

Costs and Returns in Michigan Christmas Tree Production, 2006

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Introduction

Growing Christmas trees is of significant economic importance in the Great Lakes states, the Pacific Northwest, the Northeast and North Carolina. Growers in these regions supply about 90 percent of all trees sold in the United States (Koelling et al., 1992). Among the Great Lakes states, Michigan is the largest producer, with annual harvests of approximately 4 million trees with an estimated value of more than \$100 million. The industry makes a significant contribution to the Michigan economy, providing more than 5,000 permanent jobs and employing about 35,000 seasonal workers for planting, trimming and harvesting operations (Koelling et al., 1992). In several counties, Christmas tree production is among the leading agricultural activities (Jones et al., 1999). Individual operations vary in size from a few acres to more than 5,000. The combination of a favorable climate and diverse soils enables Michigan growers to produce several species (Jones et al., 1999).

An estimated 800 Christmas tree growers in Michigan are working on approximately 130,000 acres of land. Major species planted are true firs (balsam fir, concolor fir and Fraser fir), Scotch pine and Colorado blue spruce. Among these, the best selling trees are Scotch

pine, Fraser fir, Douglas fir and blue spruce. Offering many species has permitted Michigan producers to remain competitive in nearly all national markets (NASS, 2005).

The Department of Forestry at Michigan State University has been actively involved in research and extension in support of Christmas tree growers in Michigan for decades. Periodic study of costs and returns in Christmas tree production in Michigan have been conducted by MSU Extension faculty and staff members since the late 1960s. The previous reports were published in 1968, 1972, 1982, 1986 and 1997.

Over the years, many changes have occurred in the Christmas tree industry. The past decades have seen a species shift from a market dominated by Scotch pine to true firs; Fraser fir, especially, has increased in popularity among customers. Gasoline prices have more than doubled since 1997, and growers are now faced with higher fertilizer and pesticide costs, higher labor costs, and higher harvesting, shipping and marketing costs. In addition, the popularity of choose-and-cut operations has increased in recent years, especially around cities and large population concentrations. Choose-and-cut operations are known to have slightly

different needs and costs than traditional wholesale operations.

For these reasons, it was necessary to conduct an updated assessment of costs and returns in Michigan Christmas tree production. Past studies focused on the three most popular species: Scotch pine, Fraser fir and Douglas fir. The current study also targeted the same species, but growers were given the option of providing information on additional species. Several growers provided information on Colorado blue spruce, Canaan fir, Korean fir, concolor fir and balsam fir, though there

was not enough response on any of the additional species to allow it full inclusion in the final report. Selected results are presented for these other species. A logical innovation in the 2006 report is the breakdown of costs and returns into choose-and-cut and wholesale operations. This report presents averages across the industry and allows each grower individually to assess and compare his/her operation with industry averages. This will help to identify loopholes and areas where work needs to be done to reduce costs to improve the profitability of Christmas tree operations.

Methods

The list of Christmas tree growers who are members of the Michigan Christmas Tree Association (MCTA) was obtained from the association. Additional growers and those who are not members of the MCTA were compiled using a list obtained from the USDA National Agricultural Statistics Service (NASS) database. The initial list comprised 561 growers, almost three times the 180 growers used in the 1997 study, which focused on wholesale producers. After removing duplicates and those known to be retired or out of business, a final list of 419 growers was established.

A questionnaire survey based on the format used in past surveys was prepared, incorporating information from the NASS rotational survey (NASS, 2005). The survey was modified to take into account current trends in the industry. Several MSU faculty members and MCTA board members provided feedback for corrections and validation. We requested from growers information relating to several aspects of Christmas tree

production, along with costs and returns for each production step and species.

The survey was mailed to 419 growers in January 2006. A postcard reminder was sent out in March 2006 asking growers to fill out and return the surveys if they had not yet done so. Another mailing was done in April 2006, and copies were also made available during the winter meeting of the MCTA in April 2006. From the 419 forms mailed, 59 were returned as unknown address, out of business or retired. Seventy-four positive responses were received, of which 42 were considered usable (Table 1). The number of responses for the current survey was very similar to that of the 1997 survey. A non-respondent analysis conducted by evaluating the geographical distribution, sizes and characteristics of those who did not return the survey showed no noticeable differences between non-respondents and respondents for the study.

Table 1. Questionnaires mailed, responses received and usable responses by species.

	Scotch pine		Douglas fir		Fraser fir	
	1997	2006	1997	2006	1997	2006
Questionnaires mailed	180	419	180	419	180	419
Total responses	76	74	78	74	73	74
Usable responses	36	42	35	42	21	42

The Survey

The survey contained questions about the background of the tree farm and several cost components relating to its production. Background questions related to farm type, total acreage for each species, farm location and products sold. Questions relating to costs focused on land value, property tax, site preparation, planting costs and cost of replanting. Data were also collected on irrigation, staking, basal pruning, cleanup, chemical weed control, fertilizing, mowing, shearing, insect

control, disease control and management costs. Other questions concerned costs and pricing for tagging, harvesting, transporting, cleaning (shaking) and baling, and sales prices of trees. Information on tree spacing, type of planting stock, width of access lanes, number of rows between access lanes, survival rate of first-year plantings, number of trees sold per acre and percent of trees marketed was also sought. Additional pages were provided for growers to include information about any

other tree species they wanted included in the study, in addition to the target species of Douglas fir, Scotch pine and Fraser fir.

Aspects of the survey recorded per tree or per 1,000 trees were converted to per acre units on the basis of the reported average spacing for each farm and each species. The annual land rental was used as reported when information was provided by the grower.

Otherwise, the annual land rental cost was computed using the value-to-rent ratio of 30 computed by dividing the average reported land value by the average reported rent value from Christmas tree growers. This value is similar to the 2006 published value-to-rent for other commodities, estimated at 38 in the southern Lower Peninsula and 41 in the Upper and northern Lower Peninsula for field crops (Wittenberg and Harsh, 2006).

Survey Results

Characterization of Christmas tree operations

Of the 74 responses received, a majority reported that their operations are located in the northern Lower Peninsula. Of those growing Douglas fir, 73 percent were in the northern Lower Peninsula and 27 percent in the southern Lower Peninsula. There were no respondents from the Upper Peninsula for Douglas fir. Fraser fir growers were slightly more scattered, with 7 percent in the Upper Peninsula, 57 percent in the northern Lower Peninsula and 34 percent in the southern Lower Peninsula. Of those growing Scotch pine, 17 percent were in the Upper Peninsula, 56 percent were in the northern Lower Peninsula and 28 percent were in the southern Lower Peninsula.

Growers were given several options to characterize their operations. Choices included the nature of the farm (wholesale, choose-and-cut or nursery) and MCTA membership, as well as other types of products sold by the farm. Results compiled from this characterization are summarized in Table 2.



Fig 1. Wreaths and garlands display at a choose-and-cut farm in Michigan.

Table 2. Characteristics of Christmas tree operations that returned the survey.

Operation	Proportion	MCTA member	Landscape trees	Sell other products	Potted trees
Choose-and-cut	27.5%	73.0%	27.7%	54.5%	45.4%
Choose-and-cut, nursery	2.5%	100.0%	100%	100%	100%
Wholesale	32.5%	46.1%	69%	23%	23%
Wholesale and landscape	25.0%	40.0%	100.0%	60%	20.0%
Wholesale, choose-and-cut	7.5%	100.0%	66.6%	66.6%	33.3%
Wholesale, choose-and-cut, landscape	5.0%	50.0%	100%	100%	100%

The results presented above show that 27.5 percent of the respondents had choose-and-cut operations, and 2.5 percent had operations that combined choose-and-cut sales and nursery for seedling production. Of the respondents, 32.5 percent were wholesalers, and 25 percent combined wholesale of Christmas trees with sales of landscape trees. A few growers (7.5 percent) had operations including both wholesale and choose-and-cut elements, and 5 percent combined wholesale, choose-and-cut and landscape trees.

The majority of respondents were MCTA members (68 percent), most wholesale operations (84 percent) were also involved in the landscape tree business, and most choose-and-cut operations (75 percent) also offered other types of products such as wreaths and garlands. It is notable that a high number of respondents from each of the subcategories in Table 2 reported selling potted trees (23 to 100 percent of respondents, depending on the category). This result indicates that Michigan



Fig 2. Michigan Christmas tree growers are developing the supply of potted trees.

Christmas tree growers are aware of the opportunity to supply the developing market for potted live Christmas trees.

For the economic analysis, all respondents from the choose-and-cut and choose-and-cut and nursery subcategories were classified as choose-and-cut, and all the other four subcategories — wholesale, wholesale and landscape, wholesale and choose-and-cut, and wholesale, choose-and-cut and nursery — were classified as wholesale.

Christmas tree species in Michigan

Species reported as grown for Christmas tree production in Michigan are listed in Table 3. The total

area planted for each species was quite variable, depending on the size of the operation, ranging from 1 to 1,200 acres for Scotch pine, 0.5 to 900 acres for Douglas fir and Fraser fir, and 0.2 to 10 acres for Korean fir.

To rank species used for Christmas tree production, we calculated an index dividing the average area for each species by the total number of growers who grew the species (Table 3). According to that index, Scotch pine is still the No. 1 Christmas tree species for the respondents of our survey, with an average area of 53.2 acres/grower. Scotch pine is followed by Douglas fir and Fraser fir, with 44 acres/grower and 43.5 acres/grower, respectively. Following are blue spruce with 23.7 acres/grower, and Black Hills spruce and balsam fir, with 8 acres/grower and 7.4 acres/grower, respectively. At the bottom of our list are Canaan fir, Austrian pine and Korean fir.

The ranking described above represents straight averages from the data collected and may be slightly skewed by the fact that large growers still have very large areas under Scotch pine production compared with average-sized and smaller growers.

Table 3. Average area per grower and ranking of Christmas tree species in Michigan.

	Range of area planted by species (acres)	Average area per grower (acres/grower)	Ranking
Scotch pine	1 - 1200	53.20	1
Douglas fir	0.5 - 900	44.00	2
Fraser fir	0.5 - 900	43.50	3
Blue spruce	1 - 250	23.70	4
Black Hills spruce	1 - 120	08.05	5
Balsam fir	0.5 - 63	07.43	6
White pine	0.1 - 100	06.82	7
Concolor fir	0.5 - 81	06.60	8
White spruce	0.1 - 100	02.56	9
Norway spruce	0.1 - 40	02.24	10
Canaan fir	0.1 - 20	01.85	11
Austrian pine	0.01 - 26	01.84	12
Korean fir	0.2 - 10	00.46	13

Basic data for Scotch pine, Douglas fir and Fraser fir

Data collected were used to conduct the costs and returns analysis for each of the three major Christmas tree species. For each table of the economic analysis, the 1997 value is included for comparison purposes, and the 2006 data are divided into wholesale and choose-and-cut whenever possible.

Basic data for Scotch pine, Douglas fir and Fraser fir — including the production period, the average land values per acre, the planting density, the average number of trees harvested per acre and average selling prices — are summarized in Table 4. The data reveal that the average land values for all the species are much higher than those reported in 1997. The current values were estimated at an average of \$2,600 to \$3,000 per acre, depending on the species and type of operation, in 2006, compared with \$991 to \$1,825 in 1997. Results of the 2006 survey also showed extremely high land values (\$10,000 to \$30,000 per acre) for a few Christmas tree operations located in highly urbanized counties and around major cities. The reported average number of trees harvested per acre in 2006 is generally higher than

1997 values except for Scotch pine in choose-and-cut farms and Fraser fir in wholesale production, where they were similar. The average selling prices for Scotch pine increased from \$9.40 per tree in 1997 to \$14.13 and \$15 per tree for wholesale and choose-and-cut farms in 2006, corresponding to increases of 50 and 59 percent, respectively. The per tree selling price of 7- to 9-foot Douglas fir trees increased from \$14 per tree to \$23.91 and \$34 (wholesale and choose-and-cut), corresponding to 70 and 142 percent increases, respectively. A similar trend was observed for Fraser fir, where the selling prices increased from \$22.56 to \$27.39 per tree for wholesale farms and to \$47 per tree for choose-and-cut farms.

The average percentage of total trees harvested for each year of the rotation for Scotch pine, Douglas fir and Fraser fir is summarized in Table 5. Data were collected for rotations of eight, nine and 10 years for Scotch pine and Fraser fir and 10, 11, 12 and 13 years for Douglas fir. The percentages harvested (Table 5) were used with the total number of trees harvested for each species (Table 4) as the basis for determining the costs and returns of harvesting operation for each year of the rotation.

Table 4. Basic data for Scotch pine, Douglas fir and Fraser fir Christmas tree plantations.

	Scotch pine			Douglas fir			Fraser fir		
	1997 survey	2006 survey		1997 survey	2006 survey		1997 survey	2006 survey	
		WS	CC		WS	CC		WS	CC
Production period (years)	8 to 10	8 to 10	9 to 10	10 to 13	10 to 13	11 to 13	8 to 10	8 to 10	9 to 10
Average land value per acre	991	2,600	3,000	1,825	2,812	ND	923	2,777	2,883
Average number of trees planted per acre	1,222	1,210	1,210	1,222	1,210	1,210	1,222	1,320	1,320
Average number of trees sold per acre	810	854	807	808	963	847	1,056	1,052	1,171
Average selling price per 7- to 9-foot tree	\$9.40	\$14.13	\$15.00	\$14.00	\$23.91	\$34.00	\$22.56	\$27.39	\$47.00

WS= Wholesale

CC = Choose-and-cut

ND = No data.

Table 5. Percentage of total trees harvested for each year of the rotation age for Scotch pine, Douglas fir and Fraser fir.

Species	Rotation age	Percentage harvested in							
		Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Scotch pine	8	10	30	60					
	9	10	20	50	20				
	10	10	20	30	30	10			
Douglas fir	10	0	10	15	50	25			
	11	0	10	15	40	25	10		
	12	0	10	15	25	25	15	10	
	13	0	10	15	15	25	15	10	10
Fraser fir	8	10	30	60					
	9	0	20	50	30				
	10	0	20	20	40	20			

Costs and Returns for Scotch Pine

The costs and returns of producing Scotch pine are summarized in Tables 6a, 6b and 6c. Costs incurred are reported on a per acre basis, and the value per tree obtained by dividing the total cost by the number of trees per acre. The cost values of the 1997 survey are provided, and results obtained for 2006 are presented for wholesale and choose-and-cut whenever possible. The years in which the costs are incurred for each of the three rotation ages (8, 9 and 10 years) are also included.

Results compiled in Table 6a show that the per acre costs of all these major operations have increased drastically since 1997. A simple comparison between the 2006 and 1997 per acre costs shows that the most significant changes occurred in the costs of site preparation (98 percent increase), replanting (147 percent increase), land taxes (67 percent increase), mowing (85 percent increase), staking (55 percent increase), disease control (66 percent increase) and cleanup after harvest (91 percent increase).

The comparison of wholesale and choose-and-cut costs show that land value is slightly higher for choose-and-cut farms (\$3,000 per acre) than for wholesale farms (\$2,600 per acre). The same trend was observed for land rental, evaluated at \$85.71 per acre for choose-and-cut

compared with \$66.25 for wholesale farms, and land taxes reported to be \$33 per acre for choose-and-cut farms and \$26.22 per acre for wholesale farms. The higher land-related expenses associated with choose-and-cut operations are not surprising and can be explained by the fact that such operations are usually located around urban areas, where the real estate pressure and land value are higher than in rural areas. Another interesting trend is slightly lower costs for choose-and-cut farms of most operations involving direct labor, such as site preparation, planting and replanting. This is also a predictable trend because most choose-and-cut operations are much smaller than wholesale operations and involve large labor contributions (usually undervalued by the grower) by the grower himself.

The shearing, cutting, cleaning and baling, and hauling and loading costs for Scotch pine are summarized in Table 6b. In 1997, the shearing costs varied from 6 cents/tree for 3- to 4-year-old trees to 13 cents/tree for 10-year-old trees. The 2006 survey indicates that shearing costs now vary from 14 cents/tree for small trees to 23 cents for 10-year-old trees. These represent changes of 133 percent for smaller trees and 76 percent

Table 6a. Scotch pine Christmas tree management costs (other than those associated with shearing and harvesting, eight- to 10-year rotations).

Cost item	1997 survey		2006 survey				Rotation length in years 8 9 10		
	Average cost per year or per treatment		WS		CC				
	(Per acre)	(Per tree)	(Per acre)	(Per tree)	(Per acre)	(Per tree)	(Years in which cost is incurred)		
Land value	\$991.00	\$0.81	\$2,600.00	\$2.15	\$3,000.00	\$2.48			
Land rental	\$45.35	\$0.04	\$66.25	\$0.05	\$85.71	\$0.07	1-8	1-9	1-10
Site preparation	\$53.85	\$0.04	\$107.00	\$0.09	\$100.00	\$0.08	1	1	1
Planting stock (2-0)	\$215.04	\$0.18	\$282.50	\$0.23	\$300.00	\$0.25	1	1	1
Planting	\$99.59	\$0.08	\$122.22	\$0.10	\$75.00	\$0.06	1	1	1
Replanting	\$20.34	\$0.16	\$50.29	\$0.37	\$31.35	\$0.19	2	2	2
Land taxes	\$15.69	\$0.01	\$26.22	\$0.02	\$33.00	\$0.03	1-8	1-9	1-10
Overhead	\$147.69	\$0.12	\$125.00	\$0.10	\$175.00	\$0.14	1-8	1-9	1-10
Mowing	\$20.91	\$0.02	\$38.67	\$0.03	\$44.81	\$0.04	1-8	1-9	1-10
Chemical weed control	\$28.42	\$0.02	\$31.50	\$0.03	ND	ND	1-5	1-6	1-7
Fertilizer	ND	ND	\$6.25	\$0.01	\$27.78	\$0.02	2-8	2-9	2-10
Basal pruning	\$141.28	\$0.12	\$211.60	\$0.17	ND	ND	3	3	3
Staking	\$95.19	\$0.21	\$147.40	\$0.34	ND	ND	3	3	3
Insect control	\$47.26	\$0.04	\$49.48	\$0.04	ND	ND	3-8	3-9	3-10
Disease control	\$40.54	\$0.03	\$67.38	\$0.06	ND	ND	4-8	4-9	4-10
Cleanup after harvest	\$65.72	\$0.05	\$125.56	\$0.10	ND	ND	8	9	10

WS = Wholesale

CC = Choose-and-cut

ND = No data.

Table 6b. Scotch pine Christmas tree management costs associated with shearing and harvesting, eight- to 10-year rotations.

Cost item and years in which cost is incurred	Average cost per tree			Rotation length in years and cost per acre					
	1997 survey	2006 survey		8		9		10	
			WS	CC	2006 survey		2006 survey		2006 survey
		WS	CC	WS	CC	WS	CC	WS	CC
Shearing									
3rd and 4th years	\$0.06	\$0.14	\$0.14	\$120	\$113	\$120	\$113	\$120	\$113
5th and 6th years	0.10	0.15	0.15	\$128	\$121	\$128	\$121	\$128	\$121
7th year	0.12	0.18	0.18	\$138	\$131	\$138	\$131	\$138	\$131
8th year	0.13	0.22	0.22	\$113	\$107	\$132	\$124	\$132	\$124
9th year	0.12	0.22	0.22			\$38	\$36	\$75	\$71
10th year	0.13	0.23	0.23					\$20	\$19
Cutting									
6th year	0.19	0.40	ND	\$34	ND	\$34	ND	\$34	ND
7th year	0.19	0.40	ND	\$102	ND	\$68	ND	\$68	ND
8th year	0.19	0.40	ND	\$205	ND	\$171	ND	\$102	ND
9th year	0.19	0.40	ND			\$68	ND	\$102	ND
10th year	0.19	0.40	ND					\$34	ND
Cleaning and baling									
6th year	0.63	0.73	0.5	62	43	62	43	62	43
7th year	0.63	0.73	0.5	187	128	125	85	125	85
8th year	0.63	0.73	0.5	374	256	312	214	187	128
9th year	0.63	0.73	0.5			125	85	187	128
10th year	0.63	0.73	0.5					62	43
Hauling and loading									
6th year	0.79	0.86	ND	73	ND	73	ND	73	ND
7th year	0.79	0.86	ND	220	ND	147	ND	147	ND
8th year	0.79	0.86	ND	441	ND	367	ND	220	ND
9th year	0.79	0.86	ND			147	ND	220	ND
10th year	0.79	0.86	ND					73	ND

WS = Wholesale

CC = Choose-and-cut

ND = No data.

for bigger trees. The reported shearing costs were similar for wholesale and choose-and-cut operations. The cutting cost increased from 19 cents/tree to 40 cents/tree (110 percent increase), the cleaning and baling costs increased from 63 cents/tree to 73 cents/tree (16 percent increase), and the hauling cost changed from 79 cents/tree to 86 cents/tree (9 percent increase). The total expense for each of the operations discussed above during each year of the rotation was computed by multiplying the cost per tree by the residual number of trees available (inflation is not included). This was obtained by removing the previous year's harvest from the total number of trees per acre, taking into account the mortality after planting.

The total value of tree sales, calculated by multiplying the average per tree value for wholesale and choose-and-cut by the total number of trees harvested, is summarized in Table 6c.

The data summarized in Table 6c show that the total number of trees harvested was similar to the 1997 number (810 trees per acre) for wholesale but slightly higher (854 trees per acres) for choose-and-cut operations. The total revenue from sales increased from \$7,614 in 1997 to \$11,445 for wholesale and \$12,810 for choose-and-cut operations in 2006. These values correspond to 50.3 percent and 68.2 percent increases for wholesale and choose-and-cut, respectively.

Table 6c. Average number of Scotch pine trees sold per acre for each production period and revenues received at \$14.13 and \$15 for wholesale and choose-and-cut.

Year of sale	8-year rotation			9-year rotation			10-year rotation		
	1997	2006		1997	2006		1997	2006	
		WS	CC		WS	CC		WS	CC
6	152 \$1,429	81 \$1,145	85 \$1,281	93 \$874	81 \$1,145	85 \$1,281	74 \$696	81 \$1,145	85 \$1,281
7	325 \$3,055	243 \$3,434	256 \$3,843	265 \$2,491	162 \$2,289	171 \$2,562	192 \$1,805	162 \$2,289	171 \$2,562
8	333 \$3,130	486 \$6,867	512 \$7,686	234 \$2,200	405 \$5,723	427 \$6,405	233 \$2,190	243 \$3,434	256 \$3,843
9				218 \$2,049	162 \$2,289	171 \$2,562	167 \$1,570	243 \$3,434	256 \$3,843
10							144 \$1,354	81 \$1,145	85 \$1,281
Trees sold	810	810	854	810	810	854	810	810	854
Gross revenue	\$7,614	\$11,445	\$12,810	\$7,614	\$11,445	\$12,810	\$7,614	\$11,445	\$12,810

WS = Wholesale

CC = Choose-and-cut

ND = No data.

Costs and Returns for Douglas Fir

The costs and returns (before inflation) for producing Douglas fir in Michigan are computed and tabulated as for Scotch pine and summarized in Tables 7a, 7b and 7c. Information returned from choose-and-cut growers was insufficient to provide meaningful averages for data analysis and is, therefore, not included. Consequently

the Douglas fir 2006 analysis can be directly compared with the 1997 survey.

The land value in wholesale production units for Douglas fir is very similar to that of Scotch pine. The average price for land rental to grow Douglas fir in the

Table 7a. Douglas fir Christmas tree management costs other than those associated with shearing and harvesting, eight- to 13 year rotations.

Cost item	1997 survey		2006 survey				Rotation length in years			
			WS		CC					
	Average cost per year or per treatment		Average cost per year or per treatment		Average cost per year or per treatment		10	11	12	13
	<i>(Per acre)</i>	<i>(Per tree)</i>	<i>(Per acre)</i>	<i>(Per tree)</i>	<i>(Per acre)</i>	<i>(Per tree)</i>	<i>(Years in which cost is incurred)</i>			
Land value	\$1,825	\$1.49	\$2,812.5	\$2.32	ND	ND	1-10	1-11	1-12	1-13
Land rental	\$75.53	\$0.06	\$71.67	\$0.06	ND	ND	1-10	1-11	1-12	1-13
Site preparation	\$88.93	\$0.07	\$122.73	\$0.10	ND	ND	1	1	1	1
Planting stock (2-0)	\$366.53	\$0.30	\$612.69	\$0.51	ND	ND	1	1	1	1
Planting	\$158.86	\$0.13	\$139.64	\$0.12	ND	ND	1	1	1	1
Replanting	\$39.26	\$0.30	\$65.41	\$0.42	ND	ND	2	2	2	2
Land taxes	\$26.48	\$0.02	\$22.07	\$0.02	ND	ND	1-10	1-11	1-12	1-13
Overhead	\$143.65	\$0.12	\$187.50	\$0.15	ND	ND	1-10	1-11	1-12	1-13
Mowing	\$25.52	\$0.02	\$43.84	\$0.04	ND	ND	1-10	1-11	1-12	1-13
Chemical weed control	\$25.00	\$0.02	\$42.93	\$0.04	ND	ND	1-7	1-8	1-9	1-10
Fertilizer	\$35.68	\$0.03	\$50.23	\$0.04	ND	ND	3-10	3-11	3-12	3-13
Basal pruning	\$167.06	\$0.14	\$181.78	\$0.15	ND	ND	4	4	4	4
Insect control	\$20.04	\$0.02	\$32.38	\$0.03	ND	ND	4-10	4-11	4-12	4-13
Disease control	\$29.80	\$0.02	\$33.18	\$0.03	ND	ND	7-10	7-11	7-12	7-13
Cleanup after harvest	\$101.27	\$0.08	\$144.62	\$0.12	ND	ND	10	11	12	13

WS = Wholesale

CC = Choose-and-cut

ND = No data.

Table 7b. Douglas fir Christmas tree management costs associated with shearing and harvesting, 10- to 13-year rotations.

Cost item and years in which cost is incurred	Average cost per tree			Rotation length in years and cost per acre							
	1997 survey	2006 survey		10		11		12		13	
		WS	CC	WS	CC	WS	CC	WS	CC	WS	CC
Shearing											
4th-6th years	\$0.14	\$0.15	ND	\$144	ND	\$144	ND	\$144	ND	\$144	ND
7th year	0.14	0.18	ND	\$173	ND	\$173	ND	\$173	ND	\$173	ND
8th year	0.14	0.22	ND	\$191	ND	\$191	ND	\$191	ND	\$191	ND
9th year	0.21	0.22	ND	\$159	ND	\$159	ND	\$159	ND	\$159	ND
10th year	0.24	0.23	ND	\$55	ND	\$78	ND	\$111	ND	\$133	ND
11th year	0.21	0.25	ND			\$24	ND	\$60	ND	\$84	ND
12th year	0.23	0.26	ND					\$25	ND	\$50	ND
13th year	0.20	0.26	ND							\$25	ND
Cutting											
6th year	0.20	0.45	ND	0	ND	0	ND	0	ND	0	ND
7th year	0.20	0.45	ND	43	ND	43	ND	43	ND	43	ND
8th year	0.20	0.45	ND	65	ND	65	ND	65	ND	65	ND
9th year	0.20	0.45	ND	217	ND	173	ND	108	ND	65	ND
10th year	0.20	0.45	ND	108	ND	108	ND	108	ND	108	ND
11th year	0.20	0.45	ND			43	ND	65	ND	65	ND
12th year	0.20	0.45	ND					39	ND	43	ND
13th year	0.20	0.45	ND							43	ND
Cleaning and baling											
6th year	0.62	0.91	0.5	0	0	0	0	0	0	0	0
7th year	0.62	0.91	0.5	88	42	88	42	88	42	88	42
8th year	0.62	0.91	0.5	131	64	131	64	131	64	131	64
9th year	0.62	0.91	0.5	438	212	351	169	219	106	131	64
10th year	0.62	0.91	0.5	219	106	219	106	219	106	219	106
11th year	0.62	0.91	0.5			88	42	131	64	131	64
12th year	0.62	0.91	0.5					79	42	88	42
13th year	0.62	0.91	0.5							88	42
Hauling and loading											
6th year	0.83	0.99	ND	0	ND	0	ND	0	ND	0	ND
7th year	0.83	0.99	ND	95	ND	95	ND	95	ND	95	ND
8th year	0.83	0.99	ND	143	ND	143	ND	143	ND	143	ND
9th year	0.83	0.99	ND	477	ND	381	ND	238	ND	143	ND
10th year	0.83	0.99	ND	238	ND	238	ND	238	ND	238	ND
11th year	0.83	0.99	ND			95	ND	143	ND	143	ND
12th year	0.83	0.99	ND					86	ND	95	ND
13th year	0.83	0.99	ND							95	ND

WS = Wholesale

CC = Choose-and-cut

ND = No data.

2006 survey was similar to the reported value in 1997 (\$71.67 and \$75.53, respectively) but higher than the rental value for Scotch pine (\$66.20 and \$45.30 in 2006 and 1997, respectively). This observation clearly suggests that growers expect to pay or attach higher price value to premium sites used to grow Douglas fir.

Most production costs increased between 1997 and 2006, with the largest change being in the cost of basal pruning, which changed from \$35.68/acre to \$181.78/acre (409 percent change). Mowing and chemical weed control costs increased by about 72 percent, and the purchase price for planting stock and

the cost for replanting increased 66 to 67 percent; the cost of insect control increased 61 percent, and the cleanup cost after harvest increased 43 percent.

Other production costs — shearing, cutting, cleaning and baling, and hauling and loading — are summarized in Table 7b. The shearing cost reported in 1997 varied from 14 cents/tree for 4- to 6-year-old trees to 20 cents/tree for 13-year-old trees. In the current survey, the same cost is reported at 15 cents/tree to 26 cents/tree for similar sizes. The cutting cost more than doubled, increasing from 20 cents/tree to 45 cents/tree in 2006 (125 percent increase). Cleaning and baling costs increased by 46 percent, going from 62 cents/tree to 91 cents/tree. The average price for hauling and loading was 99 cents/tree up from 83 cents/tree in the 1997 survey.

All analyses on Douglas fir were conducted assuming rotation ages of 10 to 13 years. The total cost per acre calculated and presented in Table 7b for each year of the rotation age takes into account the total number of trees harvested during the previous years of operation. Logically, the total cost per acre decreases in the later

years of longer rotation ages because portions of the field were harvested in previous years and the total number of trees involved is diminished.

The value of Douglas fir tree sales, calculated by multiplying the average sale price by the total number of trees harvested, is presented in Table 7c.

The reported total number of trees sold per acre increased from 808 trees per acre in 1997 to 963 and 847 trees per acre in 2006 for wholesale and choose-and-cut, respectively. The higher number of trees sold in 2006 could be the result of better management practices resulting in lower losses throughout the rotation and better yields at harvest. The average selling price per tree increased from \$14 in 1997 to \$23.91 (wholesale) and \$34 (choose-and-cut). This combination of a higher number of trees harvested and higher selling prices increased the gross revenue per acre of Douglas fir from \$11,312 in 1997 to \$23,049 for wholesale and \$28,798 for choose-and-cut operations (Table 7c). These values represent a 103 percent increase for wholesale and 155 percent increase for choose-and-cut.

Table 7c. Average number of trees sold per acre for each production period and revenues received at \$23.91 and \$34 for wholesale and choose-and-cut, respectively.

Year of sale	10-year rotation			11-year rotation			12-year rotation			13-year rotation		
	1997	2006		1997	2006		1997	2006		1997	2006	
		WS	CC									
6	72 \$1,008			59 \$826								
7	121 \$1,694	96 \$2,295	83 \$2,822	71 \$994	96 \$2,295	83 \$2,822	44 \$616	96 \$2,295	83 \$2,822	42 \$588	96 \$2,295	83 \$2,822
8	253 \$3,542	145 \$3,467	127 \$4,318	192 \$2,688	145 \$3,467	127 \$4,318	22 \$308	145 \$3,467	127 \$4,318	170 \$2,380	145 \$3,467	127 \$4,318
9	214 \$2,996	482 \$11,525	423 \$14,382	216 \$3,024	386 \$9,229	340 \$11,560	131 \$1,834	241 \$5,762	213 \$7,242	170 \$2,380	145 \$3,467	128 \$4,352
10	148 \$2,072	241 \$5,762	214 7276	161 \$2,254	241 \$5,762	214 \$7,276	218 \$3,052	241 \$5,762	214 \$7,276	170 \$2,380	241 \$5,762	214 \$7,276
11				109 \$1,526	96 \$2,295	83 \$2,822	175 \$2,450	145 \$3,467	127 \$4,318	85 \$1,190	145 \$3,467	128 \$4,352
12							218 \$3,052	96 \$2,295	83 \$2,822	43 \$602	96 \$2,295	84 \$2,856
13										128 \$1,792	96 \$2,295	83 \$2,822
Trees sold	808	963	847	808	963	847	808	963	847	808	963	847
Gross revenue	\$11,312	\$23,049	\$28,798	\$7,532	\$23,049	\$28,798	\$8,260	\$23,049	\$28,798	\$8,918	\$23,049	\$28,798

WS = Wholesale

CC = Choose-and-cut.

Costs and Returns for Fraser Fir

The average costs and returns for producing Fraser fir are summarized in Tables 8a, 8b and 8c. The average land value for Fraser fir is very similar to values reported for Scotch pine and Douglas fir, but the average land rental value is \$78/acre compared with the \$52.20/acre reported in the 1997 survey, and higher than the two values reported for both Douglas fir (\$71.67/acre) and Scotch pine (\$66.25/acre). The change in rental value corresponds to a 49 percent increase in rental charges to growers since 1997. In addition, the data indicate that growers are willing to pay almost \$7/acre/year more to rent premium farmland where they can grow Fraser fir than to rent land to grow Douglas fir. The same comparison between Fraser fir and Scotch pine shows that growers will pay almost \$12/acre/year more for Fraser fir farmland than for Scotch pine land.

In addition, as with Scotch pine and Douglas fir, most of the other production costs for Fraser fir in wholesale

survey returns listed in Table 8a had increased significantly since 1997. The highest increases are recorded for disease control (\$23.14 in 2006 compared with \$2.38 in 1997), basal pruning (\$206.42 in 2006 compared with \$30 in 1997), mowing (\$50.03 in 2006 compared with \$15.20 in 1997) and replanting (\$107.47 in 2006 compared with \$42.48 in 1997). Other cost items showing substantial increases include the cost for insect control, which went from \$19.58 in 1997 to \$37.05 in 2006 (89 percent increase), and the cost of site preparation, which increased from \$94.38/acre in 1997 to \$153.75/acre in 2006. For choose-and-cut operations, similar to the trend observed for Scotch pine, costs of associated activities involving hand labor, such as site preparation and replanting, are lower than for wholesale. A new cost item that appears in the 2006 survey is the irrigation cost for Fraser fir. Wholesale farms reported spending an average of \$115/acre/year for irrigation; choose-and-cut farms reported annual irrigation cost at \$120/acre.

Table 8a. Fraser fir Christmas tree management costs (other than those associated with shearing and harvesting), eight- to 10-year rotations.

Cost item	1997 survey		2006 survey				Rotation length in years		
	Average cost per year or per treatment		WS		CC				
	(Per acre)	(Per tree)	(Per acre)	(Per tree)	(Per acre)	(Per tree)	(Years in which cost is incurred)		
Land value	\$923.00	\$0.75	\$2,777.78	\$2.30	\$2,883.00	\$2.38	1-8	1-9	1-10
Land rental	\$52.22	\$0.04	\$78.00	\$0.06	N/A	N/A	1-8	1-9	1-10
Site preparation	\$94.38	\$0.08	\$153.75	\$0.13	\$76.00	\$0.06	1	1	1
Planting stock (2-0)	\$586.56	\$0.48	\$748.67	\$0.62	\$927.00	\$0.77	1	1	1
Planting	\$202.11	\$0.17	\$192.73	\$0.16	\$205.00	\$0.17	1	1	1
Replanting	\$42.48	\$0.29	\$107.47	\$0.51	\$67.00	\$0.27	2	2	2
Land taxes	\$18.98	\$0.02	\$25.33	\$0.02	\$43.00	\$0.04	1-8	1-9	1-10
Overhead	\$122.29	\$0.10	\$240.00	\$0.18	\$295.00	\$0.22	1-8	1-9	1-10
Mowing	\$15.22	\$0.01	\$50.03	\$0.04	\$72.36	\$0.06	1-8	1-9	1-10
Chemical weed control	\$27.72	\$0.02	\$39.92	\$0.03	\$54.58	\$0.05	1-5	1-6	1-7
Fertilizer	\$30.00	\$0.02	\$36.10	\$0.03	\$36.10	\$0.03	1-8	1-9	1-10
Basal pruning	\$30.00	\$0.02	\$206.42	\$0.17	\$100.00	\$0.08	3	3	3
Irrigation	N/A	N/A	\$115.00	\$0.10	\$120.00	\$0.10	3	3	3
Insect control	\$19.58	\$0.02	\$37.05	\$0.03	60.00	ND	3-8	3-9	3-10
Disease control	\$2.38	\$0.00	\$23.14	\$0.02	ND	ND	4-8	4-9	4-10
Cleanup after harvest	\$84.17	\$0.07	\$123.85	\$0.10	\$103.00	\$0.09	8	9	10

WS = Wholesale

CC = Choose-and-cut

ND = No data.

Table 8b. Fraser fir Christmas tree management costs associated with shearing and harvesting, eight- to 10-year rotations.

Cost item and years in which cost is incurred	Average cost per tree		Rotation length in years and cost per acre						
			8		9		10		
	1997 survey	2006 survey		2006 survey		2006 survey		2006 survey	
	WS	CC	WS	CC	WS	CC	WS	CC	
Shearing									
3rd and 4th years	\$0.05	\$0.13	\$0.22	\$137	\$258	\$137	\$258	\$137	\$258
5th and 6th years	0.08	0.16	0.26	\$168	\$304	\$168	\$304	\$168	\$304
7th year	0.11	0.18	0.28	\$170	\$295	\$170	\$295	\$170	\$295
8th year	0.13	0.20	0.32	\$126	\$225	\$147	\$262	\$168	\$300
9th year	0.15	0.21	0.37			\$66	\$130	\$144	\$282
10th year	0.17	0.21	0.37					\$55	\$108
Cutting									
6th year	0.20	0.41	ND	43		43		43	
7th year	0.20	0.41	ND	129		86		43	
8th year	0.20	0.41	ND	259		216		65	
9th year	0.20	0.41	ND			86		173	
10th year	0.20	0.41	ND					108	
Cleaning and baling									
6th year	0.58	0.61	0.5	64	59	64	59	64	59
7th year	0.58	0.61	0.5	193	176	128	117	64	59
8th year	0.58	0.61	0.5	385	351	321	293	96	88
9th year	0.58	0.61	0.5			128	117	257	234
10th year	0.58	0.61	0.5					160	146
Hauling and loading									
6th year	0.83	0.96	ND	101	ND	101	ND	112	ND
7th year	0.83	0.96	ND	303	ND	202	ND	112	ND
8th year	0.83	0.96	ND	606	ND	505	ND	169	ND
9th year	0.83	0.96	ND			202	ND	450	ND
10th year	0.83	0.96	ND					281	ND

WS = Wholesale

CC = Choose-and-cut

ND = No data.

The various cost items associated with shearing and harvesting operations are summarized in Table 8b.

The average shearing cost for Fraser fir trees in 1997 varied from 5 cents to 17 cents/tree. Shearing costs are currently reported at 13 cents to 21 cents/tree for wholesale and 22 cents to 37 cents/tree for choose-and-cut operations. The cutting cost increased from 20 cents/tree in 1997 to 41 cents/ tree in the current survey for wholesale. Cleaning and baling costs increased from 58 cents to 61 cents/tree, and hauling and loading costs increased from 83 cents to 96 cents/tree. The calculated cost per acre for each year of the rotation is presented in Table 8b.

The average numbers of trees harvested and total returns for Fraser fir production are presented in Table 8c.

The total number of trees harvested for wholesale operations in the 2006 survey was similar to that reported in the 1997 survey (1,056 and 1,052, respectively). The reported average number of trees harvested was slightly higher for choose-and-cut farms. The change in selling price per tree for wholesale farms is relatively small, going from \$22.56 in 1997 to \$27.39 in 2006. On the other hand, the average selling price per tree for choose-and-cut operations (\$47/per tree) is more than double the reported number in 1997 (\$22.56/tree). Consequently, the gross sales revenue for Fraser fir increased from \$23,823 to \$28,814 (21 percent increase) for wholesale and to \$55,037 per acre for choose-and-cut operations.

Table 8c. Average number of Fraser fir trees sold per acre for each production period and revenues received at \$27.39 and \$47 for wholesale and choose-and-cut.

Year of sale	8-year rotation			9-year rotation			10-year rotation		
	1997	2006		1997	2006		1997	2006	
		WS	CC	CC	WS	CC		WS	CC
6	141 \$3,181	105 \$2,876	117 \$5,499						
7	563 \$12,701	316 \$8,655	351 \$16,497	260 \$5,866	210 \$5,752	234 \$10,998	68 \$1,534	210 \$5,752	234 \$10,998
8	352 \$7,941	631 \$17,283	703 \$33,041	422 \$9,520	526 \$14,407	586 \$27,542	329 \$7,422	210 \$5,752	234 \$10,998
9				374 \$8,437	316 \$8,655	351 \$16,497	363 \$8,189	422 \$11,559	469 \$22,043
10							296 \$6,678	210 \$5,752	234 \$10,998
Trees sold	1,056	1,052	1,171	1,056	1,052	1,171	1,056	1,052	1,171
Gross revenue	\$23,823	\$28,814	\$55,037	\$23,823	\$28,814	\$55,037	\$23,823	\$28,814	\$55,037

WS= Wholesale

CC = Choose-and-cut

ND = No data.

Cost Analysis

The percentages of the total cost for each of the major farming activities for Scotch pine, Douglas fir and Fraser fir are summarized in Tables 9a, 9b and 9c.

For wholesale production of Scotch pine (Table 9a), the major expense pools are shearing cost, representing 16 to 17 percent; harvesting and postharvest handling operations (16 to 19 percent) and overhead expenses, estimated at 15 to 16 percent of the total cost. Land rental (8 to 9 percent), insect and disease control (10 to 12 percent) and mowing and chemical weed control (7 to 9 percent) are also major cost expenses for wholesale operations. The overall structure of the production costs for Scotch pine choose-and-cut operations is very similar to that of wholesale farms. Notable differences are land rental costs, which are 3 percent higher for choose-and-cut, and overhead costs, which are also 5 to 6 percent higher for choose-and-cut because of the inclusion of charges incurred for non-production amenities offered at choose-and-cut farms. Another important difference is the much lower cost for harvesting and handling at choose-and-cut farms. This is expected because customers usually cut their own trees at choose-and-cut as part of the overall "Christmas tree family tradition" experience. The costs for cleaning and baling and the help provided to customers for

loading the trees represent a lower percentage of the total costs at choose-and-cut farms than at wholesale operations.

The cost structure for Douglas fir in wholesale production (Table 9b) is very similar to that of Scotch pine. Major expenses are incurred for shearing (15 to 16 percent), harvesting (20 to 24 percent), overhead (20 to 22 percent) and weed control (8 to 9 percent). In addition, the costs of planting material (5 to 6 percent) and fertilizers (8 percent) appear as major expenses for Douglas fir production.

The cost items for Fraser fir appear to be distributed in a similar manner as in Scotch pine and Douglas fir. The major difference is the addition of irrigation costs, representing about 10 percent of the total production cost in both wholesale and choose-and-cut operations. As with Douglas fir, the cost of planting material is also a major expense in Fraser fir production. Finally, costs related to harvesting and handling operations are also 10 to 15 percent lower for choose-and-cut farms than for wholesale operations.

Table 9a. Percentage of the total production cost of farming activities for Scotch pine.

	Wholesale			Choose-and-cut		
	8 years	9 years	10 years	8 years	9 years	10 years
Site preparation	1.7	1.5	1.4	1.5	1.4	1.3
Stock 2-0	4.4	4.0	3.7	4.6	4.3	4.0
Planting	1.9	1.7	1.6	1.2	1.1	1.0
Replanting (with stock)	0.8	0.7	0.7	0.5	0.4	0.4
Chemical weed control	2.4	2.7	2.9	2.4	2.7	2.9
Mowing	4.8	5.0	5.1	5.6	5.8	6.0
Insect control	4.6	5.0	5.3	4.6	5.0	5.3
Disease control	5.2	5.8	6.3	5.2	5.8	6.3
Fertilizing	0.8	0.7	0.7	0.8	0.7	0.7
Property taxes	3.3	3.4	3.5	4.1	4.3	4.4
Land rental	8.2	8.5	8.8	10.6	11.0	11.4
Overhead	15.5	16.1	16.6	21.7	22.5	23.3
Cleanup after final harvest	1.9	1.8	1.7	1.9	1.8	1.7
Shearing	16.1	16.7	17.3	16.1	16.6	17.0
Staking	1.8	1.7	1.6	1.8	1.7	1.6
Basal pruning	3.0	2.8	2.6	3.0	2.8	2.6
Tinting	4.4	4.1	3.8	4.6	4.3	4.0
Cutting, cleaning, baling, hauling and loading	19.2	17.7	16.5	6.6	6.1	5.7

Table 9b. Percentage of the total production cost of farming activities for Douglas fir (wholesale operations).

	10 years	11 years	12 years	13 years
Site preparation	1.3	1.2	1.2	1.1
Stock 2-0	6.5	6.1	5.8	5.5
Planting	1.5	1.4	1.3	1.2
Replanting (with stock)	0.7	0.7	0.6	0.6
Chemical weed control	3.2	3.4	3.6	3.8
Mowing	4.7	4.8	5.0	5.1
Insect control	2.4	2.6	2.7	2.9
Disease control	1.4	1.7	1.9	2.1
Fertilizing	5.7	5.9	6.0	6.2
Property taxes	2.3	2.4	2.5	2.6
Land rental	7.6	7.9	8.1	8.3
Overhead	20.0	20.7	21.2	21.7
Cleanup after final harvest	1.5	1.5	1.4	1.3
Shearing	15.2	15.2	15.7	16.1
Basal pruning	1.8	1.7	1.6	1.5
Cutting, cleaning, baling, hauling and loading	24.1	22.7	21.4	20.2

Table 9c. Percentage of the total production cost of farming activities for Fraser fir.

	Wholesale			Choose-and-cut		
	8 years	9 years	10 years	8 years	9 years	10 years
Site preparation	1.6	1.5	1.4	0.8	0.7	0.7
Stock 2-0	7.8	7.2	7.0	9.6	8.9	8.7
Planting	2.0	1.8	1.8	2.1	2.0	1.9
Replanting (with stock)	1.1	1.0	1.0	0.7	0.6	0.6
Chemical weed control	2.1	2.3	2.6	2.8	3.1	3.6
Mowing	4.2	4.3	4.7	6.0	6.2	6.8
Insect control	2.3	2.5	2.8	3.7	4.0	4.5
Disease control	1.2	1.3	1.5	1.2	1.3	1.5
Fertilizing	3.0	3.3	3.8	3.0	3.3	3.8
Property taxes	2.1	2.2	2.4	3.6	3.7	4.0
Land rental	6.5	6.7	7.3	6.5	6.7	7.3
Overhead	20.0	20.7	22.5	24.5	25.4	27.7
Cleanup after final harvest	1.3	1.2	1.2	1.1	1.0	1.0
Shearing	11.4	12.2	12.5	18.4	19.5	21.5
Staking						
Basal pruning	2.2	2.0	2.0	2.2	2.0	2.0
Irrigation	9.6	9.9	9.7	10.0	10.3	10.1
Cutting, cleaning, baling, hauling and loading	21.7	19.9	15.6	6.1	5.6	4.4

Economic Analysis

Because of the long time between planting and harvesting, Christmas tree farming is different from producing most other agricultural crops. Throughout the rotation, factors such as inflation and interest rates vary and affect the profitability of the operation. For example, inflation may result in future returns that appear large in today's dollars but have low future purchasing power. Also, because interest rates are closely related to inflation, interest cost incurred or interest income foregone will vary with inflation rates. This is an important concern when considering investments that do not generate returns for many years.

Christmas tree growers do not receive any income until harvesting operations begin at the end of the rotation. Consequently, simply comparing total revenues to total costs does not provide a proper evaluation of the investment because of the time value of money (Jones et al., 1999). To determine the profitability of Christmas tree production, returns must be discounted because a dollar to be received tomorrow is not worth the same as a dollar received today. Several economic measures can be used in such cases, including the net present value

(NPV), the annual equivalent value (AEV) and the internal rate of return (IRR). The IRR can be defined as the rate at which discounted revenues equal discounted costs. An investment has good potential if the IRR exceeds rates from alternative investments with similar risk, timing and capital outlay. The IRR is based on the cash flow recorded for each year of the rotation. The IRRs determined in this study are real rates earned above the estimated inflation rate. In this study, as in the previous report, the inflation rate was assumed to affect returns and costs at the same rate. Finally, because of great variation in tax situations, the IRR was calculated before taxes and is reported as such.

The IRR is also known as return on investment (ROI) and can be used as an analytical tool to compare one's investment to alternative use of one's capital. An example could be the interest rate generated by a certificate of deposit or potential interest gains from capital investments. The IRR can be expressed as current — that is, including inflation — or as real — with inflation removed (Jones et al., 1999). The rates of return as usually published by banks are current. For example, if a bank reports a 7 percent per year earning

on a CD, it usually refers to the current rate. If during that time the inflation rate is 3 percent, the actual rate of return will be 4 percent per year. Actual rates of return of 4 to 6 percent are often viewed as acceptable for safe investments.

The IRR values for Scotch pine, Douglas fir and Fraser fir production are reported in Table 10. As expected, Fraser fir production generates the highest IRR, followed by Douglas fir and Scotch pine. In addition, choose-and-cut operations have higher IRRs than wholesale operations.

Fraser fir production in wholesale operations yields a 28 to 35 percent IRR, slightly lower than the reported value of 33 to 48 percent in 1997. This decrease in IRR since 1997 is probably due to the overall increases in production costs, which, when combined, produce a much larger impact on the production system than changes in prices of tree sales. The IRR for choose-and-cut operations is 36 to 51 percent, generally 7 to 16 percent higher than that of wholesale operations. The generally high IRR of Fraser fir production can be explained by the higher selling price of Fraser fir Christmas trees (\$27 for wholesale and \$47 for choose-and-cut).

Douglas fir in wholesale operations currently yields about a 24 to 25 percent IRR, compared with 8 to 16 percent in 1997. The current yield for Douglas fir production is 8 to 15 percent better than in 1997. The good return of Douglas fir production can be explained by the fact that, with increasing focus and movement toward Fraser fir, this species has remained below the

radar, with cost increases relatively small while tree sale prices increased significantly (\$23.91/tree in 2006 compared with \$11.91/tree in 1997).

Scotch pine production in both wholesale and choose-and-cut operations also came up with strong IRRs, yielding well over 20 percent in both cases. The IRR for Scotch pine in 1997 ranged from 9 to 16 percent, and this was a more than 50 percent drop from 1986 values (25 to 35 percent). Results of the 2006 survey indicate an increase of 5 to 11 percent in the IRR for Scotch pine. As most growers rush toward premium species such as Fraser fir, where most fertile sites and resources are used, Scotch pine is planted in marginal sites where, because of its adaptability to local conditions, it is still able to grow and perform well. In addition, because the total number of Scotch pine trees supplied to the market has declined, the sales prices for Scotch pine have remained steady and even increased since 1997. The combination of strong tree sale prices (\$14.13/tree for wholesale, and \$15 for choose-and-cut, compared with \$9.40 in 1997) and low production costs explain the good IRR obtained for Scotch pine.

As stated earlier, these numbers represent industry averages, and each Christmas tree grower can compare his/her situation — costs, revenues and yields — to better understand the operation's individual performance. A computer spreadsheet was used to calculate the IRR; growers interested in assessing their individual situations should contact the authors for a copy of the spreadsheet.

Table 10. Internal rate of return earned by three species of Christmas trees.

IRR earned (percent before tax)									
Rotation (years)	Scotch pine			Douglas fir			Fraser fir		
	1997	2006		1997	2006		1997	2006	
		WS	CC		WS	CC		WS	CC
8	16	21.6	24.3				48	34.5	50.9
9	12	21.2	23.6				39	30.3	41.9
10	9	21.0	23.0	16	25.7	ND	33	28.3	35.6
11				13	25.6	ND			
12				7	24.6	ND			
13				8	23.8	ND			

WS = Wholesale

CC = Choose-and-cut

ND = No data.

Conclusion

Results presented show that, for the growers who participated in the study, Scotch pine is still the No. 1 Christmas tree species in Michigan in total acreage per grower, followed by Fraser fir and Douglas fir. Colorado blue spruce, Black Hills spruce, balsam fir, white pine and concolor fir are also major Christmas tree species planted in Michigan.

Production costs for Scotch pine, Douglas fir and Fraser fir have increased significantly since 1997, and major cost expenses continue to be shearing, weed control and costs related to harvesting operations — cutting, cleaning, baling and loading. The costs of planting stock and fertilization are also major expenses for Douglas fir and Fraser fir production. In addition, irrigation appears as a major expense for Fraser fir production.

Christmas tree growers are investors who expect their efforts to sustain their livelihood and to generate an

acceptable level of return, at least as good as the safest alternative investment. Results obtained in this study showed that, despite the sharp increase in production costs, the industry is able to garner tree prices high enough to generate a substantial profit. Results also showed that Fraser fir is the most profitable Christmas tree species, with the highest level of return, but it is also profitable to grow Douglas fir and Scotch pine.

In addition, the survey also demonstrated that choose-and-cut operations generate 4 to 15 percent higher returns than wholesale operations for Fraser fir, and 2 to 3 percent higher returns for Scotch pine. The higher rate of return for choose -and-cut operations, due mainly to higher per tree selling prices, explains the rise of this type of operation in the Christmas tree industry.

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