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A Choose-and-Cut Pine and Fir Christmas Tree Case Study

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Introduction

Choose-and-cut Christmas tree farms are often operated on a part-time basis as a family activity. Because various family members may be involved, it is difficult to record and place a value on the time and costs required to establish, maintain, and finally market the trees over the life cycle of the plantation. Recording time and expenses becomes even more complex once additional plantings are established each spring and previous plantings become partially harvested.

In 1996 the authors purchased a small tract of land which adjoined an already established plantation. Because this was a separate and distant tract, we decided to keep accurate records in an attempt to make long-term decisions based upon facts. As a result we can report the following case study of the time requirements to establish, maintain, and harvest a 1.6-acre pine and fir plantation over an eight-year time period. Projections for year nine are provided. (Cassens (2002) published an earlier report on the same plantation.) Details on cultural activities, performance of different varieties of Scotch pine and different fir species, sales, and an estimate of production costs are included.

Cassens Trees was established in 1978 near Lafayette, Indiana. In 1986 the operation began to expand; and during the last ten years, about 15-20 acres have been maintained in Christmas tree plantations. Most trees are sold on a choose-and-cut basis, but some wholesale trees are also sold. All planting, herbicide application, mowing, shearing, and tree coloring are done by the owner, Daniel Cassens. Harvesting and sales are conducted with the help of other family members. The times reported here are for activities done on the 1.68 acre site only. Time spent on locating vendors, ordering supplies, advertising, record keeping, Web site development and maintenance, filing tax returns, attending professional meetings, and other "learning" activities are not included. The hours reported here should be considered minimal. They likely would be increased for inexperienced operators who are still learning basic procedures.

Seedlings and Mortality

Table 1 shows the species and variety of seedlings planted in the spring of 1996 as well as the number, height, age, and mortality. The seedlings were all stock items, except the Berkeley variety of Scotch pine that is a hybrid. Spacing was 6 x 9 feet.

First year mortality for the seedlings was variable; for some varieties of Scotch pine, mortality was excessive – over 10 percent. The high mortality for just two of the pine varieties, as compared to the others, indicates the problem likely originated at the nursery or during shipping. The mortality for the Douglas and Canaan fir seedlings was high, in the 17 to 19 percent range, but tolerable based on the potential value of these species.

Mortality for the Fraser fir seedlings ranged even higher, from 29 to 39 percent. No irrigation was used. Other plantations of Fraser fir have had better survival rates than this, and some have been worse. Although mortality is high,

Table 1. Species and variety, number, height, age, and percent mortality for seedlings planted in year 1 or 1996.

	Number	Height (inches)	Age (years)	Mortality [1] (percent)
Scotch Pine				
Breckland	135	6-12	2-0	49
Knieviey	200	6-12	2-0	24
Improved Pike Lake	150	12-15	2-0	10
Berkeley	100	9-14	1-2	1
Douglas-fir				
Lincoln	45	8-14	2-0	18
Deep Mountain	47	6-12	2-1	17
Canaan Fir	78	8-16	Plug +1+1	19
Fraser Fir				
Source 1	45	12-15	3-2	29
Source 2	41	9-15	3-2	39

[1] at end of first year

the number is again tolerable given the potential value compared to Scotch pine. We replaced dead seedlings the following spring.

Time Requirements

Cultural Activities

Of all the cultural activities (Table 2), mowing consumed the most hours (59 hours). We used a Ford 1600 tractor (23-horsepower) and a five foot rotary mower.

Shearing was the second most time consuming activity (57 hours) and was performed by hand with serrated knives. This is the most important cultural activity particularly for Scotch pine, as it is the shaping of the tree that makes the tree marketable. Initially, both the Douglas fir and true fir species were sheared with a knife in a fashion similar to Scotch pine. Toward the end of the cycle information on proper shearing was obtained and these procedures were used to the extent still possible (Sundback 2002a and b).

Scotch pine required the most time to culture, due to shearing. Our records indicate that shearing Scotch pine becomes a more time consuming activity as the plantation matures; whereas, fir trees take much less care.

Planting was the third most time consuming activity (32 hours). The initial planting was done by hand and required 20.5 hours, but subsequent replanting required an additional 11.5 hours. Herbicide application was the fourth most time consuming activity (31.5 hours). Herbicides were applied at least once a year to the fir trees and for the first 5 years to the Scotch pine. These applications were done with the same Ford 1600 and a PTO driven 60 gallon sprayer. Some spot application for poison ivy was also performed. Toward the end of the rotation, some insect problems began to develop. Scale was noted on some of the Scotch pine in 2001. Application of an insecticide was made in the spring of 2002 and the problem was controlled. At about the same time a spider mite infestation developed on the Canaan fir. It likely hurt the sales of these trees in 2002, due to the mottled brown color. The infestation was treated in the late spring of 2003, and some improvement in color was noted.

Table 2. Time in hours required for selected activities by year for a 1.68 acre choose-and-cut planting.

	Year									
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004[1]**	**Total**
Purchase Property	9.5									9.5
Site Preparation	13.0									13.0
Planting	20.5	9	1.5	1						32
Herbicide Application	3	6	7	2	4	3.5	2	2	2	31.5
Mowing	7.5	7	7	7	9.5	7.5	7.5	4	2	59
Deer Control	4	7		3.5	1.5					16
Fert. of Firs			2		1.5	1.5	1.5	4	4	14.5
Basal Pruning and Staking			8							8
Shearing			6	8	10	17	8	4	4	57
Applying Colorant					2	8	4	1	1	16
Pricing and Tagging					1	8	4	2	2	17
Pine Shoot Beetle						3	1			4
Insect Control							4	4		8
Wholesale Sales						1				1
Harvest Wholesale Trees						9	13	2		24
Choose and Cut Sales						80	20	10	10	120
Subtotal								405.5		
Total	57.5	29.0	31.5	21.5	29.5	138.5	65.0	33.0	25.0	430.5

[1] Anticipated

The remaining cultural activities of deer control, fertilization of the fir trees, basal pruning, and staking consumed 38.5 man-hours. Another 22.5 man-hours were invested in the purchase of the property and initial site preparation.

Tree Size and Marketability

Nearly all of the Scotch pine in this planting were marketable in seven years. Estimates in 2001 indicated that three percent of the Berkeley variety, five percent of the Improved Pike Lake, nine percent of the Breckland, and 18 percent of the Knievey were not marketable. The Knievey subsequently developed into saleable trees. By the end of 2003, 574 or 98 percent of the 585 trees planted were either selected by choose-and-cut customers or sold wholesale. Six to 13 percent of the Douglas-fir and Fraser fir appeared not marketable in 2001. Only one percent of the Canaan firs appeared to be culls. By the end of 2003, or after eight years, 80 of the 256, or 31 percent, of the fir trees had been sold. It now appears that 75 percent of the remaining trees will eventually be marketed.

A three-year time period to completely cut any particular pine planting is assumed. Most of the trees were removed as choose-and-cut trees during the first two years of harvest. These sales will be continued during the third year. The remaining salable trees, many of which will need to be shortened due to crooked trunks, are harvested one row at a time and sold as fresh cut trees at our farm or as wholesale trees. The fir trees have taken longer to develop.

Figure 1 shows the percent of all Scotch pine trees by variety and height class after six years. Comparison of the size distribution (Figure 1 and 2) and the mortality information (Table 1) demonstrates the importance of choosing the correct variety of Scotch pine. The Breckland variety would appear much better had it not experienced a 42 percent mortality rate. These remaining trees were replaced with other Scotch pine varieties and were included in Figure 1.

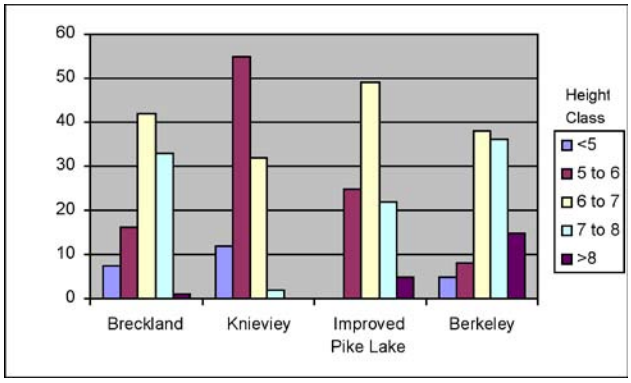

Figure 1. Percent of Scotch pine trees by variety and height class in feet after six years of growth.

Figure 2. Smaller Knieviey (first four trees in center row) as compared to Improved Pike Lake variety at the end of the row.

Figure 3 shows the percent of trees by height class for Douglas-fir, Fraser and Canaan fir after six years of growth and before any harvesting occurred. With the possible exception of about one-half of the Canaan Fir, the trees were still in a submerchantable size class. Important difference in height growth are apparent, however.

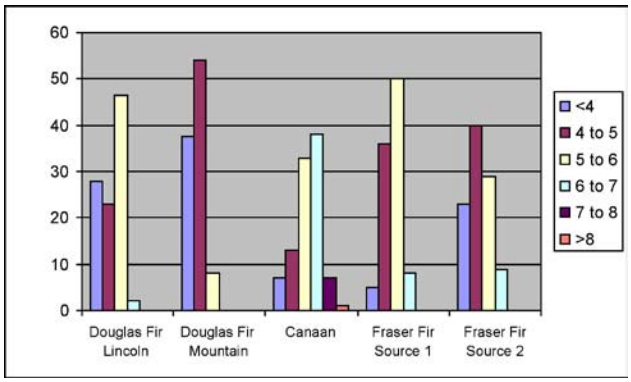

Figure 3. Percent of Douglas fir and true fir trees by height class in feet after six years of growth and before any harvesting occurred.

Figure 4. Deep Mountain Douglas-fir (first row on right) and Douglas-fir Lincoln variety (second row from right) and Canaan fir (third row from right) after six years of growth. Fraser fir are in the background.

Figure 5. Deep Mountain Douglas-fir (first row on right) and Douglas-fir Lincoln variety (second row from right) and Canaan fir (third row from right) after seven years of growth. Fraser fir are in the background.

Figure 6. Deep Mountain Douglas-fir (first row on right) and Douglas-fir Lincoln variety (second row from right) and Canaan fir (third row from right) after eight years of growth. Fraser fir are in the background.

The Lincoln variety of Douglas-fir has 48.5 percent of the trees in the greater than five-foot height class as compared to only eight percent for the Deep Mountain variety (Figure 4).

Finally, the Canaan fir produced more height growth than either source of Fraser fir or Douglas-fir (Figure 4, 5, and 6). Canaan fir and Douglas-fir tended to be a better quality than the Fraser fir. Seventy-nine percent of the Canaan fir trees were taller than five feet after six years. Figure 7 and 8 shows Canaan fir after seven and eight years of growth. Some of the better and taller trees had been removed by choose-and-cut customers.

Figure 7. Canaan fir after seven years of growth. For the tree on the left, note the openness at the bottom which is probably due to inadequate fertilization.

Figure 8. Canaan fir after eight years of growth.

When this plantation was established in 1996, we had very little technical information on the production of Douglas-fir and true fir species. Another adjacent plantation of Fraser-fir established earlier had done very well without the application of the many cultural practices now recommended for this species. One objective for the 1996 plantation was to compare the performance of two varieties of Douglas-fir, Canaan fir, and two different sources of Fraser-fir. Some very important differences are reported, and the plantation was somewhat successful. In general, the quality of the Douglas-fir is good. The Canaan fir out grew the Fraser fir and the quality of many was acceptable. The Fraser-fir grew at a slower rate and had lower quality. The trees were planted on a well-drained soil, which is particularly important for Fraser-fir.

Soil Factors

The important factors which were not known at the time the plantation was established included soil pH and fertilization levels. Soil tests for the fir planting were done in 1998 and again in 2003. Some fertilization of the fir planting had been done. A soil test of the area planted to Scotch pine was also done in 2003. This area had not been fertilized since the pine plantation was established. Based on this limited information, the P, K, Mg, and Ca were all low for the fir species recommendations given by Spectrum Analytic, Inc. (no date). Thus, the fir trees in this plantation were not adequately fertilized from the date of establishment. Over the years, some N, P, and K were applied to the fir species. The 2003 soil analysis showed the pH to be 5.3, which is appropriate for Fraser fir and a little low for Canaan, a nearly adequate level of P, excessive K, but the site is deficient in Mg and Ca. Although attempts were made to fertilize these trees based on the general recommendation that "fir trees need fertilizer", deficiencies still remained in P and probably N. The author was not aware that Mg and Ca were also deficient and important. Had the proper fertilization program been developed early in the plantation, this could have been a good crop of trees and the rotation cycle probably shortened. With the fir species, it is important that pH, macronutrients, and micronutrients be evaluated and adjusted as recommended by a competent agronomist familiar with the appropriate tree species. Due to varying requirements, species should not be mixed in the same block. The state soil testing laboratories this author was dealing with in the past did not have this expertise.

Costs

Cultural costs through 2003 or for eight years are given in Table 3. The total cost for eight years is $1,499, with the cost of the seedlings being the single largest expense followed by equipment for deer control and herbicides. Only the fir trees were fertilized; and had current recommendations been followed, this number would be substantially larger. Estimated cultural costs to carry the fir trees forward for another year are $87. The estimated cost of herbicide is $25; fertilizer is $50; and taxes are $12.

Equipment costs are provided in Table 4. A 23-horsepower Ford tractor is used with a PTO sprayer for herbicide and colorant application and for mowing with a rotary machine. In addition, a fertilizer spreader is necessary for broadcasting the nutrients needed for proper fir management. The total equipment costs for eight years are estimated at $1,035. Another $90 for herbicide application, mowing, applying colorant and fertilizer will be required to carry the fir trees forward for one more year.

Finally, sales costs of $1,080.50 are itemized in Table 5. Tree colorant is required for the Scotch pine but not for the Fraser fir. Some of the Douglas-fir are colored; it is probably advantageous to color this species. Using 2003 costs, $105 in sales costs are required to carry the fir trees forward for another year. Table 6 provides a summary of costs. Over the course of eight years, $3,614 was expended, or about $452 per year. For the 1.68 acre plantation, the cost per acre would be $2,157. To carry the

Table 3. Estimated cultural costs for materials and taxes in dollars for eight years

Item			Total for Eight Years
Soil Tests			$ 80.00
Seedlings			
Douglas-fir, 2-1, $.70 each @ 92 trees	70.00		
Fraser fir, 3-2, $1.50 each @86 trees	150.00		
Canaan fir, plug +2, $1.16 each @78 trees	116.00		
Scotch pine, 2-0, $34/hundred @585 trees	204.00		
		Total	$540.00
Herbicide $25/year			200.00
Insecticide			125.00
Fertilizer for Fir			100.00
Shearing Knives			
Cost 2 @ $30.00			60.00
Sharpening 2 @ $4.00 each for 6 years			48.00
Electric fence for deer control			250.00
Taxes $12/year			96.00
		Total	$1,499.00

Table 4. Equipment costs in dollars for eight years

Tractor with sprayer for herbicide application: 29.5 hours @ $10/hr	$295.00
Tractor for mowing with rotary mower: 57 hours @ $10/hr	570.00
Tractor with sprayer for applying colorant: 14 hours @ $10/hr	140.00
Tractor with broadcast applicator: 3 hours @$10/hr.	30.00
	$1,035.00

[1] Tractor was on site for 110 hours during sale times to power shaker but not included. Most operators would run an electric shaker.

Table 5. Sales costs in dollars for eight years

Tree Colorant $15/gal @ 50 trees	100 trees in 2000		$ 30.00	
	525 trees in 2001		157.50	
	250 trees in 2002		75.00	
	60 trees in 2003		18.00	
		Total	280.50	
				280.50
Tree Baler				250.00
Netting (netting used in 2001 - $50; netting used in 2002 - $50) netting used in 2003 - $20				120.00
Tree Shaker $1000 new - $100/year for 2 years and $40 for 1 year				240.00
Tree Boring Machine $800 new - $80/year for 2 years and $30 for 1 year				190.00
		Total		$1,080.50

Table 6. Summary of costs ($)	
Cultural	$1,499
Equipment	1,035
Sales	1,080
Total	$3,614

established and remaining fir trees for another year, the estimated cost is $282.

Marketing

Several activities lead up to and are involved in the final sale and harvesting of the trees. In total, these activities consume about one-half of all the time required (Table 2) to establish and maintain the plantation from the first year to harvest.

Typically, in a choose-and-cut operation, colorant is applied to many more of the pine trees than are eventually sold. However, judging from customer response and comments, the time and expense are well justified.

A price tag is placed in each tree that is for sale. This procedure allows a premium to be charged for the trees with exceptional quality, an average price for an average tree, and a discounted price for lower quality trees. The system also tells the customer exactly what the tree will cost before cutting. It improves efficiency and accountability at the time of payment. Because the tree is already priced, there is no need for measurement and discussion. The bottom half of the tag is simply retained for accounting records.

Four hours were spent working with the state entomologist in inspecting for the pine shoot beetle (which was negative) and obtaining a permit to ship the trees from a quarantined county to a non-quarantined county.

Finally, the amount of time required for selling is very dependent on the operation. This location opens on Friday after Thanksgiving and the following three weekends from 9 a.m. to 5 p.m.

Services provided, upon request, include field assistance, free tree shaking to remove dead needles, tree baling ($2 fee), drilling holes for trees for special tree-stands ($2 fee), and assistance in loading when requested.

Depending on volume of sales, one experienced person might manage this small plantation, but two people could be used, particularly at the busier times of the day and under good weather conditions.

With just one person in place for the eight days of sales, 80 hours are required. Nearly all of the trees sold at the Delphi location came from this plantation in 2001. The amount of time charged to this plantation was reduced during subsequent years as more trees came from other nearby plantations. Conducting sales has now become the most time consuming activity for this plantation (Table 2).

Sales

Table 7 summarizes sales information by year, species, and type of sale. Due to a shortage of small trees in adjacent plantations, we chose to begin marketing in year five. Just 20 of the larger trees were sold for $20 each.

In 2001, or after six years of growth, nearly all of the choose-and-cut trees priced at $25 or more were sold. The wholesale prices are approximately one half of the choose-and-cut value. Thus, including the small number of trees sold in 2000, $6,520 in gross income for the Scotch pine was received for 324 trees. Of the remaining trees, many were in the $20 price category and less than six feet tall. At this time, about eight percent of the total Scotch pine in the plantation were estimated to be culls and unsalable.

In 2002, 53 Scotch pine were sold for $1,250 as choose-and-cut trees while 142 were sold wholesale for $1,475. Only 55 Scotch pine remained in 2003, which brought a return of $1,107.

In 2001, 19 of the fir trees were sold for an average price of $47. In 2002, 22 fir trees were sold at an average value of $57.50 and in 2003, 39 more fir trees were sold for $59.62 each.

Table 7. Realized and estimated revenue of Scotch pine and fir by year and sales method.					
1	**Species**	**Type of Sale**	**Number of Trees Sold**	**Average Price** ($)	**Total Revenue** ($)
2000	Scotch pine	Choose-and-Cut	20	20.00	400
2001	Scotch pine	Choose-and-Cut	207	24.40	5,050
	Scotch pine	Wholesale	97	11.03	1,070
	Fir	Choose-and-Cut	19	47.37	900
				TOTAL	7,420
2002	Scotch pine	Choose-and-Cut	53	23.58	1,250
	Scotch pine	Wholesale	142	10.39	1,475
	Fir	Choose-and-Cut	22	57.50	1,265
				TOTAL	3,990
2003	Scotch pine	Choose-and-Cut	28	28.39	795
	Scotch pine	Wholesale	27	11.57	312
	Fir	Choose-and-Cut	39	59.62	2,325
				TOTAL	3,432
				SUBTOTAL	$14,842
2004[1]	Douglas-fir	Choose-and-Cut	79 59[2]	55.00	3,245
	Canaan fir	Choose-and-Cut	42 31[2]	58.00	1,798
	Fraser fir	Choose-and-Cut	62 47[2]	46.00	2,162
				SUBTOTAL	7,205
				GRAND TOTAL	$22,047

[1] Anticipated
[2] 75% of Remaining Trees

Due to a spider mite infestation, the 2002 sales were probably reduced. Given the current local demand for choose-and-cut fir trees, very few are sold for less than $40.

Table 8 provides gross and net revenue value and net revenue generated per hour of labor for this plantation at the end of eight years. Considering all of the trees which have been sold either as choose-and-cut or as wholesale trees at the end of eight years, $11,228 of net revenue has been received. This is $27.68 per hour of labor. If 75 percent or 137 of the remaining 183 fir trees are sold at average choose-and-cut prices in year nine, the net income becomes $18,151 or $42.16 per hour of labor. If all of the trees had been sold as choose-and-cut trees and if the remaining 137 fir trees are sold, the net income would be $21,776 or $50.58 per hour. This is probably the maximum value which could be generated. Conversely, if all of the trees were sold wholesale the revenue received would be about $8,186 or $22.46 per hour.

The gross income at the end of nine years should be about $22,047. The net income after subtracting all out-of-pocket expenses of $3,896 ($3,614 for actual expenses for eight years plus $282 estimated expenses for year nine) and the cost of 430.50 hours of labor at $10 per hour is $13,846 or $8,654 per acre. On a nine year cycle the return would be $962 per acre per year. The cost (value) of the land has not been considered.

Table 8. Gross revenue, net revenue, and net revenue per hour by cutting option.			
Cutting Option	**Gross Value $**	**Net Value $**	**$/Hour**
Choose-and-Cut/ Wholesale Through 2003 [1]	14,842	11,228	$27.68
Choose-and-Cut/ Wholesale Through 2004 [2, 3]	22,047	18,151	42.16
Choose-and-Cut Only, Through 2004 [2]	25,672	21,776	50.58
Wholesale Only, Through 2004 [4]	12,082	8,186	22.46

[1] Based on 405.5 hours
[2] Based on 430.5 hours
[3] Anticipated
[4] Based on 364.5 hours due to reduction in sales hours and pricing and tagging (Table 2)

For all choose-and-cut options the retail price was applied to wholesale trees. For wholesale, prices applied to retail trees. The value of choose-and-cut fir were divided in half.

Adjacent fields rent for $100 to $120 per acre. This small tract in itself is not suitable for traditional row crop production.

Note that closer spacing than our 6 x 9 feet would have increased the number of trees and the net income per acre.

Summary and Discussion

This report discusses time required for the production and sale of trees on a 1.68 acre choose-and-cut Christmas tree plantation. Actual income and costs for an eight year period and estimates for the ninth year are included.

For this plantation, the total time requirement over a nine year period is about 430.5 hours. Shearing accounted for 13 percent, and mowing accounted for 14 percent of the total time. Herbicide application and planting also consumed substantial amounts of time.

However, sales and marketing activities consumed the most time. Simply being on site to sell the trees during the first year required 80 hours or nearly 26 percent of the total time investment for the first six years. This time commitment also comes between the Thanksgiving and Christmas holiday season when families are particularly busy.

The study demonstrated distinct differences in survival, quality, and growth rate by variety in Scotch pine and Douglas-fir. Canaan fir grew faster and was more uniform than the Fraser fir.

The total value of all trees sold from 2000 to 2003 was $14,842. The expected revenue from the remaining fir trees is $7,205. Most of the Scotch pine were sold by the end of the seventh year. By the end of the eighth year 80 fir trees had been sold as choose-and-cut trees. One hundred and eighty three fir trees remain and it is estimated that 75 percent of these are marketable with an expected revenue of $7,205.

The Scotch pine, with the exception of a mortality problem in some varieties, developed

as expected. The quality of the Canaan and Fraser fir trees would probably have improved with proper fertilization. A mite problem also developed and went undetected in the Canaan fir during 2002.

The most important point to remember is the trees have no value until they are sold, and the window for sales opportunities is very short. A marketing plan must be developed and it must work. Just because the trees are available does not mean that they will all sell.

Since there will be no revenues for six years, the owner will need to absorb all costs in the interim. The final outcome can be influenced by any disease and insect problems which develop.

Finally, consumers' preferences can also change in the time frame required. The fir trees in this study were planted just as their popularity was increasing. These few trees (approximately 250) are projected to generate almost as much income as over twice (585 trees) the number of Scotch pine.

We are encouraged by the information and will continue to keep detailed records. It will allow us to make sound decisions such as the appropriate seed sources, species, and so on.

The tree farm has provided income for which our family is solely responsible. It has allowed us to attain a certain feeling of independence and security beyond a regular full-time job. However, the success of such an operation is also closely tied to a "love of trees," enjoyment of the type of work, and dedication.

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Spectrum Analytic Inc. No Date. Fertilizing Christmas Trees, Box 639, Washington Court House, Ohio 43160. www.spectrumanalytic.com

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