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Statistical Survey of the Michigan Tree Seedling Industry
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Statistical Survey of the Michigan Tree Seedling Industry



Statistical Survey of the Michigan Tree Seedling Industry

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INTRODUCTION

In the spring of 1982, a survey of tree nurseries and tree planters was conducted by the Michigan State Cooperative Tree Improvement Program (MICHCOTIP) located at Michigan State University.¹ The purpose of this survey was to develop baseline information about the size of the tree seedling industry in Michigan in order to estimate the economic benefits of tree improvement research by MICHCOTIP.

The forest nursery and tree planting industry represents a sizable and important economic segment of Michigan. A recent report by the Experiment Station estimates that over 57 thousand people were employed in 1980 in mills using wood in the state.² The same report estimates the value of raw timber products to be in excess of \$250 million and the total value of the entire forest products industry to the state at over \$4 billion.

The tree seedling industry represents a fundamental resource base for this multi-billion dollar forest products industry. MICHCOTIP is committed to substantially upgrading the genetic foundation of this forest resource base to enhance the use of this valuable renewable resource. Michigan has lagged behind other regions of the country in implementing genetic improvement for tree species. The biologic and economic importance of genetically superior raw materials to the forest products industry is now being realized.

This survey represents a complete assessment of the scope and condition of the tree seedling industry in Michigan. Until now, only limited statistical information has been available on the tree seedling industry. The information from the survey is a valuable statewide data base which can be used to calculate the economic impact of using genetic gains achieved by the research program of MICHCOTIP.

METHODS

A four-page, two-part survey questionnaire was mailed in early 1982 to over 500 potential members of the tree seedling industry. The first part of the questionnaire was directed to the nursery sub-industry, and the second part to the planting sub-industry. To in-

crease the response rate, a series of follow-up postcards, phone calls and a second mailing of questionnaires were conducted. The response from the industry to the survey was excellent with over 70% returning completed questionnaires. A random sample of 19 members of the industry not responding (30% of the industry) was contacted by phone. The values in this report are for the entire tree industry. The values are based on the numbers reported by the members of the industry who returned the survey and calculated (from the random sample) for the 30% of the industry which did not return the survey.

The survey design allowed information to be tabulated by firm and by species of tree seedlings both grown and planted. This was done by collecting the survey responses across species and across firms, respectively. Results of the survey are presented in two sections: analysis based on species combination (characterizing firms regardless of the species they grow or plant); and analysis based on firm combination (giving information on the individual species regardless of what kind of firm produced that species). A complete description of the survey methods and statistical procedures used to calculate the final results is presented in Appendix II.

RESULTS AND DISCUSSION

Tree Seedling Industry Size

The first result from our survey was an accurate list of commercial firms and organizations which comprise the Michigan tree seedling industry.³ The industry is composed of 290 separate firms that can be sub-divided into sub-industries, (1) nursery and (2) planting. The nursery sub-industry (firms which engage only in nursery operations) comprise 10.7% of the entire industry (31 firms). The planting sub-industry (strictly planters of tree seedlings) is 71.4% (207 firms) of the industry. There are also firms which are members of both sub-industries because they operate nurseries and commercially plant seedlings. This group is 17.9% of the industry (52 firms).

¹A copy of the survey questionnaire is included as Appendix I.

²Timber Products Economy of Michigan. MSU Ag. Exp. Sta. Res. Rep. No. 446, December 1982.

³The survey polled all private nurseries, planting companies (Christmas tree growers etc.) and all public organizations and institutions such as the DNR, U.S. Forest Service, and universities. For the sake of editorial convenience hereafter, these will all be referred to as "firms."

Analysis Based on Firms

Planting as a Sub-Industry

The planting segment of the seedling industry actually planted over 37 million seedlings of all commercial species in 1981 (Table 1). All but 3.2% of these seedlings were planted as bareroot stock. Approximately 50% of the seedlings planted were for reforestation and almost 40% planted were for Christmas trees. A strong loyalty to and dependency on the Michigan nursery sub-industry is observed by the planting sub-industry. Most (97.3%) of the seedlings planted in the state were produced by Michigan nurseries. Other findings concerning the source of seedlings planted in the state can be derived from our survey. When calculated as a percentage of the total number of seedlings planted, the Soil Conservation District nurseries (SCD) actually provided less than 2% of the total number of "commercial" tree seedlings planted.⁴ The Michigan Department of Natural Resources (MDNR) provided over 15% of the seedlings planted. Users of this source of seedlings should note that the MDNR is phasing out public sales of seedlings by 1984. One direct result of reducing supplies is that other sources of seedling supply will have to be found by those who have traditionally relied on the MDNR. Over 30% of the seedlings planted in Michigan are grown in planter operated nurseries (termed "own production"). Own production generally refers to the 52 firms which are members of both sub-industries. These firms are vertically integrated. That is they grow and plant seedlings mostly for Christmas trees and reforestation purposes.

Acres Planted in Michigan

In 1981, there were approximately 23 thousand acres planted with tree seedlings for all purposes. The number of acres planted over the last five years increased at an average rate of over 30% per year.⁵ The growth rate is erratic, decreasing from 1977 to 1978 and then rising dramatically in 1979 and 1980. A slower growth rate occurred in 1981 (Table 2).

Using the average growth rate of 30%, a rough estimate of future yearly total land planted with tree seedlings can be obtained. The projection of this growth rate to 1986 is supported by the past history of

⁴The SCD operates two commercial nurseries in the state and contracts for additional stock from other private nurseries. The total tree seedling production from the two SCD nurseries in 1981 was 6.4 million seedlings. The amount of seedling stock which was sold to commercial planters (630,000 seedlings) amounts to less than 10% of the 1981 total SCD production.

⁵In 1981 the Agricultural Stabilization Conservation Service (ASCS) began keeping records on the number of acres planted with seedlings sold by the SCD nurseries. Using the information from the ASCS and compensating for the reports of the acres planted from the buyers of ASCS seedlings in the survey, we calculate an additional 20,000 acres of land were planted by the non-commercial grower in 1981.

Table 1. Summary of Tree Seedlings Planted in Michigan in 1981

Tree Planting Summary:	
Number of Seedlings Planted	37,269,900
	<i>Percent</i>
Type of Stock Planted:	
Bareroot Seedling	96.8
Containerized Seedling	1.9
Direct Seeding	1.3
Intended Purpose at Harvest:	
Christmas Trees	37.9
Ornamental	6.1
Reforestation	52.0
Fruit Trees	0.0*
Other	4.0
Source of Seedlings:	
Out-of-State Private Nursery	2.7%
Michigan Private Nursery	47.3
Michigan DNR	15.7
Soil Conservation District	1.7
Own Nursery Production	32.6
*less than 0.1%	

Table 2. Acres of Land Planted With Tree Seedlings for Commercial Purposes (All Commercial Species)

Year	Acres	Percent Increase From Previous Year
1981	23,302*	7.54
1980	21,668	58.56
1979	13,665	251.10
1978	5,442	(38.79)
1977	8,879	

*In 1981 the ASCS began keeping records on acres planted. SCD stock accounted for 23,760 acres bringing the total for 1981 to 47,062 acres.

the planting industry, as well as one previous survey of the Christmas tree industry.⁶ By the year 1986, and assuming a 30% yearly growth rate, a projected 86 thousand acres will be planted yearly with tree seedlings, not including the ASCS plantings.⁷ The projected yearly planting of 86 thousand acres is still only 13.6% of the 19 million acres of commercial forest land in Michigan, based upon a 30-year rotation.⁸ In other

⁶Production and Marketing of Christmas Trees in Michigan, MSU Ag. Exp. Sta. Res. Rep. No. 412; December 1980.

⁷A second check of the 1986 projected acres planted is possible with the trends derived from information on seedling planting plans. The total projected planting of Christmas trees and reforestation for 1986 is 54,574.1 thousand seedlings, which implies 45 thousand acres planted with a 6 x 6 foot spacing for these categories alone. Assuming an average seedling spacing of 6 x 6 feet, 1,210 seedlings per acre will be planted. A change in the spacing to 8 x 8 feet means 80 thousand acres will be planted. An 8 x 10 foot spacing equals 100 thousand acres planted. The figure of 86 thousand acres appears to be within the projected planting trend derived from seedling planting information.

⁸If 86 thousand acres were planted in 1986, 1987, etc., until the year 2016 (30 years from 1986) the total forest land area under planted management would be 2.58 million acres or 13.6% of the 19 million acres of commercial forest land in Michigan.

words, 86.4% of the state's commercial forest land would not benefit from the genetic improvement research currently available for improving the forest resource.

Nurseries as a Sub-Industry

Nurseries grew 86 million seedlings in 1981 which was more than were actually planted (37 million) and less than the number sold (92 million) (Table 3). Nurseries saw smaller orders for new seedling stock so produced fewer seedlings for the immediate future. The difference between the number sold and number grown implies a reduction in nursery seedling inventory, a possible reflection of the general condition of the 1981 economy. Almost half (44.7%) of the seedlings grown were to be sold for Christmas tree stock. Only 35% were destined for reforestation and almost 14% were grown for ornamental stock. Fruit trees and other purposes comprise the remaining 6%.

Results show the nursery industry is considered an export industry. Almost 30% of the total seedling production is shipped to surrounding states. Nearly all the seedlings grown were bareroot seedlings. In 1981, only 506 thousand containerized seedlings were grown. Most of these are accounted for by only two or three nurseries. Considering trends observed in other regions of the U.S., an opportunity may exist in the nursery industry for expanded containerized seedling production as the industry expands.

Seedling Production is Controlled by a Few Firms

Both the nursery and planting sub-industries are composed of a few large firms which account for the majority of seedlings grown and planted, and the remainder are smaller firms. In the nursery sub-industry, 9% of the firms accounted for over 54% of the total production in 1981. In the planting sub-industry, even fewer firms (3%) control a large portion (65%) of the planting (Table 4).

Analysis by End-Use Production Category

The results indicate that seedlings used for Christmas tree and reforestation purposes comprise the majority of the tree seedling production in Michigan. These two industrial sectors together account for 90% of the planting sub-industry and 80% of the nursery sub-industry. For this reason, an analysis of each industry sector (Christmas tree and reforestation) is presented in more detail. Summaries of the Christmas tree industrial sector are shown in Tables 5, 6, 7, 8 and 9, and of the reforestation industrial sector in Tables 10, 11, 12 and 13.

Table 3. Summary of Tree Seedlings Grown in Michigan in 1981

Nursery Production Summary	
Number Grown	85,948,000
Type Sold:	
Bareroot Seedling	88,033,000
Transplant Seedling	3,934,900
Containerized Seedling	506,400
Total Sold	92,474,300
Intended Purpose of Seedlings:	
	Percent
Christmas Trees	44.7%
Ornamental	13.9
Reforestation	35.3
Fruit Trees	4.3
Other	1.8
	100.0
Destination of Stock:	
Out of State	29.3%
In State	64.4
Own Lands	6.3
	100.0

Table 4. Summary of Seedling and Planting Production Control*

(Percentage)			
PLANTING SUB-INDUSTRY			
Number of Firms Frequency	Cumulative Frequency	Industry Production Frequency	Cumulative Frequency
(large firms)			
2.52	2.52	65.43	65.43
2.52	5.04	7.81	73.24
2.52	7.56	4.26	77.50
2.52	10.08	3.85	81.35
5.05	15.13	5.20	86.55
84.87	100.00	13.45	100.00
(small firms)			
NURSERY SUB-INDUSTRY			
(large firms)			
8.93	8.93	54.50	54.50
8.93	17.86	22.70	77.20
17.86	35.75	17.40	94.60
64.25	100.00	5.40	100.00
(small firms)			

*Includes state, federal and other public organizations.

Christmas Tree Industrial Sector Planting and Nursery Sub-Industries Analyzed

A sizable portion of the seedlings grown and planted in Michigan are used for the production of Christmas trees. Eleven species of trees are grown for seedling sale in the state and 12 species are commercially planted in the state as Christmas trees. By far the largest current production and planned production is accounted for by Scotch pine, with more than 23 million seedlings produced by nurseries for sale or private use on company-owned lands in 1981. Other commercially important

Table 8. Christmas Tree Seedlings: Source of Seedlings Planted (12 Species)

	1981	1986*
	(Thousands)	
Out-of-State Nursery	589.2	570.7
In State Nursery	9,128.3	22,524.0
Michigan DNR	750.8	153.1
SCD	758.8	623.2
Own Production	1,958.2	4,657.6
Total	13,185.4	28,528.6

*Projected

Table 9. Christmas Tree Seedling Planting: Historical Trends 1971-1981 (All Species)

Year	1971	1976	1981	1986*
Millions Planted:	1.8	4.9	13.2	25.8
Years	1971-1976	1976-1981	1981-1986*	
Annual Growth Rate	22%	21.9%	16.4%	

*Projected

on survey responses indicate this industry sector, like the Christmas tree sector, is also planning an extensive expansion. If present plans are followed, the reforestation industry sector will double in 1986 by planting over 26 million seedlings for reforestation purposes.

On the nursery side of the industry, there is either current or planned production of 16 species to be grown for reforestation stock. Nurseries anticipate an increase in the demand for reforestation seedling stock. This is contrary to the plans for Christmas tree seedling production where a planned reduction of 5 million seedlings is anticipated. The current production of 23.7 million reforestation seedlings (1981) is projected to increase to 32.5 million by 1986. Most of this increase will be in seedling production for planting activities on company land which we term own production. The remaining increase in projected demand is accounted for by over 2 million seedlings to be shipped out of Michigan to other reforestation operations.

Reforestation Industrial Sector: A Species Analysis

There were 13 different species planted for commercial reforestation in 1981 and 16 species are planned for 1986. There were 13 species grown to the seedling stage by nurseries for commercial reforestation in 1981. A change to 15 species is planned in 1986.

Red pine is the number one ranking species both

Table 10. Nursery Sub-Industry: Reforestation Species Only

	DESTINATION OF SEEDLINGS GROWN	
	(13 Species) 1981	(15 Species) 1986*
Out of State	4,706.0	6,851.1
In State	16,845.4	17,037.7
Own Production	2,214.0	8,685.5
Total	23,765.4	32,574.3

*Projected

Table 11. Planting Sub-Industry: Reforestation Species Only

	SOURCE OF SEEDLINGS PLANTED	
	(13 Species***) 1981	(16 Species***) 1986*
	(thousands)	
Out of State Nursery	632.6	26.6
In State Nursery	2,958.9	11,699.9
Michigan DNR	3,611.3	4,162.0
SCD	1,251.3	66.8
Own Production	4,808.1	10,090.2
Total**	13,262.2	26,045.5

*Projected

**Does not include 676.0 and 777.0 thousand seedlings listed as "hardwood species" planted, but with no additional information.

***Includes undifferentiated "species"

grown and planted for reforestation. There were almost 10 million red pine seedlings produced by nurseries in 1981. Plans are for over 15 million seedlings to be produced in 1986. Six million red pine seedlings were planted for reforestation in 1981, including a large majority of the "pine (undifferentiated)" category. Thirteen million are projected to be planted in 1986 for reforestation.¹⁰ Significant increases in 1986 relative to 1981 seedling planting for reforestation are also expected for jack pine, white spruce, red oak, white pine, European larch and white ash. Nurseries are planning to increase the number of seedlings grown for reforestation in jack pine, European larch, Austrian pine, black walnut, Douglas-fir and Norway spruce. Significant decreases in planting appear only in Scotch pine and Norway spruce. Decreases in nursery production are shown for blue spruce and white spruce. White spruce is the most significantly reduced from 2.4 million grown by nurseries in 1981 to only 856 thousand projected for reforestation stock in 1986 (Tables 10, 11, 12 and 13).

¹⁰ Most of the "pine (undifferentiated)" category was reported by one respondent. A follow-up inquiry revealed that almost all the "pine (undifferentiated)" were red pine, and the "spruce (undifferentiated)" was split between white spruce and blue spruce.

Christmas tree species include blue spruce, Douglas-fir, white spruce and white pine. There are plans for a large increase in the number of Fraser fir seedlings produced, but few will be planted in Michigan if the industry adheres to projected plans (Table 5).

Although almost eight million Scotch pine seedlings were planted in 1981, the industry plants a diversity of species, some representing undoubtedly specialized markets. Substantial increases in Christmas tree planting are planned for blue spruce, from one million seedlings in 1981 to 3.8 million in 1986, and Douglas-fir, increasing from 1.4 million in 1981 to 2.4 million in 1986. However, Scotch pine will still be the dominant Christmas tree species in 1986 with over 21 million planned (Table 6).

Michigan nurseries produce Christmas tree seedling stock that is in high demand not only in Michigan but also in other states. Approximately 15 million seedlings, or more than 42% of the total Christmas tree seedling production, were shipped out of Michigan in 1981. Future plans indicate this same percentage of seedling production will continue to be shipped out of state (Table 7).

Michigan Christmas tree growers, on the other hand, buy the bulk of their planting stock from Michigan nurseries. Over 95% of the seedlings planted in Michigan were grown in Michigan, with 85% supplied by privately owned Michigan nurseries⁹ (Table 8).

Christmas Tree Industry Growth Rate

Based on past planting and marketing surveys, there are strong indications that over the last decade the Michigan Christmas tree industry has grown at a yearly rate of over 20% (Table 9). The survey response concerning future plans indicates that the industry will continue to grow at a rate exceeding 15% per year with plans to plant over 28 million seedlings of all species in the 1986 season. These figures represent only the serious industry. The survey did not get responses from the hobby farmer, thus, most of the seedlings reported in our survey can be expected to be aggressively marketed as Christmas trees when mature.

Reforestation Industrial Sector Nursery and Planting Sub-Industries Analyzed

Seedlings for reforestation were also analyzed as a separate industrial sector. The survey results indicated that almost 14 million seedlings were planted for reforestation purposes in 1981. The companies involved in reforestation have plans for 20 different species for commercial reforestation. Projections based

⁹Calculated by combining in-state nursery and own production categories which are the Michigan private enterprise sources of seedlings.

Table 5. Christmas Tree Seedling Nursery Production: 1981 and 1986

1981 Rank	Species	Total Grown (thousands)		1986 Rank
		1981	1986*	
1	Scotch pine	23,649.4	21,414.4	1
2	Blue spruce	5,947.1	3,243.0	2
3	Douglas-fir	4,086.2	2,701.6	3
4	White spruce	737.3	370.2	6
5	White pine	400.3	850.5	5
6	Austrian pine	228.2	241.2	8
7	Red pine	9.9	217.3	9
8	Norway spruce	2.0	31.6	10
9	White fir	1.0	1.0	11
10	Balsam fir	0.0	300.0	7
11	Fraser fir	0.0	900.0	4
Total		35,102.6	30,670.8	

*Projected

Table 6. Christmas Tree Seedling Planting Production: 1981 and 1986

1981 Rank	Species	Total Planted (thousands)		1986 Rank
		1981	1986*	
1	Scotch pine	7,868.6	21,095.4	1
2	Douglas-fir	1,458.1	2,384.4	3
3	Blue spruce	1,004.5	3,861.4	2
4	White spruce	970.2	879.4	4
5	White pine	74.5	60.3	6
6	Balsam fir	59.0	68.0	5
7	White fir	12.9	30.2	7
8	Austrian pine	12.4	7.8	8
9	Norway spruce	6.0	1.0	11
10	Fraser fir	4.3	2.0	10
11	Red pine	1.7	1.8	12
12	Arborvitae	1.0	2.0	10
Total		13,179.1	28,528.7	

*Projected

Table 7. Christmas Tree Seedlings: Destination of Seedlings Grown (11 Species)

	1981	1985*
	(Thousands)	
Out-of-State Nursery	14,738.9	13,627.0
In State Nursery	18,119.2	15,084.4
Own Production	2,244.5	1,959.4
Total	35,102.6	30,670.8

*Projected

Table 12. Present and Future Planting: Reforestation Species Only

SEEDLINGS PLANTED RANKED BY SPECIES				
Reforestation Species		1981	1986	
Rank		Total Planted (Thousands)	Total Planned*	Rank
1	Jack pine	3,748.0	4,692.0	1
	Pine (undifferentiated)	3,739.1	9,981.4	
2	Red pine	3,415.9	4,511.6	2
	Spruce (undifferentiated)	1,755.6	4,129.3	
	hardwood species	676.0	777.0	
3	Yellow poplar	250.5	230.0	6
4	White spruce	154.1	309.2	4
5	Red oak	62.5	111.0	7
6	White pine	58.3	306.1	5
7	European larch	55.0	1,743.5	3
8	Scotch pine	7.9	0.0	
9	Blue spruce	6.2	4.5	9
10	White ash	4.0	12.7	8
11	Norway spruce	3.6	2.0	13
12	Black walnut	1.0	3.0	11
13	Sugar maple	0.5	4.0	10
13	Serbian spruce	0.0	2.0	13
13	Mugo pine	0.0	0.5	16
13	Austrian pine	0.0	1.0	15
13	Douglas-fir	0.0	1.7	14
Total		13,938.2	26,821.6	

*Projected

Analysis Based on Species

This section of the analysis aggregates all uses (Christmas trees, reforestation, ornamental, etc.) and all individual firms or organizations to examine each species of trees throughout the tree seedling industry.

Thirty-three of the tree species reported to the survey were either grown for seedling production or planted as seedlings in the state (Table 14). Some species have specialty markets in the state. As such, not all species reported for the planting survey were reported as species grown for seedling production. Species produced from seedling stock, but not planted, are shipped out of state (exported) or sold to non-commercial planters. Conversely, those tree species planted but not grown in the state are brought in from surrounding states (imported).

Our survey asked for information on the four most important species grown or planted. Because a species did not show up on the list reported in the survey does not indicate the species is not produced or planted in the state. It shows only that the species is not considered one of the more important commercial tree species in Michigan.

A summary of the total number of seedlings produced and planted for all species for all usage categories in 1981 and projected for 1986 is presented in Table 15.

Table 13. Present and Future Nursery Production: Reforestation Species Only

SEEDLINGS GROWN RANKED BY SPECIES				
Reforestation Species		1981	1986	
Rank		Total Grown (Thousands)	Total Planned*	Rank
1	Red pine	9,862.6	15,245.6	1
2	White pine	5,443.6	6,220.5	3
3	Jack pine	4,819.0	6,225.0	2
4	White spruce	2,350.6	856.6	5
5	Scotch pine	341.7	397.0	8
6	European larch	250.0	1,675.0	4
7	Yellow poplar	200.0	200.0	10
8	Austrian pine	194.4	812.0	6
9	Black spruce	150.0	150.0	11
10	Black walnut	120.9	400.5	7
11	Blue spruce	32.3	25.8	13
12	White ash	0.5	0.0	16
13	Red oak	0.3	0.5	15
16	Douglas-fir	0.0	115.5	12
16	Norway spruce	0.0	249.8	9
16	Chestnut	0.0	0.5	15
Total		23,765.9	32,574.3	

*Projected

Table 14. Commercial Tree Species Reported in the 1981 Michigan Nursery and Planting Survey

	Nursery Production	Seedlings Planted
Balsam fir	X	X
White fir	X	X
Fraser fir	X	X
Norway maple	X	X
Red maple	X	X
Sugar maple	X	X
White birch	X	X
Chestnut	X	not planted
White ash	X	X
European ash	X	not planted
Ginko	X	not planted
Honeylocust	X	X
Black walnut	X	X
Juniper	X	X
European larch	X	X
Yellow poplar	X	X
Norway spruce	X	X
White spruce	X	X
Black spruce	X	not planted
Serbian spruce	not grown	X
Blue spruce	X	X
Jack pine	X	X
Mugo pine	X	X
Austrian pine	X	X
Red pine	X	X
White pine	X	X
Scotch pine	X	X
Aspen	not grown	X
Cherry	not grown	X
Douglas-fir	X	X
Pear	X	X
Red oak	X	X
Mountain ash	X	not planted
Yew	X	X
Red cedar	not grown	X
Arborvitae	X	X
Wildlife shrubs	X	X

Table 15. Total Seedling Production Summary For All Sub-Industries

Species	Nursery Production		Planting Production	
	1981	1986 (est)	1981	1986 (est)
	(Thousands)			
Scotch pine	24,406.0	22,054.0	7,892.3	21,137.7
Blue spruce	16,160.6	12,920.5	3,119.5	4,474.4
Red pine	9,872.5	15,525.0	3,419.7	4,513.4
White pine	5,975.4	7,208.0	159.3	397.0
Jack pine	4,819.0	6,225.0	3,748.0	4,692.0
Douglas-fir	4,256.5	3,039.0	1,468.35	2,524.8
White spruce	3,382.2	1,638.0	1,203.7	1,293.7
Wildlife spp	3,023.8	2,018.0	678.6	789.75
Austrian pine	1,408.5	2,010.0	53.5	41.0
Arbor vita	432.2	258.0	1.0	2.0
Juniper spp	319.0	383.8	90.0	152.0
Taxus spp	276.44	288.0	25.0	10.0
European larch	250.0	1,675.0	55.0	1,743.5
Yellow poplar	200.0	200.0	250.5	230.0
Black spruce	150.0	150.0	0.0	0.0
Black walnut	120.95	400.5	1.0	3.0
Spruce spp	44.0	504.0	3,954.0	4,508.0
Red oak	40.3	100.5	72.5	111.0
Sugar maple	29.5	29.0	1.5	7.0
Norway spruce	27.0	282.0	107.6	103.0
White ash	25.5	10.0	7.0	19.0
Honey locust	25.0	25.0	5.25	5.4
Mugo pine	10.0	5.0	97.5	49.5
Pine spp	8.0	14.0	9,418.5	10,873.0
Pyrus spp	5.0	5.0	5.0	5.0
White birch	5.0	4.0	2.0	4.0
European ash	2.0	5.0	0.0	0.0
White fir	2.0	2.0	14.16	30.45
Sorbus spp	0.25	10.2	0.0	0.0
Chestnut	0.15	0.5	0.0	0.0
Ginko	0.15	0.3	0.0	0.0
Fraser fir	0.0	1,000.0	4.35	2.0
Balsam fir	0.0	300.0	59.0	68.0
Norway maple	0.0	0.0	0.5	1.0
Red maple	0.0	0.0	1.25	5.95
Hardwood spp	0.0	0.0	676.0	777.0
Serbian spruce	0.0	0.0	1.5	2.0
Aspen	0.0	0.0	10.0	0.0
Prunus spp	0.0	0.0	5.0	10.0
Thuja spp	0.0	0.0	25.0	25.0

The diversity of commercially important species reported in this survey indicates that the tree seedling industry in Michigan is broadly based and supplies raw material to plant and tree related industries. Although the industry is species diverse, only a few species account for the bulk of production. Ten species of high commercial value and importance account for 82% of the total nursery seedling production and 55% of the planting in 1981.¹¹

A detailed species analysis of the tree seedling industry must include some of the relationships existing between the nursery sub-industry and the planting sub-industry. The primary purpose of such an analysis is to project potential market shortages or surpluses for a

¹¹ The species are: black walnut, European larch, white spruce, blue spruce, jack pine, Austrian pine, red pine, white pine, Scotch pine, and Douglas-fir. The value of these species is determined by the number of seedlings grown and planted, and the price of both the seedling stock and mature tree.

given species. From the time a seed or cutting is planted in the nursery or greenhouse until the seedling is commercially planted in the field, a certain shrinkage exists in the total number of seedlings produced. This shrinkage is due to thinning, insect damage, disease and other factors. The Michigan tree seedling industry showed an over-all relatively low shrinkage of seedlings between nursery production and planting. The calculated shrinkage rate for the industry is approximately 20%, meaning that 20% of the tree seedlings grown by the nurseries will never be planted.¹² Normal shrinkage for a nursery may range from 15% to over 70% depending on the previously mentioned factors.

A detailed examination of ten commercially important species follows.

Black Walnut

An analysis of black walnut shows that more seedlings are being sold in the state than are commercially planted. Over 100 thousand are shipped to in-state sources but only 1,000 are planted commercially, and these come from an out-of-state nursery. The explanation is that black walnut is a species planted by the non-commercial tree planter. The non-commercial planters were not included in our planting survey. There are few commercial black walnut plantations in the state and only a few large experimental research plantations. Much of the production of this valuable tree appears to be in the hands and management of the hobby farmer. The projection is to triple the shipments of black walnut seedlings in the state by 1986.

European Larch

Most, if not all, of the production and planting of European larch seedlings is carried out by large pulp and integrated forest products companies. Considering the limited uses of this species and the accurate information derived from the survey, a shortage of approximately 423 thousand seedlings is predicted for 1986. This is based on a nursery shrinkage of 30% between seedlings grown in the nursery and those planted in the field. MICHCOTIP research indicates that European larch promises to be one of the more valuable planted tree species for the reforestation industry in the future. Several strong research programs exist in the lake state focusing on the genetic improvement of European larch.

¹² The calculation of the shrinkage rate is determined through simple accounting. Approximately 90 million seedlings were produced and sold by the nurseries in 1981. Over 37 million Michigan sourced tree seedlings were planted in 1981. Of the 90 million seedlings produced by the nurseries, 48% are either shipped out of state or not accounted for by the planting survey (commercial fruit and ornamental planters). The calculated shrinkage rate is then 20.9%.

Table 16. Black Walnut

Nursery Sub-Industry			Planting Sub-Industry		
	1981	1986*		1981	1986*
	(Thousands)			(Thousands)	
Number Grown	120.95	400.5	Number Planted	1.0	3.0
Purpose:			Purpose:		
Reforestation	120.95	400.5	Reforestation	1.0	3.0
Destination of Seedlings:			Source of Seedlings:		
Out of State	13.9	0.0	Out of State	1.0	3.0
In State	106.8	400.1	In State	0.0	0.0
Own Production	0.25	0.4	Own Production	0.0	0.0
			Michigan DNR	0.0	0.0
			SCD	0.0	0.0

*Projected

Table 17. European Larch

Nursery Sub-Industry			Planting Sub-Industry		
	1981	1986*		1981	1986*
	(Thousands)			(Thousands)	
Number Grown	25.0	1,675.0	Number Planted	55.0	1,743.5
Purpose:			Purpose:		
Reforestation	25.0	1,675.0	Reforestation	55.0	1,743.5
Destination of Seedlings:			Source of Seedlings:		
Out of State	0.0	25.1	Out of State	0.0	0.0
In State	0.0	75.4	In State	0.0	167.4
Own Production	250.0	1,574.5	Own Production	55.0	1,576.1
			Michigan DNR	0.0	0.0
			SCD	0.0	0.0

*Projected

White Spruce

The supply and demand situation for white spruce is unclear due to the reporting of large numbers in the "spruce (undifferentiated)" category. Almost 4 million "spruce (undifferentiated)" were reported planted in 1981 and 4.5 million projected to be planted in 1986. The nursery sub-industry reported only 44 thousand "spruce (undifferentiated)" seedlings grown in 1981 and projections of 504 thousand in 1986. Given an assumption that half of these are white spruce and the other half are blue spruce, a shortage may also occur in this species.

A projected total of 1.9 million white spruce seedlings could be produced by nurseries in 1986. However, the demand for white spruce seedlings for planting could reach 3.5 million in 1986. This apparent shortage may be compounded by the high percentage of white spruce seedlings which are exported to other states. The magnitude of the shortage will depend on the percentage of white spruce included in the generic spruce category.

Genetically improved white spruce seed will soon be commercially available to nursery operations producing seedlings for the reforestation and Christmas tree industrial sectors. The availability of the new genetically improved seed will further increase the demand for white spruce as a commercial species.

Blue Spruce

A detailed study of survey results for blue spruce shows that a large portion of the seedlings grown by the nurseries are going to the non-commercial tree planter. This is a popular species to plant in small numbers and is favored by the hobby farmer. There appears to be a rather large projected surplus of blue spruce seedlings available to the commercial planter in 1986 (12.9 million seedlings grown and 4.5 million to be planted in 1986). The non-commercial planter (small lot buyers) typically will pay a higher price for the seedling stock than the large commercial bulk buyer or planter. The flow of seedlings currently going to the non-commercial planter should remain steady if not increase.

Of the 12.9 million seedlings projected to be grown in 1986, six million will probably be shipped to out-of-state buyers and planters. This will leave 6.9 million for Michigan planters, and assuming a 20% shrinkage, only 5.5 million will actually be available for planting. The demand for blue spruce consists of almost 4.5 million projected blue spruce to be planted plus the assumed 2.25 million blue spruce in the "spruce (undifferentiated)" category. The total required demand is then 6.75 million seedlings. If marketing patterns shift and nurseries begin to shift shipments from the small planter to the commercial planter, a shortage of seed-

Table 18. White Spruce

Nursery Sub-Industry	1981	1986*	Planting Sub-Industry	1981	1986*
	(Thousands)			(Thousands)	
Number Grown	3,382.2	1,638.0	Number Planted	1,203.7	1,293.7
Purpose:			Purpose:		
Christmas Tree	737.3	370.2	Christmas Tree	970.2	879.7
Ornamental	294.3	168.7	Ornamental	79.4	104.8
Reforestation	2,350.6	856.7	Reforestation	154.1	309.2
Other	0.0	242.4	Other	0.0	0.0
Destination of Seedlings:			Source of Seedlings:		
Out of State	1,221.0	583.1	Out of State	9.6	16.8
In State	2,144.3	873.1	In State	304.5	333.8
Own Production	16.9	181.8	Own Production	233.5	882.3
			Michigan DNR	640.4	37.5
			SCD	15.7	23.3

*Projected

Table 19. Blue Spruce

Nursery Sub-Industry	1981	1986*	Planting Sub-Industry	1981	1986*
	(Thousands)			(Thousands)	
Number Grown	16,160.6	12,902.5	Number Planted	3,119.5	4,474.4
Purpose:			Purpose:		
Christmas Tree	5,947.2	3,243.0	Christmas Tree	1,004.5	3,861.4
Ornamental	8,888.3	9,057.3	Ornamental	2,018.8	599.6
Reforestation	32.3	25.9	Reforestation	6.2	4.5
Other	1,292.8	594.3	Other	0.0	8.2
Destination of Seedlings:			Source of Seedlings:		
Out of State	5,898.6	6,072.6	Out of State	18.7	4.5
In State	8,080.3	5,491.2	In State	1,188.5	3,749.5
Own Production	2,181.7	1,356.7	Own Production	1,341.4	666.7
			Michigan DNR	527.2	0.0
			SCD	43.7	53.7

*Projected

lings in 1986 may be averted. However, should the non-commercial planter maintain or increase current demand pressure for blue spruce seedlings a shortage of seedlings for the commercial planter is possible in 1986.

Blue spruce is also a species for which genetically improved seedling stock is available. As the genetically improved stock reaches the market, the price of the new varieties of blue spruce will rise. This may further increase the demand for the species and contribute to the potential shortage.

Jack Pine

Virtually all nursery production and planting of jack pine is accounted for by a few pulp and forest products companies, the Michigan DNR and the U.S. Forest Service. The projected nursery production of jack pine seedlings in 1986 is 6.2 million. With a 20% shrinkage and subtracting the number anticipated to be exported, 4.8 million seedlings will be available for planting. The current projected demand for planting

in 1986 is 4.5 million seedlings which means supply-demand is balanced.

Jack pine is another species subjected to an intensive breeding program in the lake states. Seed orchards, established by MICHCOTIP and cooperators, with commercial production capability will be operating in 1985 (the first year commercial quantities of certified genetically improved seed will be available). The size of the present jack pine seed orchards is sufficient to cover the projected planting needs for 1986. Given the current planting trends at the state level, and the early availability of genetically improved jack pine seedlings, some further increase in demand for jack pine seedlings is expected.

Austrian Pine

The situation for Austrian pine is similar to that of white spruce. The accuracy of the analysis depends on how many Austrian pine seedlings were included in the "pine (undifferentiated)" category. The number of "pine (undifferentiated)" seedlings reported by the

Table 20. Jack Pine

Nursery Sub-Industry	1981	1986*	Planting Sub-Industry	1981	1986*
	(Thousands)			(Thousands)	
Number Grown	4,819.0	6,225.0	Number Planted	3,748.0	4,692.0
Purpose:			Purpose:		
Reforestation	4,819.0	6,225.0	Reforestation	3,748.0	4,692.0
Destination of Seedlings:			Source of Seedlings:		
Out of State	303.6	298.8	Out of State	0.0	0.0
In State	3,310.7	1,500.2	In State	0.0	37.5
Own Production	1,204.7	4,426.0	Own Production	1,937.7	1,717.3
			Michigan DNR	1,810.3	2,937.2
			SCD	0.0	0.0

*Projected

Table 21. Austrian Pine

Nursery Sub-Industry	1981	1986*	Planting Sub-Industry	1981	1986*
	(Thousands)			(Thousands)	
Number Grown	1,408.5	2,010.0	Number Planted	53.5	41.0
Purpose:			Purpose:		
Christmas Tree	228.2	241.2	Christmas Tree	12.4	7.9
Ornamental	969.0	924.6	Ornamental	41.0	32.1
Reforestation	194.4	812.0	Reforestation	0.0	1.0
Other	16.9	32.2	Other	0.0	0.0
Destination of Seedlings:			Source of Seedlings:		
Out of State	850.7	1,541.7	Out of State	3.0	3.8
In State	498.6	365.8	In State	23.5	36.2
Own Production	59.2	102.5	Own Production	26.0	0.0
			Michigan DNR	1.0	0.0
			SCD	0.0	1.0

*Projected

planting sub-industry as planted in 1981 is 9.4 million. For 1986, the number reported is 10.9 million seedlings. If only 10% of this reporting category are Austrian pine, the demand for seedlings to be planted is 1.1 million seedlings.

The nursery sub-industry is projecting a production level of two million seedlings, but 1.5 million are anticipated to be shipped to out-of-state buyers. Currently, 60% of the nursery production is shipped out of state. Most of the increase in nursery production is accounted for by expectation of an expanding market in this area of export. In 1986, 75% of the nursery production is expected to be shipped out of state. Like blue spruce, Austrian pine is also a major species shipped to the non-commercial tree planter.

The non-commercial planter usually purchases in small lots and commands a higher price. This may produce apparent shortages of high quality stock for the commercial planter.

Red Pine

Red pine is an important species to the reforestation industry. Almost all production of red pine seedlings

for planting in Michigan is from government nurseries and is used for reforestation programs. Own production (mostly the pulp and forest products companies) is increasing significantly. Red pine is also becoming an important export species with many more seedlings designated for out-of-state shipments. SCD plans significant increases in red pine seedling production, but most of this is destined for the non-commercial planter.

Eastern White Pine

Eastern white pine is another valuable export species. The anticipated production for out-of-state shipments is expected to rise 40% by 1986. Almost all production (90%) is for reforestation purposes with most of this shipped to and planted by the small non-commercial tree farmer. Pest problems such as blister rust, Sclerodaris and tip weevil deter the commercial use of eastern white pine for reforestation purposes. The production problems with the species are of less consequence to the hobby farmer who is generally looking at more aesthetic values in planting white pine.

Table 22. Red Pine

Nursery Sub-Industry	1981	(Thousands)	1986*	Planting Sub-Industry	1981	(Thousands)	1986*
Number Grown	9,872.5		15,525.0	Number Planted	3,419.7		4,513.4
Purpose:				Purpose:			
Christmas Tree	9.9		217.4	Christmas Tree	0.0		0.0
Reforestation	9,862.6		15,261.0	Reforestation	3,416.3		4,513.4
Ornamental	0.0		46.6	Ornamental	3.4		0.0
Destination of Seedlings:				Source of Seedlings:			
Out of State	1,648.7		3,027.4	Out of State	0.0		0.0
In State	7,779.5		10,184.4	In State	88.9		275.3
Own Production	444.3		2,313.2	Own Production	1,597.0		3,132.3
				Michigan DNR	1,689.3		1,105.8
				SCD	44.5		0.0

*Projected

Table 23. White Pine

Nursery Sub-Industry	1981	(Thousands)	1986*	Planting Sub-Industry	1981	(Thousands)	1986*
Number Grown	5,975.4		7,208.0	Number Planted	159.3		397.0
Purpose:				Purpose:			
Christmas Tree	400.4		850.5	Christmas Tree	74.7		60.3
Ornamental	113.5		134.0	Ornamental	26.3		30.6
Reforestation	5,443.6		6,220.5	Reforestation	58.3		306.1
Other	17.9		0.0	Other	0.0		0.0
Destination of Seedlings:				Source of Seedlings:			
Out of State	1,655.2		2,638.2	Out of State	14.7		0.0
In State	4,236.6		4,526.6	In State	37.3		58.3
Own Production	83.6		43.2	Own Production	17.2		189.8
				Michigan DNR	83.6		145.7
				SCD	6.5		3.2

*Projected

Scotch Pine

Scotch pine is the species grown and planted more than any other in Michigan. It is of great export value to the nursery industry. Of the nine conifers most commonly used in the industry, Scotch pine accounts for 46% of all exports of seedlings and 35% of the nine species total seedling production. If current projected plans by the nursery sub-industry are implemented, the supply of Scotch pine seedlings from Michigan nurseries available to Michigan planters in 1986 will be 9.5 million. The demand by Michigan planters for Michigan grown Scotch pine seedlings is expected to be 20.7 million. Unless the nursery sub-industry increases production or allocates more of the production to in-state commercial planters, a definite shortage of seedlings in Scotch pine will exist.

Douglas-fir

Commercial planters in Michigan may experience a shortage of Michigan produced Douglas-fir seedlings in 1986. The number of seedlings expected to be supplied

by the Michigan nurseries and available to the commercial planters in 1986 is 1.6 million. The projected demand from the commercial planters in 1986 is calculated to be 2.5 million seedlings. A potential shortage of almost one million seedlings may exist. Anticipation by the commercial Christmas tree growers of a strong future market demand for Douglas-fir Christmas trees is the principal reason behind this predicted shortage.

INDUSTRY ANALYSIS AND CONCLUSIONS

There are approximately 300 commercial or industrial organizations extensively involved with growing and planting tree seedlings in the state.¹³ The majority of these firms are in planting as a sub-production activity, usually for a future end-product such as Christmas trees, woody fiber (pulp), or timber. There

¹³These include the state and federal agencies which engage in reforestation for all purposes.

Table 24. Scotch Pine

Nursery Sub-Industry	1981	(Thousands)	1986*	Planting Sub-Industry	1981	(Thousands)	1986*
Number Grown	24,406.0		22,054.0	Number Planted	7,892.3		21,137.7
Purpose:				Purpose:			
Christmas Tree	23,649.9		21,414.4	Christmas Tree	7,868.6		21,095.4
Ornamental	170.6		110.3	Ornamental	15.8		42.3
Reforestation	341.7		397.0	Reforestation	7.9		0.0
Other	244.1		0.0	Other	0.0		0.0
Destination of Seedlings:				Source of Seedlings:			
Out of State	11,129.1		10,166.9	Out of State	434.1		549.6
In State	12,227.4		10,726.4	In State	6,629.5		16,783.3
Own Production	1,049.5		1,124.7	Own Production	678.7		3,191.8
				Michigan DNR	23.7		84.6
				SCD	126.3		528.4

*Projected

Table 25. Douglas-Fir

Nursery Sub-Industry	1981	(Thousands)	1986*	Planting Sub-Industry	1981	(Thousands)	1986*
Number Grown	4,256.5		3,039.0	Number Planted	1,468.3		2,524.8
Purpose:				Purpose:			
Christmas Tree	4,086.2		2,701.7	Christmas Tree	1,458.1		2,383.4
Ornamental	170.3		221.8	Ornamental	10.3		136.4
Reforestation	0.0		115.5	Reforestation	0.0		2.5
Other	0.0		0.0	Other	0.0		2.5
Destination of Seedlings:				Source of Seedlings:			
Out of State	1,298.2		975.5	Out of State	43.6		2.5
In State	2,541.2		1,650.2	In State	1,170.3		2,269.8
Own Production	417.1		413.3	Own Production	246.7		224.7
				Michigan DNR	0.0		22.8
				SCD	8.8		5.0

*Projected

are very few strictly professional planting companies in Michigan. Seventy percent of the tree seedling industry engages strictly in planting and buys all of their seedling planting stock from nurseries. Ten percent of the tree seedling industry specializes in growing tree seedlings and does not engage in significant planting activities. The remaining 20% are combinations of nurseries and planters who grow their own seedlings for their own planting operations.

Planting Conclusions

In 1981 over 37 million tree seedlings were planted in Michigan. Virtually all of the seedlings planted were produced by Michigan nurseries. At this time, the Michigan planting sub-industry is quite dependent on Michigan nurseries, since there is very little seedling stock brought in from nurseries in the surrounding states. Plans for 1986 show even fewer commercial planters willing to rely on out-of-state nurseries for planting stock.

Nine conifer species accounted for over 90% of the commercial planting in 1981. These species are: Euro-

pean larch, white spruce, blue spruce, jack pine, Austrian pine, red pine, white pine, Scotch pine and Douglas-fir.¹⁴ Almost 40% of the seedlings planted were for Christmas trees and 50% were for reforestation purposes. The SCD supplied only a small number of seedlings to commercial planters (less than 600 thousand) with most of the SCD stock going to the non-commercial planter or hobby farmer.

Nursery Conclusions

Over 86 million tree seedlings were grown in 1981. The nursery industry is a strong export industry supplying many planters outside Michigan. In 1981, 25 million Michigan-grown tree seedlings were planted in other states. The same nine conifer species account for over 80% of the total seedling production in number of seedlings grown. The exported species are primarily for Christmas trees and high value ornamentals.

In both the nursery sub-industry and the planting sub-industry, a few firms or organizations account for

¹⁴This includes the "pine and spruce species (undifferentiated)."

the bulk of commercial production. The planting sub-industry has 7.5% of the firms controlling 77.5% of the total production. The nursery sub-industry has 8.9% of the firms controlling 54.5% of the total production. In this sense, the planting sub-industry is subject to less competitive pressures than the nursery industry. Additionally, more nurseries rely on selling seedlings as their primary economic activity, than do the majority of the commercial planters. The practical implication is that the nursery industry will most likely bend to the increased demand from the planting sub-industry and expand production.

Industrial Sector Conclusions

The Christmas tree and reforestation industrial sectors account for most of the volume in tree seedling production and planting. The ornamental industry sector may account for a higher dollar percentage than the volume in ornamental seedling production indicates. (Ornamental seedlings typically are much higher priced than Christmas tree or reforestation stock.) Fruit tree production is controlled by two or three companies, with one nursery having virtually total control of fruit tree seedling production in Michigan.

Within the Christmas tree industrial sector, the importance of various species to the commercial grower may change in the coming years. The basic four: Scotch pine, blue spruce, white spruce and Douglas-fir will still account for the bulk of the industry in volume but Fraser fir, Balsam fir and white pine will become increasingly important.

There has also been a large increase in the amount of Christmas tree planting over the past decade. Data from this survey indicate a yearly growth rate of seedling planting greater than 20%. This trend is calculated by combining results from a previous survey conducted by the Cooperative Extension Service several years ago with the results from this survey. This survey anticipates that industry growth will be sustained if there is not a serious shortage of seedlings for the grower. The source of seedlings for the planting sub-industry is expected to be Michigan nurseries.

There are no indications from the commercial planters of going out of state to purchase seedlings. Shortages of seedlings for Christmas trees may arise in blue spruce, white spruce and white fir if nurseries are unresponsive and planters put projected plans into use.

The reforestation industrial sector has also experienced a rapid growth over the past decade. Results from this survey predict this industry sector will continue its expansion, planting almost 27 million seedlings in 1986 for reforestation purposes. The primary expansion should occur in red pine. European larch and jack pine are also expected to increase in number of seedlings planted for reforestation purposes. The

major future source of seedlings should be provided by "own production" facilities and by private Michigan nurseries. There appears to be a strong market for high quality, genetically improved seedlings of red pine, white spruce and European larch. The availability of commercial quantities of genetically improved seed for these species will further increase seedling demand in the next decade.

Species Conclusions

Some shortage of the nine most important seedling species can be expected by 1986 without expansion or some response from the nursery industry. Nurseries do not appear to be as optimistic as the planting industry for the next few years. Traditionally, seedling stock from Michigan nurseries is of high quality. The planting industry recognizes this quality and can be expected to apply pressure on the nurseries to increase production, assuring a Michigan source of seedling stock.

SUMMARY AND ECONOMIC COMMENTS

Our survey has presented a statistical picture of the Michigan commercial tree seedling industry. In determining the economic value of the tree seedling industry to the state, the simple fact is that seedlings must survive to become forest products. A healthy and progressive tree nursery and planting industry is a key to improving the efficiency and performance of the forest products industry. The potential economic impact the industry may have on the state's \$4 billion forest products industry is staggering. Assuming that an average 10% genetic gain can be obtained in the nine most important conifer species, the yearly gain to the tree seedling industry is worth over one million dollars.¹⁵

Using the figure of \$260 million for the total worth of raw forest resources at harvest, a 10% genetic gain translates into a yearly economic savings of over \$26 million, assuming that the entire raw material base is derived from planted forests.

This economic analysis shows the conservative potential of economic worth to the state that can be derived if all the state's forests were under management and regenerated with superior genetic planting stock. The last question in our survey asked what the planter or nursery could afford to pay for genetically improved stock. Most of the respondents indicated that they could afford and would be willing to pay at least twice as much for genetically improved stock.

¹⁵Basing the price of tree seedlings with a known seed source at 20 cents each, genetic gain can then be translated directly into an increase in price. At least two nurseries with known seed sources and proven genetically improved stock are obtaining much more than this price on the open market.

APPENDIX I

Michigan Nursery and Tree Production Survey

Instructions

Enclosed you will find two survey questionnaires, one for Nursery Production and one for Planting activities. Please answer one or both if appropriate to your operation. We have kept the questions short and hopefully simple. It should take only 5 or 10 minutes to answer each questionnaire.

Please fill in appropriate boxes with the information requested. If for some reason you cannot give all the information asked for, we ask that you provide whatever is possible. Please write in your four (4) most important species for 1981 production and write in the names of the species for anticipated production (1986). Again, no respondent names will be used and strict confidentiality will be maintained.

When completed, return the questionnaire in the enclosed self-addressed stamped envelope. If you have any questions, please call or write. The telephone number: 517-355-0090.

Thank you.

Nursery Production Questionnaire

Please write the requested information in the following boxes for 1981 production and what you currently have planned for 1986 production (5 years from now)

1. Name of your 4 (four) most important species or varieties.

	CURRENT PRODUCTION (1981)					ANTICIPATED PRODUCTION (1986)				
	1.	2.	3.	4.	Total Production All species	1.	2.	3.	4.	Total Production All species
<i>Write names here</i>										
2. SEED SOURCE (lbs) and amount used.										
a. Collected (lbs)										
b. Bought (lbs)										
c. Grafts and bud propagation (Number thousands)										
3. NUMBER GROWN (Thousands)										
4. TYPE OF STOCK SOLD (Thousands)										
a. Bareroot seedling										
b. Transplant seedling										
c. Containerized seedling										
5. INTENDED PURPOSE (Thousands)										
a. Christmas trees										
b. Ornamental										
c. Reforestation (Pulp, Timber)										
d. Fruit tree										
e. Other _____										
6. DESTINATION OF STOCK (Thousands)										
a. Out of State										
b. In State										
c. Use on Own Lands										

7. What trait or character in trees is most valuable to you? *Please write the trait* _____

8. IF available next year and assuming 15% "genetic improvement" in the above trait;
How much more could you pay for seed and/or seedling?

[Please check one each column]

pay 10 times more than average price
 pay 5 times more than average price
 pay 2 times more than average price
 not pay any more

SEED	SEEDLINGS

Planting Activities Questionnaire

Please write the requested information in the following boxes for 1981 planting and what you plan to plant in 1986 (5 years from now)

1. Name of your 4 (four) most important species or varieties.

Write names here

	CURRENT PLANTING (1981)					ANTICIPATED PLANTING (1986)				
	1.	2.	3.	4.	Total Planting All species	1.	2.	3.	4.	Total Planting All species
2. SEEDLINGS PLANTED (1981) (Thousands)										
3. TYPE OF STOCK PLANTED (Thousands)										
a. Bareroot seedling										
b. Containerized seedling										
c. Direct seeding										
4. INTENDED PURPOSE (Thousands)										
a. Christmas trees										
b. Ornamental										
c. Reforestation (Pulp, Timber)										
d. Fruit tree										
e. Other										
5. SOURCE OF STOCK (Thousands)										
a. Out of state private nursery										
b. In state private nursery										
c. Mich. DNR Nursery										
d. District Soil Cons. Service Nursery										
e. Own Production										
6. NUMBER OF ACRES PLANTED IN LAST FIVE YEARS.										
1981										
1980										
1979										
1978										
1977										

7. What trait or character in trees is most valuable to you?

Please write the trait

8. IF available next year and assuming 15% "genetic improvement" in the above trait;

How much more could you pay for seed and/or seedling?

Please check one each column

pay 10 times more than average price
 pay 5 times more than average price
 pay 2 times more than average price
 not pay any more

SEED

SEEDLINGS

APPENDIX II

Methods and Statistical Analysis of Survey Results

Calculation of the Industry Population

This appendix describes, in detail, the methodology and statistical design used in the study. At the time of sampling, the population size of the industry was not known. To estimate the potential size of both the nursery and planting industry, a master mailing list encompassing all possible industry members was generated from nine separate mailing lists. The two largest mailing lists used were the Michigan Association of Nurserymen and the Michigan Christmas Tree Association. Both associations provide addresses and other information about members such as primary market activity and type of products sold or produced.

Additional names of companies and individuals were obtained from the Department of Natural Resources sales receipts of seedlings at the Brighton and Toumey Nurseries (those individuals who purchased more than 5,000 seedlings in 1980 and/or 1981 were included), from the Directory of Michigan Consulting Foresters, from the Directory of Tree Nurseries published by the United States Forest Service, and from various mailing lists provided by specialists in the Department of Forestry at MSU. The master mailing list was reviewed by several members of the industry. Individuals not on any of the mailing lists were then added. Note that the purpose of this survey was to gather accurate information on the *full-time* professional nursery and planting operator. Many individuals grow and plant trees. Our purpose was to create a statistical profile of the commercial grower and planters who derive a significant portion of their income from these activities. We did not solicit information from the numerous landscapers and ornamental nurseries (mostly shrub species) in the state, nor were owners of small hobby farms or backyard nurseries included on the mailing list.

The resulting master list was given a final check against the Michigan Department of Agriculture Nursery Inspection Bulletin's issuance of 1,026 nursery licenses, 2,654 Nursery dealers licenses, 342 Plant Dealers licenses, and 333 Plant Growers licenses disbursed during 1980-1981. No additional names were revealed from this cross check of the Michigan Department of Agriculture Nursery Inspection Bulletin. Many were listed on multiple mailing lists under different names, so computerized cross checks of the returns were made to reduce the possibility of duplicate returns being counted. A final total of 475 individuals and companies were contacted by questionnaire. Each form was marked with a serial identification number.

The initial survey form was mailed to all 475 recipients in February 1982. A follow-up postcard was sent

two weeks after the initial survey mailing. Additional responses were solicited by another postcard after six weeks and by personal phone call reminders. A second selected mailing of questionnaire forms was sent eight weeks later to non-respondents and still another follow-up postcard reminder one week later (Table A-1).

Response to the Survey

A total of 520 survey forms were mailed. Prior to the survey, it was not known how many nurseries also planted trees and how many planters grew their own stock. For this reason, each survey questionnaire had two parts, a nursery section and a planting section. The same identification number was used for both the nursery and planting section on an individual survey form. This way we could tell which segment of the industry specialized in either nursery or planting and how many companies were combination growers and planters.

Of the 520 identification numbers sent, 140 returned were not used because they did not actually operate nurseries or plant trees or were too small to fit into the industrial class (Table A-2). Thus, the population was reduced to 380 companies and individuals. From this population, 42 were located out of state and were not included. Of the remaining 338, 209 identification numbers were returned. This left 129 identification numbers to be accounted for.

To determine the characteristics of the non-respondent group of 129 identification numbers, a random sample of 19 identification numbers was chosen and all 19 were contacted by telephone. The survey was completed over the phone for this random sample.

Of the 19 random identification numbers, seven were not applicable (did not qualify), nine planting forms and four nursery forms were answered. This implies that one enterprise combination was in the random sample.

Of the 209 returned identification numbers (including the random sample generated from the non-respondents) there were 198 planting sections and 56 nursery sections. This means that 45 companies and individuals were returning both nursery and planting sections.

All the surveys returned were not complete in each response category.¹ Two different statistical procedures were performed. For the calculation of the industry cross-section composite, (aggregating across species) the mean of responses was used to fill missing entries in the surveys.² In almost all cases, the category "total

¹See Appendix I for a copy of the survey questions.

²Linear regression was tried first to predict the missing cases but a model with good predictive capability could not be found.

Table A-1. Time Table for Survey Mailing

DATE: 1982						
2/21	3/5	3/26	6/14	6/29	7/9	8/1
Initial Survey Sent	Postcard Reminder Sent	Begin Telephoning Reminders —Second Postcard Sent	Second Survey Mailing Sent	Postcard Reminder Sent	Random Sample Called	Date of last survey to return and data analysis begins

Table A-2. Summary of Questionnaire Returns

Total Identification Numbers Sent	520
Returned Not Applicable (did not qualify)	140
Out of State	42
Remaining Michigan Base Population (Nursery & Planting)	338
Valid Returned Sample:	
Total Returned Identification Numbers	209
Total Planting Forms Returned	198
Total Nursery Forms Returned	56
Total Sample Returned (treating each nursery and planting form as a separate individual)	254
Enterprise Combinations in Returned Sample	45
(254 - 209 = 45)	
Random Sample of Non-Respondents	
Total Identification Numbers	19
Nursery Forms	4
Planting Forms	9
Not Applicable (did not qualify)	7
Enterprise Combinations in Returned Sample	1

number grown or planted” was answered. The only missing sections of incomplete questionnaires referred to the characteristics of the species being described. For this analysis, incomplete questionnaires were considered as fully completed ones and only the percentages of characteristics were calculated based on fully complete forms.

In both composite analyses, across firms and across species, the random sample was linearly extended to account for all the non-respondent population. Due to the non-stratified nature of the survey and the wide variance of size within the industry, standard errors associated with the random sample of non-respondents are not meaningful.³

³This does not diminish the accuracy of the results. On a species basis, the extrapolated random sample added less than 5% to the total in the most extreme case. Not reporting standard errors with the results lends a conservative tone to the analysis. The results indicate a minimum size of the industry. If the non-respondents not in the random sample are large, then the industry could be considerably larger.

Table A-3. Calculation of Base Population

Random Sample N = 19			
(A) Industry category	(B) Number	(C) Percent of Sample	(D) Calculated for 129 Non-Respondents*
Nursery Only	3	15.8	20
Planting Only	8	42.1	54
Combination Enterprise	1	5.3	7
Not Applicable	7	36.8	48
Returned Sample N = 209			
Nursery Only			11
Planting Only			153
Combination Enterprise			45
Total Nursery Only**			31
Total Planting Only			207
Total Combination Enterprise			52
Total Number of Firms in the Industry			290

* (C) X 129 = (D) rounded to nearest integer
 ** Adding the returned sample with the calculated random sample

In the planting section, the critical category is the total number of seedlings planted. The addition of the non-respondent random sample extrapolated to the entire non-respondent population accounts for 22.3% of the estimated total number of seedlings planted for all-use categories (Christmas trees, reforestation etc.). In the Nursery section, the most important category is number of seedlings grown. In this category, the addition of the extrapolated random sample accounted for only 1.1% of the total. A complete description of the effect the random sample had on the categories for the Nursery and Planting Section is found in Table A-4.

Table A-4. Calculated Return Rate for Survey Response

	Percent Returned
Return Rate for Identification Numbers	61.8
Treating Nursery and Planting Separately	75.2
Industry Sector Results	
For N = 209 Identification Numbers	
Planting Only	73.2
Nursery Only	5.3
Enterprise Combinations	21.5
For N = 19 Identification Numbers (Random Sample)	
Planting Only	42.1
Nursery Only	15.8
Enterprise Combinations	5.3
Not Applicable	36.8
Reduced Population of Random Sample Excluding Not Applicable Companies (N = 12)	
Planting Only	66.7
Nursery Only	25.0
Enterprise Combinations	8.3

Table A-5. Effect of Random Sample on Survey Results by Question

PLANTING SECTION	
Category	Effect on Values by Including Extrapolated Random Sample
Question	Percent
Total Planted	22.3
Number of Bareroot Seedlings	17.3
Number of Containerized Seedlings	0
Number Planted for Christmas Trees	83.2
Number Planted for Ornamentals	0
Number Planted for Reforestation	0.01
Number Planted for Fruit Trees	0
Number Planted for Other purposes	0
Seedlings from Out of State Nurseries	38.9
Seedlings from Michigan Private Nurseries	86.3
Seedlings from Michigan DNR	9.4
Seedlings from A.S.C.S.	0
Seedlings from Own Production	1.6
Acres Planted in 1981	10.1
Acres Planted in 1980	19.4
Acres Planted in 1979	11.1
Acres Planted in 1978	13.6
Acres Planted in 1977	13.9
NURSERY SECTION	
Category	Additional Percent Effect by Including Extrapolated Random Sample
Question	Percent
Total Number of Seedlings Grown	1.1
Seed Bought	0.1
Seed Collected	0
Vegetative Propagation	243.3
Bareroot Seedlings Grown	0.3
Transplant Seedlings Produced	0
Containerized Seedlings Produced	157.4
Seedlings Produced for Christmas Trees	1.0
Seedlings Produced for Ornamentals	3.3
Seedlings Produced for Reforestation	0
Seedlings Produced for Fruit Trees	0
Seedlings Produced for Other Purposes	0
Seedlings Shipped Out of State	0.2
Seedlings Shipped In State	1.1
Seedlings for Planting Purposes	6.4

Table A-6. Raw Data — Planting Section (Aggregated for all Responses)

Category	(1)	(2)	(3)	(4)
	Total for 198 returned surveys	Total for 9 random surveys	(Thousands) Calculated total for non-respondent group	Total calculated seedlings for each category
Question	n = 198	n = 9	(2)/9 x 58.05*	(1) - (2) + (3)
Total Planted	30,468.9	1,248.0	8,049.0	37,269.9
Number of Bareroot Seedlings	30,300.6	965.0	6,224.1	35,559.7
Number of Containerized Seedlings	695.1	0.0	0.0	695.1
Number Planted for Christmas Trees	7,367.0	952.0	6,135.9	12,550.9
Number Planted for Ornamentals	2,024.3	0.0	0.0	2,024.3
Number Planted for Reforestation	17,188.3	13.0	83.6	17,258.9
Number Planted for Fruit Trees	20.3	0.0	0.0	20.3
Number Planted for Other Purposes	1,345.6	0.0	0.0	1,345.6
Seedlings from Out of State Nurseries	419.5	30.0	193.3	582.8
Seedlings from Michigan Private Nurseries	5,437.7	861.0	5,553.1	10,129.8
Seedlings from Michigan DNR	3,065.6	53.0	341.3	3,353.9
Seedlings from ASCS	360.2	0.0	0.0	360.2
Seedlings from Own Production	6,865.2	21.0	135.3	6,979.5
Acres Planted in 1981	42,740.2	793.0	5,114.8	47,062.0
Acres Planted in 1980	18,137.1	648.0	4,179.6	21,668.7
Acres Planted in 1979	12,298.3	251.0	1,617.8	13,665.1
Acres Planted in 1978	4,790.4	119.5	771.5	5,442.4
Acres Planted in 1977	7,794.7	199.0	1,283.5	8,879.2

*58.05 is the calculated number of planting firms not responding to the survey.

Category Raw Data — Nursery Section (Aggregated for all Responses)

Category	(1)	(2)	(3)	(4)
	Total for 56 returned surveys	Total for 4 random surveys	(Thousands) Calculated total for non-respondent group	Total calculated seedlings for each category
Question	n = 56	n = 4	(2)/4 x 25.8*	(1) - (2) + (3)
Total Number of Seedlings Grown	84,962.6	180.8	1,166.2	85,948.0
Seed Bought (lbs include walnut)	82,238.5	14.0	90.3	82,314.8
Seed Collected (lbs)	4,406.3	0.0	0.0	4,406.3
Vegetative Propagation	168.0	75.0	483.7	576.7
Bareroot Seedlings Grown	87,708.0	60.0	387.0	88,033.0
Transplant Seedlings Produced	3,934.9	0.0	0.0	3,934.9
Containerized Seedlings Produced	196.6	56.8	366.4	506.4
Seedlings Produced for Christmas Trees	30,343.2	60.0	387.0	30,670.2
Seedlings Produced for Ornamentals	9,199.3	56.8	366.4	9,508.9
Seedlings Produced for Reforestation	24,297.7	0.0	0.0	24,297.7
Seedlings Produced for Fruit Trees	2,951.4	0.0	0.0	2,951.4
Seedlings Produced for Other Purposes	1,238.4	0.0	0.0	1,238.4
Seedlings Shipped Out of State	25,097.6	8.8	56.8	25,145.6
Seedlings Shipped In State	54,786.3	112.0	722.4	55,396.7
Seedlings for Planting Purposes	5,078.7	60.0	387.0	5,045.7

*25.8 is the calculated number of nursery firms not responding to the survey.