitable type for shade-tree purposes and could easily be propagated vegetatively, then this sterility would not be a particular disadvantage. On the other hand, sterility of the hybrid would preclude further crossing to improve tree type or disease resistance.

Two methods of approach are being followed:

1. Crosses are being made on cut branches in the greenhouse between U. americana and U. pumila. The triploid hybrids will be evaluated for suitability as shade trees and for resistance to Dutch elm disease. Only one hybrid has been produced to date.

2. Seeds of U. pumila were treated with colchicine to double their chromosome number. Six seedlings that appear to be tetraploids have been obtained. It is possible that these tetraploids will be fertile and will cross readily with U. americana and that the hybrids will also be fertile.

Several other species of Ulmus appear to have some resistance to Dutch elm disease but none appears to carry as much resistance as U. pumila. The Christine Buisman elm, a Dutch selection from U. carpinifolia, is reported to be highly resistant in the United States. Arrangements have been made to secure trees from the United States Department of Agriculture this spring (1950).

Two plants of the hybrid U. Wilsoniana x U. japonica have been obtained from the Arnold Arboretum, Jamaica Plain, Mass. This hybrid is reported to have some resistance to Dutch elm disease.

NATIONAL RESEARCH COUNCIL OF CANADA

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