

## **MSU Extension Publication Archive**

Archive copy of publication, do not use for current recommendations. Up-to-date information about many topics can be obtained from your local Extension office.

Cost and Returns in Michigan Christmas Tree Production  
Michigan State University Agricultural Experiment Station and Cooperative Extension  
Service

Research Report

Victor J. Rudolph, Jan J. Hacker, Lee M. James, Melvin R. Koelling, Forestry

Issued June 1982

8 pages

The PDF file was provided courtesy of the Michigan State University Library

**Scroll down to view the publication.**



JUNE 1982

24.41

# RESEARCH REPORT

440

NATURAL RESOURCES

FROM THE MICHIGAN STATE UNIVERSITY  
AGRICULTURAL EXPERIMENT STATION EAST LANSING

## *Cost and Returns in Michigan Christmas Tree Production*





# Costs and Returns in Michigan Christmas Tree Production<sup>1</sup>

By Victor J. Rudolph, Jan J. Hacker, Lee M. James and Melvin R. Koelling<sup>2</sup>

## Introduction

In 1979, the Department of Forestry at Michigan State University began a statewide study of the Michigan Christmas tree industry. In the first phase of the study, questionnaires requesting production and marketing information were mailed to all known and likely Christmas tree growers in Michigan. The results of that survey were published in "Production and Marketing of Christmas Trees in Michigan" (2). The number of growers, size and distribution of their holdings, numbers of trees planted by species, numbers of trees sold each year, and other data on production and marketing procedures are included in that report.

In the second phase of the study, a questionnaire survey requesting information on the costs and returns associated with producing Christmas trees in Michigan was mailed in 1981. Results of two similar earlier surveys were published in 1968 and 1972 (4 and 5).

This report updates the earlier surveys and presents costs, returns and profitability for the Michigan Christmas tree industry based on 1980-81 conditions.

## The Survey

Questionnaires requesting detailed cost and return information for four species — Scotch pine, white spruce, Douglas-fir and blue spruce — were mailed in April 1981, to 67 selected members of the Michigan Christmas Tree Association who had responded fully to the 1979 production and marketing survey. A follow-up mailing was done in June 1981. The association had approximately 100 regular members in 1980 and, although they made up only about one-fifth of the known Christmas tree growers in the state, they accounted for more than four-fifths of the trees sold annually as reported in the 1979 survey.

<sup>1</sup> This study was financed by the Michigan Agricultural Experiment Station, the Cooperative Extension Service of Michigan State University and partly by McIntire-Stennis funds (P.L. 87-788).

<sup>2</sup> Rudolph, James and Koelling are Professors, and Hacker is a Graduate Research Assistant, Department of Forestry.

Completed questionnaires were received from 23 growers.

Production costs covered by the questionnaire included land value; site preparation; planting stock; planting and replanting; land taxes; overhead for management, supervision and sales; mowing and chemical weed control; fertilization; shearing; insect and disease control; and basal pruning. Harvesting and other costs up to the loading of trees on a truck or railroad car included color tinting, cutting, cleaning (shaking), baling, hauling to the point of sale and loading. Wholesale prices were for trees loaded on a truck or railroad car. Additional items in the questionnaire included the number of trees planted per acre, and the number of trees sold per acre in each year of the production period. All costs and prices were for trees 6½ to 8 feet tall.

Costs and returns reported per tree or per 1,000 trees were converted to a per acre basis, taking into account the average number of trees planted initially and sold later. Annual land rental costs were calculated at 4.6% of reported land values. This is the same ratio of rent-to-value as the U.S. Department of Agriculture (6) reported for cropland rented for cash in Michigan.

## Costs and Returns

Basic data from the survey were used to financially evaluate Scotch pine, white spruce, Douglas-fir and blue spruce Christmas tree production (Table 1). Included are production period lengths for each species, average land value per acre, average number of trees planted per acre, average number of trees sold per acre, and average selling price per tree.

Tables 2 and 3 summarize the results of the survey for Scotch pine Christmas trees grown for 7 to 12 years. The year or years of each production period in which the various costs were incurred are indicated in Table 2. Shearing costs are incurred over several consecutive years and generally increase gradually from year to year. To simplify computations, shearing costs have been averaged for every two consecutive years. Growers whose schedule of operations differs from that listed in Table 2 should use their



**Table 1. Basic data for Scotch pine, white spruce, Douglas-fir, and blue spruce Christmas tree plantations.**

Item	Scotch pine	White spruce	Douglas-fir	Blue spruce
Production periods	7 to 12 years	11 to 13 years	13 to 18 years	12 to 16 years
Average land value per acre	\$616	\$508	\$671	\$725
Average number of trees planted per acre	1,157	1,263	1,362	1,229
Average number of trees sold per acre	930	970	1,000	894
Average selling price per 6½- to 8-foot tree	\$7.35	\$7.97	\$11.15	\$9.33

own specific timing of operations to compute their costs and returns.

In Table 2, the average per acre and per tree costs for land rental, site preparation, planting stock, planting, replanting, taxes, overhead costs, mowing, and chemical weed control are based on the reported average of 1,157 Scotch pine trees initially planted per acre. The average per acre and per tree costs for shearing, insect control, disease control, basal pruning, color tinting, cutting, cleaning, baling, and haul-

ing and loading are based on the reported average of 930 trees sold per acre in the harvest years of each production period.

Likewise, the revenues received each year trees are harvested (Table 3) are based on an average of 930 trees sold per acre at an average wholesale price of \$7.35. Growers whose costs, sales prices, or numbers of trees planted or sold differ from the averages on which Table 2 is based should use their own specific data in computing their costs and returns.

The average number of Scotch pine Christmas trees sold and the revenues received per acre in each year of 7- to 12-year production periods are presented in Table 3. Tables 4 and 5 were compiled for white spruce, Tables 6 and 7 for Douglas-fir, and Tables 8 and 9 for blue spruce.

### Profitability Analyses

To determine the profitability of growing Christmas trees, compare the profitability of the four species covered in this study, or to compare production periods for the same or different species, several measures of economic efficiency can be used. The most commonly used measures include net future value, net present worth, and internal rate of return.

Net future value is the difference between all expected revenues carried at compound interest to the

**Table 2. Costs of growing Scotch pine Christmas trees in production periods ranging from 7 to 12 years.**

Cost item	Average cost per year or per treatment		Years in each production period in which the cost item is incurred					
	Per acre	Per tree	7	8	9	10	11	12
Land rental	\$ 28.33	\$0.02	1-7	1-8	1-9	1-10	1-11	1-12
Site preparation	59.83	.05	1	1	1	1	1	1
Planting stock	75.56	.07	1	1	1	1	1	1
Planting	39.44	.03	1	1	1	1	1	1
Replanting	30.78	.03	2	2	2	2	2	2
Land taxes	10.68	.01	1-7	1-8	1-9	1-10	1-11	1-12
Overhead	42.45	.04	1-7	1-8	1-9	1-10	1-11	1-12
Mowing	8.27	.01		1-7	1-9			1, 4-9
Chemical weed control	26.20	.02	1-5	1, 2, 4	1-4, 6	1-8	1-6	1, 3-5, 7
Shearing:								
3rd and 4th years	45.56	.05	3, 4	3, 4	3, 4	3, 4	3, 4	3, 4
5th and 6th years	63.70	.07	5, 6	5, 6	5, 6	5, 6	5, 6	5, 6
7th and 8th years	66.03	.07	7	7, 8	7, 8	7, 8	7, 8	7, 8
9th and 10th years	55.47	.06			9	9, 10	9, 10	9, 10
11th and 12th years	85.00	.09					11	11, 12
Basal pruning	59.25	.06	3	3	2	4	4	5
Insect control	11.67	.01	1-7	4-8	1, 3-9	3-10	2-11	5-9
Disease control	8.09	.01		4-8	6-9	7, 8	6, 7	8, 9
Color tinting	277.50	.30	6, 7	6-8	6-9	5-10	7-11	8-12
Cutting	111.25	.12	6, 7	6-8	6-9	5-10	7-11	8-12
Cleaning	85.00	.09	6, 7	6-8	6-9	5-10	7-11	8-12
Baling	230.62	.25	6, 7	6-8	6-9	5-10	7-11	8-12
Hauling and loading	247.59	.27	6, 7	6-8	6-9	5-10	7-11	8-12



Table 3. Average numbers of Scotch pine Christmas trees sold by years in 7- to 12-year production periods, and revenues received.

Year of sale	Average numbers of trees sold per acre for each production period and revenues received at \$7.35 per tree					
	7	8	9	10	11	12
5				15		
				\$ 110.25		
6	110	120	31	15		
	\$ 808.50	\$ 882.00	\$ 227.85	\$ 110.25		
7	820	670	173	30	20	
	\$6,027.00	\$4,924.50	\$1,271.55	\$ 220.50	\$ 147.00	
8		140	410	443	320	279
		\$1,029.00	\$3,013.50	\$3,256.05	\$2,352.00	\$2,050.65
9			316	250	200	53
			\$2,322.60	\$1,837.50	\$1,470.00	\$ 389.55
10				177	296	420
				\$1,300.95	\$2,175.60	\$3,087.00
11					92	26
					\$ 676.20	\$ 191.10
12						152
						\$1,117.20
Totals	930	930	930	930	930	930

Table 4. Costs of growing white spruce Christmas trees in production periods ranging from 11 to 13 years.

Cost item	Average cost per year or per treatment		Years in each production period in which the cost item is incurred		
	Per acre	Per tree	11	12	13
Land rental	\$23.38	\$0.02	1-11	1-12	1-13
Site preparation	21.00	.02	1	1	1
Planting stock	76.43	.06	1	1	1
Planting	37.30	.03	1	1	1
Replanting	74.17	.06	2	2	2
Land taxes	8.42	.01	1-11	1-12	1-13
Overhead	37.80	.03	1-11	1-12	1-13
Chemical weed control	25.20	.02	1-7	1-4, 6	1-6
Fertilization	36.21	.03	4-10	3-6	1-8, 10
Shearing:					
3rd and 4th years	26.43	.03	3	3	4
5th and 6th years	52.80	.05	5, 6	5, 6	5, 6
7th and 8th years	58.00	.06	7, 8	7, 8	7, 8
9th and 10th years	72.00	.07	9, 10	9, 10	9, 10
11th and 12th years	108.00	.11		11, 12	11, 12
13th year	168.00	.17			13
Basal pruning	50.00	.05		7	
Insect control	11.63	.01	1	4, 6-10	4-13
Color tinting	466.67	.48	8-11	7-12	8-13
Cutting	114.00	.12	8-11	7-12	8-13
Baling	255.00	.26	8-11	7-12	8-13
Hauling and loading	337.50	.35	8-11	7-12	8-13

end of the investment (production) period and all expected costs carried at compound interest to the end of the investment (production) period. Net present worth is the reverse calculation; all revenues and costs are discounted to the beginning of the investment period, and the sum of the discounted costs is subtracted from the sum of the discounted revenues.

In either case, the expected profitability depends a great deal on the interest rate used in the compounding and discounting procedures. If net future value or net present worth are positive, then the investment can be expected to earn more than the rate of interest used in the calculations. If net future value or net present worth turn out to be negative, then the investment cannot be expected to earn the rate of interest used in the computations.

Borrowed funds must obviously return at least the cost of borrowing. The investor should determine the

Table 5. Average numbers of white spruce Christmas trees sold by years in 7- to 13-year production periods and revenues received.

Year of sale	Average numbers of trees sold per acre for each production period and revenues received at \$7.97 per tree		
	11	12	13
7		32	
		\$ 255.04	
8	108	125	161
	\$ 860.76	\$ 996.25	\$1,283.17
9	216	204	161
	\$1,721.52	\$1,625.88	\$1,283.17
10	323	225	162
	\$2,574.31	\$1,793.25	\$1,291.14
11	323	56	162
	\$2,574.31	\$ 446.32	\$1,291.14
12		328	162
		\$2,614.16	\$1,291.14
13			162
			\$1,291.14
Totals	970	970	970



Table 6. Costs of growing Douglas-fir Christmas trees in production periods ranging from 13 to 18 years.

Cost item	Average cost per year or per treatment		Years in each production period in which the cost item is incurred					
	Per acre	Per tree	13	14	15	16	17	18
Land rental	\$ 30.89	\$0.02	1-13	1-14	1-15	1-16	1-17	1-18
Site preparation	77.00	.06	1	1	1	1	1	1
Planting stock	142.19	.10	1	1	1	1	1	1
Planting	48.97	.04	1	1	1	1	1	1
Replanting	42.20	.03	2	2	2	2	2	2
Land taxes	10.50	.01	1-13	1-14	1-15	1-16	1-17	1-18
Overhead	59.00	.04	1-13	1-14	1-15	1-16	1-17	1-18
Chemical weed control	22.04	.02	1, 3, 5, 7, 10	1, 3, 6, 10	1	1, 8, 12	1, 8, 12	1, 3, 5, 8
Fertilization	42.25	.03	6, 8, 10, 12, 14	6, 8, 10, 12, 14		7-11	7-11	3, 5, 7, 10, 13
Shearing:								
3rd and 4th years	19.67	.02						4
5th and 6th years	35.04	.04	6	6	5	5, 6	5, 6	
7th and 8th years	50.27	.05	7, 8	7, 8	7, 8	7, 8	7, 8	7
9th and 10th years	60.47	.06	9, 10	9, 10	9, 10	9, 10	9, 10	10
11th and 12th years	82.28	.08	11, 12	11, 12	11, 12	11, 12	11, 12	
13th and 14th years	108.57	.11	13	13, 14	13, 14	13, 14	13, 14	13
15th and 16th years	80.00	.08					15, 16	
Basal pruning	41.00	.04	6				3	
Insect control	12.12	.01	6, 9, 12, 13	6, 9, 12, 13	6, 10, 13	6, 10, 13	5, 8, 11	5, 9, 12, 16
Disease control	60.00	.06						5, 8, 11, 14
Color tinting	350.00	.35	8-13	8-14	8-15	8-16		9-18
Cutting	112.00	.11	8-13	8-14	8-15	8-16	7-17	9-18
Baling	312.00	.31	8-13	8-14	8-15	8-16	7-17	9-18
Hauling and loading	308.33	.31	8-13	8-14	8-15	8-16	7-17	9-18

Table 7. Average numbers of Douglas-fir Christmas trees sold by years in 7- to 18-year production periods, and revenues received.

Year of sale	Average numbers of trees sold per acre for each production period and revenues received at \$11.15 per tree					
	13	14	15	16	17	18
7					50	
					\$ 557.50	
8	30	50	95	50	50	
	\$ 334.50	\$ 557.50	\$1,059.25	\$ 557.50	\$ 557.50	
9	203	125	95	100	50	100
	\$2,263.45	\$1,393.75	\$1,059.25	\$1,115.00	\$ 557.50	\$1,115.00
10	259	160	143	195	200	100
	\$2,887.85	\$1,784.00	\$1,594.45	\$2,174.25	\$2,230.00	\$1,115.00
11	333	250	143	200	200	100
	\$3,712.95	\$2,787.50	\$1,594.45	\$2,230.00	\$2,230.00	\$1,115.00
12	111	200	143	150	100	100
	\$1,237.65	\$2,230.00	\$1,594.45	\$1,672.50	\$1,115.00	\$1,115.00
13	64	160	143	100	100	100
	\$ 713.60	\$1,784.00	\$1,594.45	\$1,115.00	\$1,115.00	\$1,115.00
14		55	143	80	100	100
		\$ 613.25	\$1,594.45	\$ 892.00	\$1,115.00	\$1,115.00
15			95	75	50	100
			\$1,059.25	\$ 836.25	\$ 557.50	\$1,115.00
16				50	50	100
				\$ 557.50	\$ 557.50	\$1,115.00
17					50	100
					\$ 557.50	\$1,115.00
18						100
						\$1,115.00
Totals	1,000	1,000	1,000	1,000	1,000	1,000



Table 8. Costs of growing blue spruce Christmas trees in production periods ranging from 12 to 16 years.

Cost item	Average cost per year or per treatment		Years in each production period in which the cost item is incurred				
	Per acre	Per tree	12	13	14	15	16
Land rental	\$ 33.35	\$0.03	1-12	1-13	1-14	1-15	1-16
Site preparation	121.12	.10	1	1	1	1	1
Planting stock	267.50	.22	1	1	1	1	1
Planting	66.18	.05	1	1	1	1	1
Replanting	51.46	.04	2	2	2	2	2
Land taxes	13.82	.01	1-12	1-13	1-14	1-15	1-16
Overhead	46.91	.04	1-12	1-13	1-14	1-15	1-16
Mowing	7.79	.01					1-16
Chemical weed control	27.97	.02	1, 3, 5, 7, 9, 11	11	1-6	1-10, 12	1, 2, 4, 6, 8, 11
Fertilization	43.91	.04	4, 7, 10	10-12	1-10	3-11, 13	2, 4, 6, 8, 10, 12
Shearing:							
3rd and 4th years	14.80	.02			4	4	3
5th and 6th years	37.29	.04	6	5	5, 6	5, 6	6
7th and 8th years	52.69	.06	7, 8	7, 8	7, 8	7, 8	7, 8
9th and 10th years	65.60	.07	9, 10	9, 10	9, 10	9, 10	9, 10
11th and 12th years	89.97	.10	11, 12	11, 12	11, 12	11, 12	11, 12
13th and 14th years	84.58	.09		13		13, 14	13, 14
15th and 16th years	67.75	.08				15	15, 16
Basal pruning	50.00	.06	7				
Insect control	12.14	.01	6, 9		5-12	4-15	1, 3-16
Color tinting	270.00	.30		8-13			11-16
Cutting	160.00	.18	7-12	8-13	10-14	10-15	11-16
Baling	391.66	.44	7-12	8-13	10-14	10-15	11-16
Hauling and loading	365.62	.41	7-12	8-13	10-14	10-15	11-16

Table 9. Average numbers of blue spruce Christmas trees sold by years in 7- to 16-year production periods and revenues received.

Year of sale	Average numbers of trees sold per acre for each production period and revenues received at \$9.33 per tree				
	12	13	14	15	16
7	26 \$ 242.58				
8	105 \$ 979.65	16 \$ 149.28			
9	158 \$1,474.14	55 \$ 513.15			
10	421 \$3,927.93	330 \$3,078.90	178 \$1,660.74	197 \$1,838.01	
11	158 \$1,474.14	219 \$2,043.27	179 \$1,670.07	150 \$1,399.50	50 \$ 466.50
12	26 \$ 242.58	219 \$2,043.27	179 \$1,670.07	150 \$1,399.50	100 \$ 933.00
13		55 \$ 513.15	179 \$1,670.07	197 \$1,838.01	150 \$1,399.50
14			179 \$1,670.07	50 \$ 466.50	247 \$2,304.51
15				150 \$1,399.50	247 \$2,304.51
16					100 \$ 933.00
Totals	894	894	894	894	894



profitability of a proposed investment by using a rate of interest for compounding and/or discounting which is realistic. This rate should reflect what could be expected from the best alternative available investment opportunity for similar periods and with similar risks.

Christmas tree growers, and most other investors, face uncertainties in determining the appropriate rate of interest to use in calculating net future value or net present worth of Christmas tree operations. Not only are interest rates uncertain today, but the appropriate interest rate will vary from one grower to the next. Thus, we believe it is more useful to present the results of our profitability analysis in terms of the *internal rate of return* (IRR), which is the rate of interest actually earned by an investment.

The IRR is determined by computing the net present worth using different interest rates, until a rate is found which will make the net present worth equal to zero, that is, the sum of the discounted revenues equals the sum of the discounted costs. These computations can be laborious, but can be simplified by the use of an appropriate computer program. We used a program developed by Forster (1). The calculated internal rates of return for the four species of Christmas trees grown in production periods of varying length are displayed in Table 10.

Table 10. Internal rate of return earned by four species of Christmas trees grown for production periods of varying length.

Production period, years	Species of Christmas tree and internal rate of return earned, percent			
	Scotch pine	White spruce	Douglas-fir	Blue spruce
7	43			
8	42			
9	31			
10	30			
11	26	27		
12	24	26		23
13		23	29	20
14			28	14
15			27	13
16			26	10
17			26	
18			18	

Internal rates of return actually earned on the investments in growing Christmas trees are highest for Scotch pine, primarily because its production periods are the shortest for the four species covered in the study. The IRR ranges from 43% for a 7-year production period, to 24% for a 12-year production period. The IRR actually earned decreases as the production period increases because costs keep ac-

cumulating during each year of the production period while total revenues do not change.

White spruce shows a narrow range of IRRs because only three production periods were reported by growers of this species.

For Douglas-fir, the IRR ranges from 29% for a 13-year production period to 18% for an 18-year production period.

Lowest IRRs were calculated for blue spruce. It ranged from 23% for a 12-year production period to 10% for a 16-year production period.

For production periods of about the same length, the IRRs for the four species do not differ significantly. The decrease in the internal rates earned for each species as the production periods increase is somewhat uneven because growers with different production periods do not apply the same cultural practices and thus incur different costs in the same years.

It is evident from the data in Table 10 that the shortest production periods are the most profitable. Thus, cultural practices which shorten production periods and still produce high quality trees that are large enough for sale will increase profitability. Certainly for white spruce, Douglas-fir and blue spruce, opportunities exist for reducing production periods considerably and thereby increasing their profitability.

A major way for growers to reduce their production periods is to plant seedlings grown from seed sources that have demonstrated rapid growth rates. Growers should consult the recommendations made by Koelling and Wright (3) in their publication "Recommended Species for Christmas Tree Planting." For white spruce, they point out that Ontario, Canada seed sources grow more rapidly than native Michigan seed sources.

For Douglas-fir, they state that seed sources from Arizona and New Mexico grow three times as fast as those from the West Coast. Seed sources from northern Idaho and adjacent British Columbia grow almost as fast and are less susceptible to frost. With Douglas-fir planted from these seed sources, production periods of seven to nine years are possible, in contrast to 13- to 18-year periods reported in this study. For blue spruce, early research results indicate that growth rates and foliage color can be improved through proper seed source selection.

Some of the more progressive nurseries in Michigan are producing planting stock of known and preferred seed origins. Growers should check for the availability of such planting stock before placing their orders with a nursery.

To some prospective or current Christmas tree growers, rates of return as high as 43% on an investment in a Christmas tree plantation may appear high, and thus very attractive. It should be noted,



however, that the rates of return shown in this report are not guaranteed to anyone who plants Christmas trees.

The calculated rates of return are based on some of the largest and most efficient Christmas tree operations in Michigan. Cultural practices on these operations are highly developed, aimed at producing high-quality trees and minimizing tree losses. It should also be noted that, initially at least, substantial investments are required over a period of 7 to 13 years before any income will be realized from Christmas tree sales.

### Summary

A questionnaire survey of the costs and returns in growing Scotch pine, white spruce, Douglas-fir and blue spruce Christmas trees in Michigan was conducted among selected growers in 1981 to update previous similar surveys made in 1968 and 1972. Surveyed growers were specifically selected to include some of the largest and most efficient Christmas tree operations in the state.

Reported production costs included land rental; site preparation; planting stock; planting and replanting; land taxes; overhead for management, supervision and sales; mowing and chemical weed control; fertilization; shearing; insect and disease control; and basal pruning. Harvesting and other costs included color tinting, cutting, cleaning (shaking), baling, hauling, and loading. Revenues were based on the average number of trees cut per acre and the average wholesale prices for trees loaded on a truck or railroad car.

The internal rate of return (IRR), or the rate of interest actually earned on investments in Christmas tree growing, was used as the measure of profitability for evaluating production periods. These periods ranged from 7 to 12 years for Scotch pine, 11 to 13 years for white spruce, 13 to 18 years for Douglas-fir, and 12 to 16 years for blue spruce.

Internal rates of return were highest for the shortest production periods. Scotch pine showed the highest IRR's, ranging from 43% to 24% on 7- to 12-year

production periods. For white spruce, the range was from 27% to 23% for 11- to 13-year production periods. Douglas-fir showed IRR's of 29% to 18% for production periods of 13 to 18 years. Rates of return for blue spruce ranged from 23% down to 10% for 12- to 16-year production periods.

The internal rates of return reported in this study may appear high to prospective and current Christmas tree growers, and thus highly attractive for investment. However, there is no assurance that these earning rates will be realized by a grower when trees are harvested and sold at the end of investment periods of seven years or longer.

Practices which shorten production periods can considerably increase the profitability of growing Christmas trees. There appear to be opportunities to shorten production periods for white spruce, Douglas-fir and blue spruce by planting trees from seed origins that have demonstrated rapid growth. Such seed origins have been identified in earlier research, and should be used to increase the profitability of Michigan's Christmas tree industry.

### Literature Cited

1. Forster, R. B. (1968). A computer technique for the evaluation of investment alternatives. Information Report E-X-1. Forest Economics Research Institute, Ottawa, Ontario, Canada. 20 pp.
2. James, L. M., V. J. Rudolph and M. R. Koelling (1980). Production and marketing of Christmas trees in Michigan. Mich. Agric. Exp. Sta. Research Report 412. 8 pp.
3. Koelling, M. R. and J. W. Wright (1977). Recommended species for Christmas tree planting. Mich. State Univ. Coop. Ext. Service Bull. E-1155. 4 pp.
4. Rudolph, V. J. (1968). Costs and returns in Christmas tree plantations. Mich. Agric. Exp. Sta. Research Report 75. 4 pp.
5. Rudolph, V. J. (1972). Costs and returns in Christmas tree management. Mich. Agric. Exp. Sta. Research Report 155. 24 pp.
6. U.S. Department of Agriculture (1980). Farm Real Estate Market Developments. CD 85. pp. 43-44.