SOME METHODS OF SELECTING AND PROPAGATING ASEXUALLY HIGH QUALITY PHENOTYPES OF SILVER MAPLE (ACER SACCHARINUM L)

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Silver maple is an important swamp species in southern Ontario occurring in both pure stands and in mixtures with American elm (Ulmus americana L), black ash (Fraxinus nigra Marsh), bur oak (Quercus macrocarpa Michx), yellow birch (Betula lutes Michx), and eastern cottonwood Populus deltoides Marsh). This forest type is commonly referred to as the soft maple-elm type and is the second most important forest type in south-western Ontario, containing about 33 percent of the total primary growing stock (2).

There is a great need in southern Ontario to restock many of the swamps with high quality trees of desirable species to replace the elm which are being devastated by the Dutch elm disease. Silver maple appears to be one of the most suitable species for general planting in such swamps. This species will grow rapidly both in pure and mixed stands when properly managed. For instance a thinning study indicated that the annual diameter increment of a dense stand of silver maple in the polewood stage of development could be increased from a quarter of an inch a year to half an inch a year by thinning the trees to a 17-foot specing. At the same time, the basal area of the crop trees was almost doubled and the volume almost tripled over a 10-year period as compared to only a one-third increase in basal area and a doubling of the volume for the silver maple in the unthinned portion of the stand (3).

Unfortunately many silver maple tend to be heavily forked and branched as well as having a large proportion of dark heartwood. In addition the boles of many trees are perforated by the larvae of the Ambrosia beetle. All these features greatly reduce their value for veneer and lumber. Nevertheless trees of exceptional vigour and quality have been encountered in the bush indicating that there are individual trees and groups of trees within this species which could serve as potential genotypes for the production of high quality nursery stock. These observations led to the initiation of a program in 1958 for locating, selecting, and reproducing high quality silver maple phenotypes in southern Ontario for reforestation purposes.

LOCATING SUPERIOR TREES

A great number of high quality silver maple stands were located and marked in 1958 on county maps in southwestern Ontario for future reference. Many of these have since been inspected by one to four men traversing them at 100-foot intervals and examining the high quality trees which were encountered on and between the lines. The quality of the superior-looking trees was assessed by using quality standard tables (table 1) which had been developed earlier for evaluating tree quality of silver maple during the selection of crop trees in thinning studies. If any high quality trees were encountered, the tree number and a white band was painted at breast height on their trunk for future reference.

Selection work was started in March 1959 in the Stratford Zone of the Lake Huron District by inspecting silver maple in a number of swamps. This survey has been continued to the present time. The first high-quality phenotypes for lumber and veneer production were not located until the fall of 1961. These were found near the Otter Creek Tract, on Concession XII, Lots 16, 17 and 18, Burford Township, Brant County.

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The superior trees occurred in two different locations in the swamp but were considered to be part of the same population as they were less than one half mile apart. One area contained 10 trees and the other had 6 trees. In the same year, four more superior trees in a different location but of the same population were located in the Beverly Swamp, Concession IX, Lot 21, Beverly Township, Wentworth County. All trees were growing on private land and permission had to be obtained before the scions and cuttings were removed from the selected trees.

SELECTING SUPERIOR TREES

Considerable variation in growth habits occurs in silver maple. Some trees are tall, straight and lightly branched while other trees within the same stand are forked, crooked and heavily branched. It is generally agreed that difference in the form and growth habits of a tree may be attributed to stand history, environment and heredity or to a combination of two or more of these factors.

At present, it is most difficult to determine which of the three aforementioned factors is partly or entirely responsible for a high quality tree. For instance, it is not unusual to find a high-quality tree and a low-quality tree originating from the same stump or from the same root collar. In this instance one might assume that environmental conditions rather than genes determined the ultimate quality of the two trees. However if all the trees in the same coppice are high-quality, then we might assume that all three factors have been favourable for producing the high quality trees in that coppice. This same approach might also be used in evaluating the quality of trees of seedling origin growing under uniform conditions. In either case such high quality trees should be clonal tested to determine if the ramets of such clones will exhibit the same features of quality as the original ortets. Cuttings, budding and layering were considered the best methods of reproducing these superior trees for testing purposes.

EVALUATING SUPERIOR TREES

Vigour and quality were considered of equal importance in selecting plus trees. Tree vigour is defined here as a healthy tree with a considerably above average height and diameter increment. This was determined by heights and diameter-measuring instruments and by taking age counts. Quality on the other hand refers to form, number of logs and noticeable defects. This was determined by using a quality standard table (table 1) based on a tree analysis of several silver maple stands. Provisions were made in this table to include a list of qualities to distinguish superior trees within the species. Each main feature of a tree was given a numerical rating and when all the scores were added together they gave a total rating of 91 to 100 points for a superior tree. The following table served as a guide in the initial selection of high quality silver maple phenotypes which are now being used for the propagation of clonal and progeny material.

Table 1.--Vigour and quality features of superior silver maple phenotypes for the production of lumber and veneer

1.	Must be dominant or co-dominant.	5
2.	Must have either three potential 16-foot logs, or two 16- and one 10- or 12- or 14-foot log.	30
3.	Bole of the first two 16-foot logs should be free of branches and those which might be present on the third potential log should not be greater than two inches in diameter at point of attachment to the bole (Loss of 5 points if there is some branching). Heavy epicormic branching eliminates the tree.	20

4.	Bole must be straight, single stemmed and uniformly rounded in cross section (Tree is put in a lower quality class if any of the above qualities are missing).	20
5.	Bole must be straight grained with no noticeable defects such as rot, canker, spiral grain, seams and heavy knots which will automatically cull the tree.	10
6.	Tree must have a well balanced crown in relation to competition. (Deduct up to five points if crown is unbalanced and if the crown is unhealthy the tree is rejected).	5
7.	Tree must maintain an annual diameter increment of not less than half an inch a year within two years of release.	10
	Total Score for a perfect tree:	100

PROPAGATING SUPERIOR TREES

<u>Cuttings</u>

Enright's studies have indicated that silver maple could be propagated successfully by cuttings. It was decided to run a series of tests using Enright's results as a basis for determining the best rooting media, the most effective concentration and duration of soaking in Indolebutyric acid solution and to see if cuttings from coppice of old stumps (60 to 80 years) could be reproduced successfully.

Test 1

To determine the best soil media for rooting silver maple cuttings.

<u>Methods</u> .--Ten soil media were evaluated, namely sand, vermiculite, acid peat, muck and paired combinations of each at a 1 to 1 mixture by volume. Four to six inch cuttings were prepared in early July 1957 from current season growth of coppice origin. Half of the cuttings were treated by soaking them for three hours in an aqueous solution containing 200 ppm of indolebutyric acid and the other half were soaked in distilled water only. The test consisted of 20 treatments with 25 cuttings per treatment making a grand total of 500 cuttings for the entire experiment.

<u>Results</u> .--Rooting only occurred on those cuttings which had been treated with the rooting hormone. Of these, the best rooting occurred on those cuttings which had been planted in the vermiculite and sand mixture which had 24% success as compared to only 4% in sand, 12% in vermiculite, 4% in vermiculite and peat, and 8% in the vermiculite and muck mixture.

Test 2

To determine the relationship between the length of time of soaking in indolebutyric acid solution and the concentration of the hormone on the rooting of silver maple cuttings.

<u>Methods</u> .--Silver maple cuttings from 4 to 6 inches long were procured in early July 1959 from the current season coppice. The cuttings were soaked in indolebutyric acid solutions of 500, 1000, 10,000 and 20,000 ppm for 60, 20, 5, 1 minute and for 10 seconds depending on the strength of the solution. For instance, cuttings were soaked for 20 to 60 minutes in the 500 ppm solution and for only 1 minute to 10 seconds in the 20,000 ppm solution. There were also 5 untreated controls, making a total of 13 treatments for 20 cuttings per treatment which were replicated twice giving a grand total of 520 cuttings for the entire experiment.

The cuttings were planted in flats containing an equal volume of vermiculite and sand and were placed in an outdoor cutting bed. Humidity was kept above 70 percent by covering the top with plastic sheeting and the ventilation was controlled by small openings in the cutting frame. Temperature ranged from 55 to 75° F. The cuttings were tallied in six weeks for rooting success.

Results. --The best rooting results occurred in those cuttings soaked for 60 minutes in a 500 ppm solution of indolebutyric acid (table 2). Less soaking at this strength gave almost the same results as soaking in distilled water only. However, soaking the cuttings for 20 minutes in 1000 ppm or for 5 minutes in 10,000 ppm or for 1 minute in 20,000 ppm of indolebutyric acid appeared to be detrimental to rooting (table 2) whereas, if the length of time of soaking at 1000, 10,000 and 20,000 ppm is reduced to 5 minutes, 1 minute and 10 seconds respectively the percentage of rooting increased.

Table 2.--Percentage of silver maple cuttings with roots following soaking in several concentrations of indolebutyric acid at five time intervals

Concentrations	Soaking time	No. of cuttings	Cuttings with roots %
1) 500 PPM	60 min.	40	67
2) " "	20 "	"	33
3) 1,000 "	20 "	"	7
4) " "	5 "	"	33
5) 10,000 "	5 "	"	7
6) " "	1 "	"	25
7) 20,000 "	1 "	"	7
8) " "	10 sec.	"	2
9) Control	60 min.	"	33
10) "	20 "	"	7
11) "	5 "	"	25
12) "	1 "	"	30
13) "	10 sec.	"	35

Test 3

To determine the rooting ability of cuttings from coppice of the current season procured from a 5, 30 and an 80 year old silver maple.

Methods.--Cuttings from 4 to 6 inches in length were prepared in early July 1964 from coppice of the current season growing at the base of fresh stumps of a 5, 30 and an 80 year old silver maple which had been cut in the late winter of 1964. These were planted in a 1 to 1 sand-vermiculite media after being soaked for two hours in 200 ppm solution of indolebutyric acid.

Results. --Best rooting occurred in the cuttings from coppice of the five-year-old trees with 63% success followed by the cuttings from the 30 year old tree with 12% success and the poorest rooting was from coppice of the 80-year-old trees which were only 1% successful.

Budding

Propagation of the 20 high quality silver maple phenotypes located in 1961, 1962 and 1963 in southwestern Ontario was started in early August of 1962 by budding eight of these plus trees and one inferior tree for comparison purposes. Since then, approximately 20 superior phenotypes have been budded each year.

Collecting the Bud Sticks

A crew of three men collected the bud sticks. Two of the men used bicycle climbers to climb the selected trees and the third man gathered the severed branches from the ground and prepared scions from the fresh terminal shoots of that year. Each shoot was cut into one or more six-inch sticks bearing from two to six buds. The petiole of each leaf was severed to leave a half-inch of stem to serve as a handle when budding. The bud sticks were placed in bundles of from 10 to 50 sticks and were labelled with the phenotype number and the origin of the branch; that is whether it was a lateral, epicormic or coppice. Each bundle was then wrapped in wet cloth, put in a cooler and covered with ice where they remained for one to three days until required for budding.

Budding Technique

The high quality silver maple phenotypes were budded by a two to six man crew in early August of 1962, 1963, 1964 and 1965 at the Orono Forest Tree Nursery of the Ontario Department of Lands and Forests. Budding was done directly to the original stem of the nursery stock or to coppice shoots arising from the root collar of the original stem.

The technique consisted of T-budding at two to six inches from the ground. The bud was a shield type which was held firmly in the incision on the stem of the nursery seedling by wrapping it with a special one-half-inch plastic band. The budding bands remained in place until the following spring when they were removed. Buds from each of the selected phenotypes were budded on to 50 silver maple seedlings. A record was kept of the time of budding, phenotype number and whether the bud was a terminal or lateral bud from a coppice, epicormic or lateral branch.

Each spring, the budded trees were tallied as to success or failure. All successfully budded trees were marked with yellow paint below the bud and the nursery seedling, which had been successfully budded, was cut off at about one inch above the growing bud. In August of the same year the successfully budded trees were root pruned. In early September, the total height of the ramets of each clone were measured and the presence or absence of forks and branches were recorded for each ramet as well as any other pertinent information on growth.

RESULTS

Results for 1962

Table 3 indicates that of the 10 phenotypes budded at that time only five of these were successfully propagated. It was also observed that side buds from coppice, epicormic and lateral branches and top buds from epicormic branches could be successfully budded.

Table 3.--Percent success and height in August 1963 of nine silver maple budded in August 1962

Phenotype number	Bud origin	Success %	Range in height (inches)	Average height (inches)
B-3-1	Coppice-side*	6	54-66	60
B-3-2	Branch-side	12	34-54	42
B-3-4	Epic.**-side	0		
B-3-5	Branch-side	0		
B-3-6	Epic.-top*	16	8-32	22
B-3-7	Branch-top & side	0		
B-3-8	Epic.-side	0		
B-3-9	Branch-epic-side	6	33-52	43
Cull - 639	Branch-side	2	69	69

* side refers to a side bud and top refers to the terminal shoot
** epic. - epicormic shoots

Results for 1963

Nineteen high quality lumber phenotypes and one low quality lumber phenotype were budded in 1963. Twelve of the plus trees and one inferior tree were propagated by budding (table 4). Success ranged from 2 to 31 percent. The selected trees 1, 2, 4, 5, 6 and 9 which were successfully budded in 1962 were again successfully budded in 1963. However, trees 7 and 8 which were unsuccessfully budded in 1962, again failed to "catch" in 1963 (tables 3 and 4).

Results for 1964

Table 5 indicates that 43 percent of the phenotypes which were budded in August 1964 were successfully propagated by this method. Side buds from epicormic and lateral branches were again equally successful. It was interesting to note that the silver maple phenotypes B-3-1 which was first budded in 1962, with only a 6% success, had 14% in 1963 and 40% in 1964. The buds were taken each year from the successfully budded trees of the previous year. These results might indicate a gradual selectivity in buds conducive for budding. Again the phenotypes 7 and 8 failed to take in 1964.

Table 4.--Percent success and height in August 1964 of 19 high quality and one low quality silver maple clones budded in August 1963

Phenotype number	Bud origin	Success %	Range in height (inches)	Average height (inches)
B-3-0	Branch-side	0		
	Epic.-side	12	29-60	44
B-3-1	Branch-side	14	36-82	62
B-3-2	Branch-side	22	37-62	52
B-3-3	Branch-side	10	24-48	40

B-3-4	Epic.-side	31	36-73	61
B-3-5	Branch-side	9	48-79	68
B-3-6	Branch-top	21	21-77	49
B-3-7	Branch-side	0		
	Branch-top	0		
B-3-8	Epic.-side	0		
B-3-9	Epic.-side	6	23-68	43
B-3-10	Epic.-side	0		
B-3-11	Epic.-side	2	81	81
B-3-12	Branch-top	0		
B-3-13	Epic.-side	0		
B-3-14	Branch-top	22	26-76	52
V-1-1	Branch-side	11	1-67	52
	Branch-top	0		
V-1-2	Branch-side	8	68-90	83
V-1-3	Branch-side	0		
	Branch-top	0		
V-1-4	Branch-side	0		
	Branch-top	0		
Cull V-7	Branch-top	2	69	69

Epic. - Epicormic

Table 5.--Percent success and height in August 1965 of 19 high quality clones and two low quality clones of silver maple budded in August 1964

Phenotype number	Bud origin	Success %	Range in height (inches)	Average height (inches)
B-3-0	Branch-side	0	10-39	24
B-3-1	Coppice-side	40	5-26	18
B-3-2	Branch-side	24	23-37	29
B-3-3	Epic.-side	8	3- 3	3
B-3-4	Branch-side	3		
B-3-5	Branch-side	0		
B-3-7	Branch-side	0		
B-3-8	Coppice-side	0		
B-3-9	Branch-side	8	1-39	29
B-3-10	Epic.-side	12	34-78	55
B-3-11	Epic.-side	0		
B-3-12	Branch-side	0		
B-3-13	Epic.-side	0		
B-3-14	Branch-side	24	4-55	40
B-3-15	Branch-side	0		
V-1-1	Branch-side	10	32-59	42
V-1-2	Branch-side	10	47-68	61
V-1-3	Branch-side	0		
V-1-4	Branch-side	0		
Cull 639	Branch-side	0		
Cull V-7	Branch-side	0		

Layering

A pilot-layering bed was established beside the budding bed in the spring of 1964. The successfully budded phenotypes of 1962 were layered by planting half the trees vertically and the remaining half horizontally in the layering bed.

The severed stem of the grafting stock of the vertically planted ramets were placed to a depth of approximately six inches below the surface to insure that they would not send up coppice. The stem of the budded tree was then cut off at about 6 inches above the surface to induce coppicing. The horizontally planted ramets were laid in the trench at about 30 degrees to the horizontal and the rooted portion and the severed stem of the grafting stock was covered with more than six inches of soil to prevent it coppicing. The stem of the budded phenotype was held almost horizontally in the trench with bent wire so as to induce the branches to grow vertically.

The basal portion of the coppice from the vertically planted ramets and the elongated stems of the horizontally planted ramets were nicked with a knife and the injured portion was dusted with the rooting hormone, Stim Root, and covered with soil to induce rooting. The soil was kept moist during the rest of the growing season.

The treated stems were examined as to success or failure of the treatment in the spring of 1965. All successfully rooted layers were then taken to a production-layering bed and planted in trenches for further layering.

Results

Measurements were taken of the coppice from the vertically layered and of the shoots from the horizontally layered ramets on the 16th June, 1964, and again on the 25th September, 1964. Observations indicated that the shoots from the vertically layered ramets grew more rapidly than did those shoots of the horizontally layered trees (table 6).

The success of the treated and the untreated stems was evaluated in the spring of 1965 by digging them up and examining each one for the presence or absence of roots.

Table 7 indicates that a rooting hormone is not essential for rooting all phenotypes but is recommended for maximum rooting results. In one phenotype, B-3-6, no roots occurred after treatment with Stim Root. Although table 7 does not indicate the difference in rooting between the vertically and horizontally layered trees, nevertheless the best rooting results occurred on the horizontally layered trees.

SUMMARY

Our studies have indicated that silver maple will grow rapidly in both pure and mixed stands under swamp conditions. Quality is generally low where less than 5 percent of the trees in a stand are of high quality. Plus trees are capable of growing almost an inch in diameter a year. Such trees could be used to advantage in re-stocking with clonal and progeny material those swamps which are being devastated by the Dutch elm disease.

Studies have been conducted on reproducing silver maple by cuttings, budding and layering since 1957. Best conditions for rooting cuttings are: prepare 4 to 6 inch, semi-hard cuttings in early July, from epicormic or coppice shoots of the current season. These should be dipped for one hour in 500 ppm of indolebutyric acid prior to planting in an equal mixture by volume of sharp sand and vermiculite in an outdoor

Table 6.--Average number and the minimum and maximum height in inches of shoots which developed in the 1964 growing season from vertically and horizontally layered ramets of five silver maple phenotypes

Phenotype number	Ramet number	Type of layering	No.	Average number	Height: Minimum (inches)	Height: Maximum (inches)
B-3-1	1	Vertical	7		9	41
	2	"	5	6	15	38
	3	Horizontal	9		4	15
	4	"	7	8	4	28
B-3-2	1	Vertical	6		14	39
	2	"	6		11	25
	3	"	3	5	8	33
	4	Horizontal	7		3	18
	5	"	9		5	36
	6	"	7		5	24
	7	"	6	7	4	52
B-3-6	1	Vertical	4		3	42
	2	"	2		23	50
	3	"	6	4	4	41
	4	Horizontal	4		13	30
	5	"	7		4	22
	6	"	11	7	2	29
B-3-9	1	Vertical	5		6	42
	2	"	5	5	9	34
	3	Horizontal	7			
	4	"	8	8	3	15
Cull	1	Vertical	4	4	57	62

Table 7.--Effects on rooting by treating vertically and horizontally layered shoots of silver maple with a rooting hormone

Phenotype number	Ramet number	Type of layering	Treatment	Occurrence of roots	No. of rooted layerings
B-3-1	1	Vertical	Rooting hormone		
	2	"	Nil		
	3	Horizontal	Rooting hormone	Present	
	4	"	Nil		
Total:					7
B-3-2	1	Vertical	Rooting hormone	Present	
	2	"	Nil		
	3	"	Rooting hormone	Present	
	4	Horizontal	Nil	Present	
	5	"	Rooting hormone	Present	
	6	"	Nil		
Total:					13
B-3-6	1	Vertical	Rooting hormone		
	2	"	Nil		
	3	"	Rooting hormone		
	4	Horizontal	Nil		
	5	"	Rooting hormone		
	6	"	Nil		
Total:					0
B-3-9	1	Vertical	Rooting hormone	Present	
	2	Horizontal	Nil	Present	
	3	"	Rooting hormone		
Total:					9

cutting bed. This bed should be completely enclosed in a wooden frame, the top of which should be covered with lath shading which in turn should be covered with plastic sheeting to keep the humidity at about 80 percent and a temperature from 60°F to 70°F. On hot days at 80° or higher, a single thickness of newspaper should be spread over the bed to cut down on the heat.

Best budding results in this study occurred when the buds were taken from juvenile shoots (epicormic and coppice) or from current season shoots of trees which had originated from budding the previous year. There was an indication that the last week of July and the first week of August was the most satisfactory period for budding.

Horizontal layerings produced better layered trees than did the vertical layerings. Better rooting occurred on those shoots treated with a rooting hormone.

CONCLUSIONS

It may be concluded from this paper that fast-growing, high quality plus trees of silver maple do occur and that these trees can be successfully propagated by cuttings, budding and layering, if the proper techniques are employed. The progeny and clones of high quality trees should be used wherever possible to restock those swamps devastated by the Dutch elm disease.

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DISCUSSION

HUNT - I'd like to ask Bill Gabriel if he finds that maple sugar producers are sufficiently interested to continue this screening on their own and to locate additional sweet trees? Secondly, after collecting material from this stock would you propagate it clonally for release as known clones or perhaps work through commercial nurserymen to produce these clones? Do you believe these individuals would be interested in establishing their own improved sugar bush?

GABRIEL - When we first started our program, we were naive enough to believe that we could get the sugar producer to do the testing, but if you have ever been in a sugar bush at the time that the sap is running, you'll find that the producer stays in the sugar house until the season is over, and you can't get him out. So consequently we had to shift from the idea of having the State forestry personnel and the extension agents to teach the sugar producer how to do it, to having them actually doing the work themselves. The answer to your first question then is "No." To the second question; we've thought a little about the distribution of the clonal material and also the seedlings and seed from selected trees. We're not in the position to give you anything definite on this right now. Probably the various state forestry organizations will get the material and distribute it on a state basis. We won't do any distributing ourselves. I'm in no position to speak with authority on this since it is more of an administrative problem; I'm more interested in the experimental end of it.

FUNK - I have a question for Professor Fechner. G il, now that you've got promising results so far, what's your inclination: Are you satisfied; would you like to try more of the Northeastern Station poplar hybrids; would you like to make some of your own crosses perhaps involving some of the western poplar species?

FECHNER - I think "Yes" to several of the questions that you asked. We're encouraged certainly; I think we'd like to try some more of the hybrids that are already in existence, if Ernie is willing to give these to us, and we can find the outplanting areas to use. Furthermore, "Yes", I think we ought to investigate some of our own native species and what their potentials might be; we haven't compared any of these Northeastern hybrids to our species for example. We have established another series of plots this spring under much more severe conditions than the ones that I reported on here a little earlier in Akron, Colorado, about 130 miles east of Fort Collins, definitely in the grassland plains. We set out a 3-block, 3-replicate test of each of seven of the hybrids, the 7 best of these 10, from cuttings taken from the ones we had there. I think it's too early to say anything very conclusive, because as Ed Palpant pointed out during the coffee break, the four years of this test certainly haven't tested the extremes of possibility of climatic variation that we have in Colorado. Not only these daily variations in temperature but winter desiccation. I think there is probably much more loss through winter desiccation than there is through simply low temperatures in winter and killing back from cold.

FRY - Professor Fechner, I came to listen and not to talk, but you know how hard a job it is for a Pennsylvania-Dutchman to keep his mouth shut. But, at your request, I'm going to tell about a Mrs. Ellis, wife of a rancher near Boulder, Colorado, who in 1966, January, ordered 100 cuttings. We sent a clonal mixture of which three contained deltoides; I do not have a record of the clone numbers with me. On May 20 of 1967 we got a letter from her asking whether we could furnish 1000 cuttings. She cited what you said about the incessant wind, temperature changes from -5 to 20 on successive days which take the life out of trees. She told abut the efforts of herself and her husband to grow trees for fifteen years with no success on their ranch and said for the first time they had 96 trees out of the 100 cuttings running 5 to 7 feet high. Fortunately we had 1000 cuttings in storage to send her at the late date of almost June 1. Mrs. Ellis further noted that the 1966 planting showed no winter-kill and they were all budding out in good shape. I made that observation at your request.

DAVIS - I wanted to corroborate some of the information that Mr. Fechner had on clones #17 and 41. On the acid spoils in Pennsylvania, 41 did very well and 17 did very poorly. Just the reverse is true on the high alkaline soil that he had, and I must add that the plots that Bethlehem Steel put out on pH of about 8.0 ore waste that they had, 17 did very well on that too. These extremely variable and even contradictory results demonstrate the importance of testing as many clones as possible under local soil and climatic conditions.

DORN - I have a question directed to Cedric Larsson; I was impressed with the rigorous selection standards; I would think you would have great difficulty finding trees. I also want to check, if I heard you right, do you have trees graving at the rate of an inch in diameter a year?

IARSSON - Yes, we have had a difficult time locating these trees. Since 1958 we have only found 25 selected trees of which we rogued 3, one of them was rogued because it went epicormic when we opened up the stand; another was rogued because it had a bad core and the third tree was rogued because it was growing so slowly. However it had excellent form but very little vigor following release.

STAIRS - I'd like to ask Mr. Larsson to discuss the market situation for silver maple at the present time.

LARSSON - They're using it for veneer and lumber in southern Ontario as this species is con on in many of our swamps in close proximity to saw mills and furniture factories. A lot of it is used as core stock in furniture.

SCHREINER - I could add something to that. I had a friend who owned a dowel mill in Maine and during the war he had trouble getting white birch. So he cut some silver maple and red maple, north of Rumford, Maine, and sent these maple dowels to several of the furniture manufacturers, and asked them whether they could use either or both the silver and red maple. The answer he got back was that they would prefer the silver maple to white birch dowels. Unfortunately he couldn't find enough silver maple. So silver maple has possibilities for furniture stock.

GENYS - Dr. Schreiner, is it possible to obtain some cuttings of selected poplar clones which proved superior in your most recent studies? Several local merchants in Maryland have recommended poplar clones that actually have never been tested. I am certain the poplars selected by you on the basis of long-term studies would be very valuable for practical application.

SCHREINER - We have distributed these hybrids widely. Mr. Fry was one of approximately 3500 individuals throughout the U. S. who received cuttings of 4 hybrids for trial planting in 1935. We now can supply only a few cuttings of our best hybrids for experimental trials, but we have supplied the state nurseries of Pennsylvania, New York, and Maryland in past years.

BOND - We have some of the Northeastern Station hybrids; we distribute 10,000-12,000 per year.

SCHREINER - Next year will complete fifteen-year tests of some 250 hybrids in north western Massachusetts. We then expect to recommend mixtures of 30-40 clones for commercial planting as synthetic multiclonal hybrid varieties with the expectation that such clonal mixtures will assure a profitable final crop. We must accept a calculated risk because we cannot test these hybrids on every acre of land that someone wants to plant to poplars; and this calculated risk is the principal reason for the use of multiclonal hybrid varieties rather than monoclonal plantations. We can supply a limited amount of cuttings but we're not in the business of growing cuttings. Since 1930 we've distributed these hybrids very, very widely; some of these hybrids have been tested on practically a world-wide basis. We've lost all control of their distribution. Mr. Fry sends them out by the thousands; we have no idea where he sends them.

FRY - In the last four or five years, we've sent out a quarter of a million items of planting stock; cuttings, rooted cuttings and trees. These were sent to every state in the U. S., to Newfoundland, Nova Scotia, Ontario, the Canal Zone, Jordan, and Israel.