ROLE OF THE WHITE BIRCH IN FORESTRY

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It is a safe bet that few foresters have ever even considered the utilization of the white birch in reforestation. However, our own particular interest was excited by our experience in reforesting portions of the area which has become known as the Morgan Arboretum at Macdonald College. In this predominantly hardwood area, offering a wide variety of soil types, it was found that the survival rate of the white birch on all sites compared favorably with that of all other hardwood species. In freedom from mouse damage (frequently a serious plague in this area), it was in a class by itself. In tolerance of grass competition, it was second only to the white ash. The absence of a strong tap root as in the oaks, hickories and walnuts, simplified transplanting operations and being a highly intolerant species, it proved well adapted to reforesting old farm fields, which made up a considerable portion of the property. Although sometimes regarded as a slow growing tree, it was found that on favorable sites seedlings made surprisingly rapid growth. On one particular collection, for example, originating from a single individual catkin gained an average height of 13 feet after only five years' growth.

Our interest in this tree was further stimulated as a result of collecting trips across the length and breadth of Canada. The ubiquity of this species lining roadsides, lakes and streams, wherever one journeyed, was indeed impressive. Even when flying over the vast coniferous forests of our north, a sudden gleam of white here and there signaled the spot where this persistent species had infiltrated some break in the forest cover. In many of the far northern areas visited, it was the only useful hardwood present and its great adaptability, to so many sites, renders it worthy of consideration as a reforestation species in certain cases.

All this leads to a consideration of suitable seed sources and in this connection it should be said, that while among individual collections there appeared forms markedly superior in growth rate and other qualities to the average performance of the species, the time has not yet arrived when we can select "superior" seed trees for reforestation purposes. Nevertheless, there is one elementary step that can be taken, This consists in avoiding seed catkins of the mountain white birch (Betula cordifolia Regel). This tree shares with the white birch (Betula papyrifera Marsh.) cooler portions of its range, Whether considered as a variety or as a true species, it is morphologically, physiologically and genetically distinct, The relevance of this lies in the fact that it makes a very slow growth as compared with its relative the white birch. Unfortunately, however, it is rarely distinguished from the latter by the uninformed collector who is, indeed, likely to favor the larger and more conspicuous seed catkins of the mountain species° Measurements of 100 specimens of each species, using three-year-old seedlings grown on the same site are of particular interest here. The average height growth of the mountain white birch seedlings was 25 inches and, for the white birch, 40 inches. After two further years of growth, the gap widened still further, showing 40 inches and 125 inches respectively.

It is only fair to say that the foregoing observations are confined to young seedlings and information as to future behavior is unavailable at present. Clearly, however, trees of this species eventually grow to a size comparable to the white birch, though information as to comparative wood quality is also lacking.

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Actually, the (cordate) leaves of the mountain white birch are sufficiently diagnostic, though there are a number of finer characters in seed and bracts which can be readily distinguished by the use of an ordinary hand lens, Even the first leaves of the two species are readily distinguishable. In addition to this, the stem of the white birch seedling is densely pubescent while that of the mountain white birch is relatively smooth. Finally, cytological studies made from seedling root tips showed that 28 is the characteristic chromosome number for the mountain white birch specimens.

It is true that we find a small proportion of mountain white birch with 56 clan mosomes, which we cannot as yet positively identify as hybrids, though obvious inter mediates were also noted with counts of either 42 or 56. In growth habits, hybrids more closely follow the pattern of the white birch, the characteristic chromosome number for this species being 70 or 84, rarely 56.

Time will not permit extended treatment of a characteristic birch of our northwest, i.e., the Alaska white birch (Betula resinifera Brit.), which takes the place of the mountain white birch of the east. Like the latter, it overlaps the range of the white birch with which it also forms hybrids. Collections were made the length of the Mackenzie River and its tributaries, the Liard and Peel rivers, as far north as Reindeer Depot, In the valley of the Liard River, trees were observed obtaining a diameter of 20 inches at the base. Further collections were made in a brief survey of the Yukon Territory. The lone birch on Discovery Claim Bonanza Creek, in whose shade Robert Service says he so often slept, must have left some sturdy descendent, On that spot today other trees of this species flourish, growing out of the rubble left by the Guggenheim dredges. In fact they are a common sight all along those ravaged creeks, some being 40 feet tall.

In conclusion we have passed very lightly over a series of observations and studies which up to the present are merely introductory. However, we have managed to assemble in the Morgan Arboretum a reservoir of genetic material sufficient for the continuing study of many students for the years to come.

DISCUSSION[1]

STAIRS - In the young fertilization studies on jack pine, did you get a marked increase in growth rate?

HOLST - The needles grew longer the first year and had a beautiful green color, as these are pretty heavy doses of ammonium nitrate; but the year after there was a reduction of leader growth. In another experiment where we gave increasing doses of ammonium nitrate to red pine, there was about a 30 percent reduction in leader growth the year after application. So I thought, perhaps female flowers were induced by a fertilizer shock. Perhaps the ammonia created a poisonous condition. Perhaps ammonia blocks a growth hormone so we get reduced growth and flowering. I just don't know, But it is there, I know there are some people here who wouldn't like to hear that you retard the growth of pines with nitrogen, but you do.

[1] Transcripts of the discussion were sent to each of the participants for editing with the specific request not to change the contents of their remarks.

CONNOLA - I'd like to ask Dr. Hoist about his applications of 2,4D. You say they were made for 2 weeks starting June 18. How was it applied and how many applications were made?

HOLST - In this particular case we made two different spraying schedules for 2,4D using 10-20-40 and 80 parts per million. The two lower concentrations we sprayed twice a week for three weeks and the two high concentrations a week apart, and that was all. We were just testing out, and there were no significant differences between concentrations. None whatever. In timing experiments with sprays, one should start early (earlier than we did) and spray for a limited period of about two to three weeks. June 18 is an intermediate date. If you start June 1st, or earlier, you get beautiful results. If you start the 1st of July you have no effect. So June 18 is just one of those days in between, but it so happened that it was the day our red pine breeding was over and had time for the spray experiments.

JACIW - Dr. Hoist, how do you explain the delayed reaction of flowering to the late application?

HOLST - When you fertilize late there is no immediate effect the following year but in 2 years after there is, and as far as I can see it is a true fertilizer effect. The red pine plantation is on a warm, dry somewhat limey soil, and may be a little deficient in nitrogen, but we don't know, The fact that we got decreased leader growth for the mid-season application of ammonia nitrate indicates a specific effect which is not a fertilizer effect.

MEAGHER - Mark, in the ammonium nitrate application, what carry-over into the cone development of the flowers was there?

HOLST - This is a seed production area, and I think that even the Ontario Dept. of Lands and Forests lost the cones there to somebody else, so I never carried this beyond counting the flowers.

HUNT - Mark, could you expect to increase both the number of male and female cones with a fertilizer application in late September of one year, followed by a second application in the ensuing spring?

HOLST - There are all kinds of possibilities in this game. For instance, we have started some new experiments with annual application to see whether we can counteract the reduction in female flowers. If you keep adding ammonium nitrate annually, then you should have a continuous increase of female flowers and you should be able to find out what is really going on. We started such a series of experiments, but we have no results on them yet.

HOLST- Of course most of these experiments were pilot tests, and we didn't know exactly how fine we should make them. In some of the experiments we started too late. I'm the first one to admit this. And therefore they are not as fine as they could be. But there are still some interesting things. In red pine Professor Duff found that the female flower primordia are initiated later than the male flower primordia. But when exactly that day is we don't know. And we don't know the exact period between primordia initiation and the date when these can be seen in a microscope. We don't know what the delayed period is for whatever

treatments you apply. Thus most of the evidence for when the flower primordia are formed is indirect and empirical, based on the last date the treatment was effective and the first date flower primordia become visible in the microscope. This is one point that we don't know. In fruit trees this period is about a month. Also there is a very large variation of flowering, so if you don't have enough trees in your treatments, this kind of situation can spoil your experiments completely.

GERHOLD - I'd like to ask Don Fowler to comment on the possible effect of environmental pre-conditioning on seed weight.

FOWLER - Environmental pre-conditioning can have a very marked effect on seed weight and thus on subsequent seedling development. In one of the papers under discussion, George MacGillivray suggested that environmental factors were responsibl e for much of the differences in seed weight. This is supported by the fact that the red spruce sites from which he obtained seeds were more variable than the black spruce sites. The red pine work at Maple, Ontario, indicates that soil fertility influences seed weight.

LARSSON - I have heard that Mr. Dyer and his staff have located some exceptionally high quality black spruce. Are these phenotypes localized in groups on particular sites or do they occur as individual specimens.

DYER - We think that our black spruce are particularly good -- I don't think there' a separate group within our plus trees. If you're thinking about white spruce and the Pagwa area, we have a number of selections there that are certainly in a group and in a site that's unique. But for black spruce our list of plus ire shows they are well distributed, likely not more than one or two in any particular location

LARSSON - Can you pinpoint the reason why the selected black spruce are of such high quality?

DYER - You mean as to being above average quality. Well, I think it's just our method of selecting plus trees. We interest all our districts located in the boreal forest in selecting in both white and black spruce. A lot depends, fo instance, on where next year's logging operations may be encountered. The field staff are familiar with this a year ahead and are looking for candidate trees and these are the areas in which we select. We're not confining our selection to any particular area or site.

OLSEN -I was wondering Dr. Hoist, this ammonium nitrate, was this in a solution or was it put on dry and washed in?

HOLST - We have tried to give dry fertilizers, as well as fertilizers in solution, but I don't think it really matters, You just apply dry 33% ammonia nitrate commercial type on top of the soil. The dose used goes up from about 50 grams per square meter, The other point is that if you run into a dry period, how sure are you that a dry fertilizer becomes available to the trees within a few days. For some fertilizers this would be hard to answer, but we know ammonia nitrate is very hygroscopic and within a few days you see that it has disappeared. Then nitrogen becomes very quickly available in the soil.

GERHOLD - I believe you said the isolation zone around seed orchards was one-half mile to a mile wide. This is somewhat wider than the figure I'm accustomed to seeing. Would you comment on the reason for such a wide isolation zone?

DYER - It was decided on the basis of what we could find in the literature about pollen dispersal patterns. We are not able to obtain it in each case, but we try to get it. We have located seed orchards in areas where the species is present but to the extent that we can remove it from the surround. It is an average figure and not a definite requirement.

JACIW - I wish to ask Mr. MacArthur whether he would like to comment on what role can be ascribed to white birch in reforestation.

MacARTHUR - In the province of Quebec we think of it as a possibility in reforesting extensive areas of abandoned farm land that have been shown unfortunately to be too poor for spruce, particularly white spruce. It has been suggested that white birch is well suited to form a first crop on some of these lands and improve them, possibly as a nurse crop, for more valuable species, either softwoods or possibly deciduous species. We feel that we're getting to the stage in parts of Canada where wood is approaching short supply. In the next 20 years we expect the supply-demand curves to converge and the industry is beginning to think much more seriously about more intensive forestry -- bringing the growing of the raw material closer to the mill and using these abandoned lands. This is seen as one possible and important role of white birch, and if we're going to use it at all it's important that we look for quality. If we're going to plant it then we'd like to plant something that will produce a good type of raw material, the best we can manage to grow. I think this is the major role seen in the Quebec area at this time. I think this probably applies elsewhere in Canada.

HOWE - Mr. MacArthur, do you anticipate that the birch borer would be a problem in the white birch?

MacARTHUR - Bronze birch borer? I don't know of a problem with it in Quebec at this time. It was once thought to be the cause of the birch dieback. Once it was eliminated as causing the dieback no one seems to have paid much attention to it. I have never seen a serious case of birch borer damage. There is one other insect that could be a nuisance and that is birch leaf miner. In large populations of birch it builds up to very heavy populations and destroys a large part of the foliage annually, unless something is done about it. This doesn't kill the trees usually in Quebec at least, but it certainly reduces the foliage drastically and must have an adverse effect on growth.