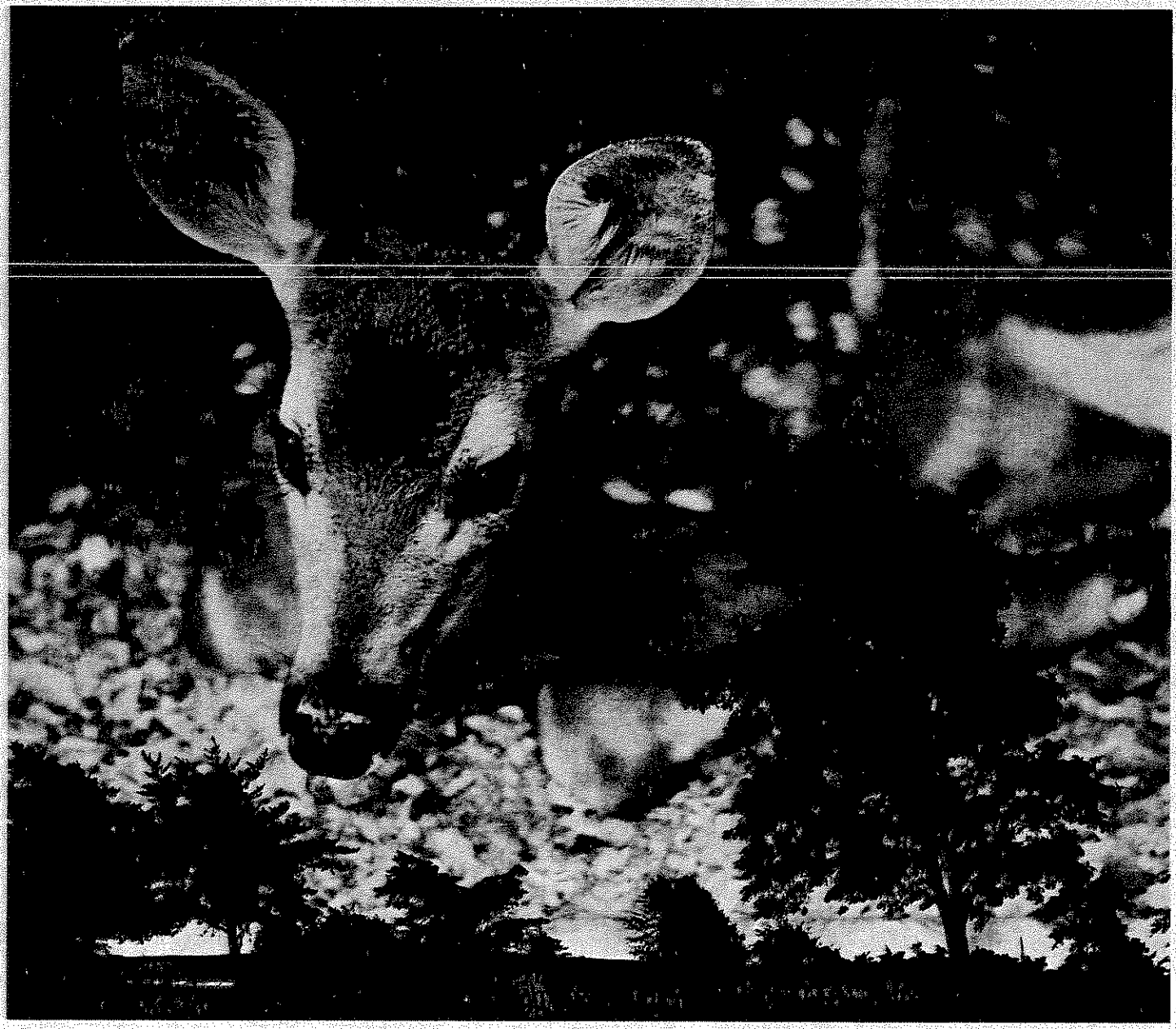
THE ECONOMICS OF PRODUCING & MARKETING CHRISTMAS TREES



FWS-1-75 ● DIVISION OF FORESTRY & WILDLIFE RESOURCES ● VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

The Economics of Producing and Marketing Christmas Trees on Small Plantations in Virginia

by

William A. Leuschner

and

William A. Sellers[1/]

1/ The authors are Assistant Professor of Forest Economics, Virginia Polytechnic Institute and State University, Blacksburg, Va. 24061 and Regeneration and Inventory Forester, Southland Paper Mills, Inc., Lufkin, Tx. 75901. The authors would like to express their appreciation to the Virginia Agricultural Foundation for funding this study and to the Virginia Christmas Tree Growers Association for its help and cooperation in completing it.

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

The purpose of this report is to assist potential and existing Christmas tree growers in making better informed decisions on investments in small Christmas tree plantations. We seek to accomplish this by presenting cost and revenue data and an analysis system to assess probable financial returns. Potential growers should find the entire report of interest although existing growers may want to concentrate their attention on the sections containing cost and revenue data and the discussion of financial analyses.

Data in this report come from two questionnaires administered in the first half of 1973. The Growers Questionnaire was mailed to 236 people identified as possible Christmas tree growers and requested information about cultural and marketing practices. Seventy-eight percent of the questionnaires were returned. Sixty-seven of the 184 persons returning the questionnaire met the study definition of a grower which required that a person had either sold one or more crops of over 100 Christmas trees or had 3 or more acres of plantations that were sheared at least once.

A Financial Questionnaire, gathering detailed cost information, was personally administered to a sub-sample of 37 growers. Only experienced growers with intensively managed plantations were chosen. This was done to obtain the most information at the lowest cost and so the data would reflect the lowest costs or highest prices. The results are therefore applicable to a grower practicing sound, business-like plantation management.

Most Virginia growers operate small plantations. Consequently, the data gathered reflect practices and costs found in small operations. Other practices and equipment which may be lower cost when used on large operations are not included and the interested reader must look elsewhere for this information.

This report does not include recommendations about many important biological aspects of Christmas tree production, such as choice of site, matching species to site, and control of insect and pathological enemies. That information can be obtained from numerous publications and by consulting your local extension agent.

General Financial Prospects

Christmas tree production in Virginia can be a worthwhile enterprise. The financial return from well-managed plantations can be significantly higher than other alternatives usually available to small investors. Further, Christmas trees can be grown on land too poor for farming and is therefore a potentially high return alternative for farmers and small landowners.

The interest rate earned on Virginia Christmas tree investments may range between 13 and 41 percent for well-managed plantations, depending on individual circumstances. This return can be compared to 5 percent which many banks pay or perhaps 8 percent which is available from Certificates of Deposit.

However, growers must manage their plantations in a serious and business-like manner to earn this return. Further, cultural operations require much work during certain times of the year. Persons expecting to plant trees and leave them untended for eight or ten years before harvest will not succeed and can be in danger of losing all or part of their investment.

The Virginia Christmas Tree Industry

This study identified a total of 67 Christmas tree growers in Virginia who currently manage about 900 acres of plantations--an average of 13.4 acres per grower. These growers sold about 30,000 trees in 1972 and we estimated they will sell between 90,000 and 140,000 trees a year by 1976 and thereafter. This can be compared to estimated 1972 sales in Virginia of 1,275,000 trees. Thus, existing Virginia growers produced less than 3 percent of the trees sold and we estimated they will be able to produce only 10 percent in the future. This indicates an ample market for locally grown trees if growers are competitive.

The Virginia grower also has lower transportation costs which will give him a competitive advantage. Although all of Virginia's eight cities exceeding 100,000 persons in population are located in the coastal area, there are twenty-four cities with populations between 10,000 and 50,000 and twenty-eight cities with populations between 5,000 and 10,000 scattered throughout the state. This population distribution gives a potential grower flexibility in choosing a market and a marketing method because he may, at one extreme, sell his trees on the stump in the field, or, at the other extreme, retail them himself in a town.

In summary, small Christmas tree plantations are currently a good potential investment for Virginia's small landowners. The potential return is high, the trees are well suited to poorer quality land, there appears to be ample room in the Virginia market for new growers, and the population distribution allows a wide latitude in choosing markets and marketing practices. This opportunity is balanced by a need for hard work to grow the trees and business-like plantation management.

CULTURAL PRACTICES

Producing Christmas trees takes a long time and those entering the business must have the patience and the financial reserves to wait between 6 and 15 years before they receive their first revenues. The production cycle begins with preparing the plantation site and planting the trees. Most growers perform some type of vegetation control during each year of the plantation's life and shear their trees annually from the second or third year after planting until the year before harvest. In addition, trees may be pruned

several times during the cycle, insect control may be needed if an attack occurs, fertilization may be required periodically, and artificial coloring may be applied just prior to harvest. Finally, the grower must choose a marketing method for his trees and depending on his choice, harvest the trees and transport them to a buyer.

This simplified version of the production cycle shows that a great deal of work is required before a tree is produced. Further, the grower must spend money for labor, supplies, equipment, fuel, and many other items before he receives any income. He stands the risk of being unable to find a buyer if he decides to liquidate his investment before the final harvest. There are additional risks of insect attacks or pathological outbreaks which may destroy or substantially reduce the plantation's value. The decision to invest should therefore be carefully investigated and constitute a real commitment.

Site Preparation

Once the plantation site has been chosen the site must be prepared. This is needed for several reasons. The site may be wooded or brush-covered making it impossible to use mechanized equipment and existing plants such as sod, weeds, or trees, may take soil moisture and nutrients which the Christmas trees need. Even if the trees could survive without site preparation, the competing plants may slow their growth thereby requiring more time before harvest. This longer growth period can decrease the financial return by increasing the time until revenues are received.

There are several methods of site preparation and the choice of method depends both upon the kinds of plants currently on the site and the cost of the individual method. Two-thirds of the interviewed growers site prepared in the last two years. They reported four primary types of preparation--clearing, cultivation, mowing, and application of herbicides.

Clearing

Clearing must be used when the site is covered with brush or trees. Additional preparation, usually some type of cultivation, is often required. Clearing is usually performed with 65 or 140 horsepower crawler tractors using dozer or special brush clearing blades. Existing growers hired both the machine and the operator to perform the task.[2/] Land is usually cleared during the summer before planting.

2/ A list of contractors who perform site preparation is available from the Virginia Division of Forestry, Box 3758, Charlottesville, Va. 22903 or from a local Virginia Division of Forestry office.

Cultivation

Existing Virginia growers used four types of soil cultivation: plowing, disking, dragging, and sub-soiling, and usually combined two or more types such as plowing and disking. Cultivation is generally used after clearing to further prepare the site or as an alternative method of site preparation instead of mowing or applying herbicides. Soil was usually cultivated about one month before planting.

The decision to cultivate depends on the existing cover type and may be affected by the available equipment. For example, a grower may plow and disk rather than mow if he already owns a plow and disk harrow but not a mower.

Mowing

Mowing is the cutting down of all grasses and weeds on the plantation site. It differs from mowing after plantation establishment in that the entire site is mowed, rather than just the corridors between the trees. Large equipment is usually used because there are no planted trees to restrict its movement.

This is the most common type of site preparation and existing growers usually mow either in the fall or immediately before spring planting. They report no advantage to either time, therefore mowing can be scheduled at the growers' convenience.

Herbicides

The final site preparation method reported was the application of herbicides in either small circular spots or in long strips. Circular spots are better adapted to hand-planting and strips to machine planting.

The method of application depends on whether the herbicide is liquid or granular. Granular herbicides were usually applied with small lawn spreaders while liquids were applied with either manually operated backpack sprayers or 30 to 40 horsepower tractors with 50 to 100 gallon pressure sprayers.

Time of application depends upon the chemical used and the vegetation being controlled. Late summer or early fall treatment is usually recommended for perennial grasses or low-growing shrubs, such as blackberries or dewberries. Other types of vegetation are controlled either in the fall or the spring before planting.

The most commonly used herbicides were Princep and 2,4,5-T although the final choice depends upon the vegetation being controlled.[3/] Growers are urged to contact their local extension agent if they are in doubt about the appropriate chemical. Instructions on the label should, of course, be followed.

[3/] The use of a brand name in this report does not imply special approval or recommendation of that brand.

Planting

Planting follows site preparation and is one of the more critical steps in the whole production cycle. Several key decisions must be made at this point: the species to plant, the source of the planting stock, the spacing between the trees, and the method and timing of planting.

The choice of tree species depends upon the plantation's site characteristics, an assessment of which species will be most marketable at harvest, and several other factors. Recommendations on the biological aspects of species selection can be obtained from the local extension agent, the Virginia Christmas Tree Growers Association, or any one of numerous publications such as Gill (1972) and Bell and White (1966).

The importance of seedling source is often overlooked by the new grower. A nursery supplying healthy seedlings with good root systems must be found. The speed of delivery after the seedlings are removed from the nursery bed and the care taken in preparation for shipment are also important because seedlings which are dry or are otherwise damaged will have greater mortality after planting or take longer to begin growing. The seed source of White and Scotch pine is particularly important. For example, a nursery using a Mediterranean source for Scotch pine is preferable because these trees grow straighter and have a more desirable color. Most growers purchased their seedlings from independent nurseries in Pennsylvania. These were more expensive than alternative sources but the growers felt the added cost was justified by better quality seedlings.

Most growers space their trees 5' x 5' or 6' x 6' which allows planting between 1,200 and 1,700 trees per acre. The closer together trees are planted the more can be grown on an acre. This is important when land prices are high and the grower desires a minimum investment. Spacing closer than 5' x 5' is not recommended because the trees will not have room to grow into a desirable shape.

Another consideration in spacing is the type of equipment the grower will use. There will not be room for larger tractors if the trees are planted too close together. In fact, one grower recommends planting 6' x 12' so a larger, faster tractor can be used. The final spacing choice depends on the individual case and is a balance between land cost, machinery operating cost, and the availability of the grower's time or other labor. It is constrained at the closer spacings by the biological requirements of the trees.

Finally, the small grower must choose between machine or hand planting. A crawler tractor or 30 horsepower farm tractor is used to pull the planter for machine planting. This typically requires a tractor operator, a laborer riding the planter to place the seedlings, and another worker (often the grower) following the planter to reset and straighten the seedlings. Most growers preferred hand planting with a planting bar because greater care could be given to setting the seedlings and to uniform spacing. This care is reflected by an average mortality rate 6 percent lower than that for machine planting. However, some growers report lower mortality with machine planting.

Replanting

Replanting is used either following planting to replace seedlings which have died, or following a partial harvest. Replacing dead seedlings is important because it will increase the number of harvestable trees per acre and hence the total revenue. Twenty-six of the growers answering the Financial Questionnaire had replanted following their initial planting during the last two years. Replanting beyond the first few years after planting is not usually practiced because it causes an uneven aged stand and the attendant problems.

Replanting after a partial harvest can be important because it puts the land back into production sooner. However, this production gain must be balanced against possible increased costs of site preparation and planting due to the necessity of working around matured trees. In addition, many growers feel that cultural and harvesting operations would be hampered by having an uneven aged stand. Consequently, most growers replant only during the first two years after the initial planting and only a few growers replant after a partial harvest. Replanting was done by hand in all cases observed.

Shearing

Shearing is the cutting of the ends of branches and terminal leaders to increase the density of the trees and to give them more symmetrical and tapered shapes. This is perhaps the single most important cultural operation in producing a high valued and marketable tree. Its importance is reflected by 92 percent of all the growers interviewed having sheared their plantations at least once during the past two years.

Shearing begins the second or third year after planting when the root system becomes well established and the tree begins rapid lateral and terminal growth. The tree will look sparse and spindly if this growth is not cut back to 8 to 12 inches a year. Shearing also induces additional growth on the remaining branches thereby producing a denser, fuller tree. Most growers shear annually--some stopping the year before harvest while others include the year of harvest. The former feel shearing in the year of harvest causes unsightly cut-off branches which reduce tree value.

Pines are sheared in the late spring or early summer after the new growth has stopped but before it hardens into woody tissue. There is a period of about 10 days, usually during June or July in Virginia, which is ideal for shearing but some growers begin before and end after this period. Other species may be sheared throughout the year, although best results are obtained during the dormant season.

Shearing pines is one of the major constraints to large Christmas tree plantations in Virginia. It is labor intensive requiring, for example, about 20 manhours per 1000 three to five foot trees when shearing with a knife. This means about 25 to 35 manhours an acre are required during a 10 to 20 day period.

Growers report great difficulty in finding suitable labor for shearing. The work is physically demanding, it only lasts for a few weeks, it can be physically dangerous when shearing with knives, and skilled labor is needed to obtain proper shearing. These difficulties usually result in the grower and his family performing most of the shearing and serves as a real constraint on the total number of trees one person can grow.

Fifty-seven percent of all identified growers who shear use only hedge shears, 17 percent only knives, and 23 percent some combination of methods. Some growers have used electric shears but these are not favored because of the difficulty of moving the power generator and electric cords. Shearing knives are faster than hedge shears but this advantage is offset by the increased safety hazard.

Pruning

Pruning is the complete removal of a branch. The first few branches at the base of the tree may be removed to form a "handle" to facilitate placing the tree in a stand. Deformed branches, upper branches, and multiple leaders may be removed to improve vigor and shape.

Combining pruning and shearing into one operation results in a considerable saving of time. Hence, 24 percent of the growers followed this procedure and in effect pruned annually on an "as needed" basis. About half of the remaining growers prune periodically when they think their plantation requires it and the other half prune annually between the second and fifth years after planting. Pruning to form a "handle" is often performed in the off-season.

Vegetation Control

Vegetation control is important for several reasons. Weeds compete for moisture and nutrients thereby hindering tree growth. They may also choke young trees, causing poor shape and decreased merchantable value and they can slow a worker's movement through the plantation thereby increasing cultural and harvesting costs. Finally, they make the plantation less attractive to consumers if the grower retails his trees at the plantation. The importance of vegetation control is reflected by over 90 percent of all growers interviewed practicing it in some manner.

Mowing and application of herbicides were the two basic control methods. Mowing is the most common method followed by joint mowing and herbicide application. Only three growers reported using herbicides alone. Mowing is generally effective for controlling weeds and grasses in the rows between the trees. Herbicides are combined with mowing to kill vegetation which cannot be mowed, such as vines and briar bushes, or to kill vegetation in areas which cannot be mowed, primarily immediately around the tree.

Mowing

Equipment ranged from a 2 horsepower lawnmower through a 30 horsepower tractor but a 10 to 15 horsepower horticultural tractor with a mounted rotary or sickle blade was used most often. The size of the mower chosen depends upon the cost, the time required to mow, and the space between the rows. Larger mowers have greater purchase and operating costs but require less time per acre. A grower may therefore choose a larger, more expensive mower if he plans to do the mowing himself and wants to minimize the time he spends doing it.

However, larger mowers are less maneuverable and may cause significant tree damage as the plantation grows. The grower can compensate for this by planting his trees farther apart and receiving less gross revenue per acre, by buying a smaller mower which will fit between the trees as they grow but which requires more mowing time when trees are smaller, or by purchasing both a large and a small mower. This is a decision each grower must make on the merits of his particular case. Only he can evaluate his relative costs of time, land, and money.

Herbicides

Growers applied herbicides either manually with backpack or tank sprayers, or mechanically with a pressure sprayer pulled by a tractor. The most common herbicides used were Princep, 2,4-D, and 2,4,5-T, in that order. Time of application varied with the vegetation being controlled and the chemical being used. Growers should seek the advice of their local extension agent before applying herbicides. This is necessary not only to match the correct herbicide to the vegetation and to assure the correct time of application, but also because of the toxicity of the material used.

Fertilization

Fertilizing is the least common cultural practice with only nine of 67 growers reporting its use. Four of these used it every year of a plantation's life, two used it in years four through seven, and the remainder used it during selected years.

Fertilization will increase tree growth and improve vigor and color. Growers usually apply fertilizer for the last two reasons because excess growth must be removed by shearing. Indeed, those growers answering the Financial Questionnaire who fertilized spent 15 percent more time shearing their trees than those who did not fertilize.

However, some tree species, such as Douglas-fir and white pine, require good sites and may need fertilizer to improve growth. The cost of extra shearing can be avoided if artificial tree coloring instead of fertilizer will improve color. The final choice depends on the individual grower's assessment of his costs of fertilizing and extra shearing as opposed to the cost of spraying color and the possible decrease in market value of artificially colored trees.

Most growers sprinkle about two ounces of fertilizer around the tree by hand. Some type of nitrogen-phosphorus-potassium fertilizer, usually 10-10-10, was used in all cases of hand fertilization. Only two growers used mechanized spreading and both of these broadcast fertilized over their entire plantation before planting.

Fertilizer should be applied in the spring of the year just before the new growth starts if increased tree growth is desired. Midsummer application is best for improved vigor and color because growth is least affected then. Broadcast fertilization either before or after planting is not recommended because it is more expensive and will aid competing vegetation.

Insect Control

Insects are a major threat to plantations because they can strip them of value in any year of the production cycle. The threat is compounded because neither the time of year nor the year of attack can be predicted in advance, and hence preparation for a specific outbreak is difficult. Timely insect control will lessen financial loss because fewer trees have to be sprayed and there is less income lost through reduced tree quality.

Growers can most effectively control insects by preparing for an attack before it occurs. They should be familiar with the insects most likely to attack, the control measures needed, the sources of insecticides, and should have the necessary equipment ready.

Determining the need for control is difficult because judgment must be made about whether the insect will become epidemic. A logical decision requires balancing chemical and application costs against the benefits of control which are the net revenues received from the sale of trees which would have been killed.

The risk of a large financial loss makes the cost of control (about $20 per thousand trees) appear relatively low and usually results in early control. It is suspected that lack of control usually results from a grower's lack of knowledge rather than a conscious decision not to control.

Insects may be controlled before attack by propagating their natural enemies or by timing shearing or pruning to remove insects before their emergence. In addition, twenty growers reported spraying for insects in the last two years. Backpack sprayers were used by 12 growers and the remainder used tractors with power sprayers. Method of application varied with the severity of attack. Backpack sprayers were used for small infestations where only individual trees had to be sprayed and mechanized application was used for larger infestations where all trees had to be sprayed. The most common chemicals used were Malathion, Cygon, and Sevin. Growers should, as with herbicides, consult their local extension agent.

Disease Control

Problems of disease control closely parallel those of insect control. Occurrence is impossible to predict, plantations may be destroyed, determining the need for control is difficult, and control can be best accomplished by adequate familiarization and preparation.

There are a few differences however. Many diseases can be controlled by physically removing an infected branch or tree from the plantation although spraying is sometimes necessary. Some growers harvest and sell infected trees to minimize revenue loss but obviously damaged trees cause much customer dissatisfaction. Finally, infected branches can be removed during pruning at little added cost. All of this requires that the grower, and his labor, be familiar with the various diseases. It also made obtaining cost data impossible.

In addition, there are state and federal control programs for some diseases. The appropriate agency will pay control costs where the programs exist. Thus, the grower can obtain control at no personal expense. An example of this is white pine blister rust. Growers are again urged to contact their local extension agent to obtain information.

Artificial Coloring

It is also difficult to identify the need to apply artificial coloring because, to be most effective, the color must be applied in the early fall before temperatures drop below 45 or 50 degrees and before trees begin to turn yellow. Therefore, a grower must decide to apply artificial color based on prior years' observations of needle fade.

In the past, growers were concerned about the quality of artificial color. However, it has been reported that improved coloring materials, applied using the recommended procedures, make artificial color difficult to detect. The emphasis consumers place upon color and the improved quality of artificial color make artificial coloring a realistic emergency measure.

Costs of Cultural Practices

Estimated costs of cultural practices are based on responses to the Financial Questionnaire. The reader should exercise caution in using them for several reasons. First, they are responses to questionnaires and therefore only as accurate as those responses. For example, time studies may have provided more accurate cost data but time and budget constraints did not allow them.

Second, there are varying numbers of observations for each practice because every grower did not use each practice. Generally, averages are more representative the greater the number of observations, although there can still be a large variation within any one cost. The number of growers contributing cost data is indicated to assist the reader in judging how much faith he wishes to put in the results. Further, dollar costs were estimated for 1972 and may be considerably higher in the future due to inflation. Finally, the reader should remember that these are averages and that his costs may vary from them.

Consequently, for all these reasons, these results should be considered indicative of what can be expected, but individual growers are encouraged to make their own estimates where possible. Equipment and labor hour estimates are shown separately so that growers may substitute their costs if they are known.

Site Preparation Costs

Land clearing is the most expensive site preparation cost varying between $109 and $140 per acre, depending on the size tractor used (table 1). A grower purchasing his plantation site can save these costs, or afford to pay that much more per acre, if he buys land not requiring clearing.

Cultivation costs averaged between $18 and $49 per acre, but are difficult to compare because the different methods are often not substitutable. For example, subsoiling is not a substitute for disking, although dragging may be a substitute for disking. Cultivation requirements might also be avoided or decreased by purchasing an alternative site.

Mowing, or mowing combined with herbicide applications, can be a substitute for cultivation. Mowing with a 30 horsepower tractor is the lowest cost ($11 per acre) of all site preparation methods and hence may be the most preferred whereas mowing with a 12 horsepower tractor is both more costly ($28 per acre) and takes more labor than using herbicides alone.

However, four out of 13 growers have used herbicides combined with mowing during the past two years. The cost of these combined operations can approach that of cultivation. For example, a 30 horsepower tractor-mower ($11 per acre) plus a 30 horsepower tractor-sprayer ($21 per acre) costs $32 per acre, only $5 an acre less than disking. In this case, the grower may decide to disk because of equipment availability or if he gets better control.

Table 1. Reported Site Preparation Costs Per Acre, 1972

Type of Site Preparation	Nmbr. Obs.	Hours Required: Equipment	Hours Required: Labor	Cost Per Hour: Equipment	Cost Per Hour: Labor	Total Cost
Clearing						
140 HP Crawler Tractor	3	6.03	6.03		$18.00 a/	$109
65 HP Crawler Tractor	3	10.00	10.00		14.00 a/	140
Cultivation						
30 HP Tractor and Plow	5	3.84	3.84	7.80	3.50	43
30 HP Tractor and Disk	5	3.24	3.24	7.97	3.50	37
30 HP Tractor and Drag	3	1.55	1.55	7.97	3.50	18
30 Hp Tractor and Subsoiler	3	4.50	4.50	7.44	3.50	49
Mowing						
30 HP Tractor and Mower	5	0.91	1.03	7.85	3.50	11
12 HP Tractor and Mower	3	5.50	7.10	1.27	3.00	28
Herbicide						
Hand Applicator	5	0	5.50		3.00	25 b/
30 HP Tractor and 100 gal. Sprayer	3	0.92	0.92	6.38	3.50	21 c/

a/ Labor and machine rate combined because we assume grower will hire machine and operator.

b/ Includes 3.0 pounds of Princep at $2.80 per pound.

c/ Includes 0.75 gallons of 2,4,5-T at $16.00 per gallon.

The reader should note that the above statements apply only to the data we have gathered. There were no observations of large equipment, for example, a 30 horsepower tractor with a 30 foot sprayer boom, or for equipment which combines spraying and mowing in one operation. It may be that equipment such as this would provide even lower costs.

In summary, based on the data gathered, mowing alone with a 30 horsepower tractor is the least cost method of site preparation followed by application of herbicides and mowing with a 12 horsepower tractor. The cost of combined mowing and herbicides approaches that of cultivation, hence cultivation may be considered as a substitute. The final site preparation decision will probably be based on the above costs, the biological requirements of the particular plantation site, and the availability of equipment to do the job.

Planting Costs

The costs for hand planting and machine planting, including seedlings, are $86 and $73 per thousand trees, respectively (table 2). The cost of planting bars for hand planting is not included because bars are used almost indefinitely and the cost per tree planted approaches zero. Bars cost about $7 each.

Table 2. Reported Planting Costs Per Thousand Trees, 1972

Type of Planting	Nmbr. Obs.	Hours Required		Cost Per Hour		Total Cost [a]
		Equipment	Labor	Equipment	Labor	
Hand Planting	20	0	21.49	0	$2.50	$86
30 HP Tractor and Planter	6	3.0	7.14	7.44	2.62	73
Hand Replanting						
1st year after planting	21	0	19.90	0	2.50	82
2nd year after planting	14	0	12.10	0	2.50	62
After Partial Harvest	5	0	29.98	0	2.50	107

[a] Includes 1,000 seedlings at $32.10/M.

Machine planting appears most desirable because of lower costs and labor requirements. However, hand planting may be preferable because of the reasons previously cited, particularly if the grower experienced decreased mortality. Growers interviewed reported, on the average, that seedling mortality was 25 percent with machine planting and 19 percent with hand planting, although some growers report lower mortality with machine planting. It would cost the grower about another $5 to replant the additional mortality due to machine planting thereby decreasing the cost difference between methods. The cost of not replanting has a present value of about $125 per acre (Sellers, 1974, p. 49).

The costs of hand replanting are $82 per thousand trees the first year after planting and $62 per thousand trees the second year after planting. Replanting costs are probably lower than hand planting because it takes less time to line up the rows. We can offer no explanation for the lower cost in the second year. The cost of hand replanting after a partial harvest is the highest of all planting costs ($108 per thousand trees) as expected.

Shearing and Pruning Costs

Shearing cost increases as the height of the tree increases regardless of whether knives or hedge shears are used (table 3). The cost for shearing a thousand trees with knives ranges from $46 to $59 and is less than the cost of using hedge shears in all but the shortest tree category. The cost of pruning ($39 per thousand trees) can be reduced by over one half by combining it with shearing. These costs are slightly understated because the cost of shears and knives, about $8 to $9 each, is not included.

Shearing and pruning's high labor requirements are well demonstrated in table 3. Prospective growers are urged to use these labor estimates to calculate the number of manhours needed to shear their plantation and to make estimates of labor availability. These estimates, and the number of days during which shearing is biologically possible, should be used to determine the maximum plantation size which can be adequately maintained.

The data clearly show that wherever possible pruning and shearing should be combined. Shearing with knives is desirable because it is least costly but the safety hazard may cause use of the higher cost hedge shears. Individual growers must make this decision based on their circumstances and the quality of their labor.

Table 3. Reported Shearing and Pruning Costs Per Thousand Trees, 1972

Type of Shearing or Pruning	Nmbr. Obs.	Hours Required		Cost per Hour		Total Cost
		Equipment	Labor	Equipment	Labor	
Shearing - Knives						
Trees under 3 ft.	9	0	18.45	0	$2.50	$46
Trees 3 to 5 ft.	9	0	20.75	0	2.50	52
Trees over 5 ft.	9	0	23.67	0	2.50	59
Shearing - Hedge Shears						
Trees under 3 ft.	21	0	16.43	0	2.50	41
Trees 3 to 5 ft.	21	0	25.69	0	2.50	64
Trees over 5 ft.	21	0	33.15	0	2.50	83
Shearing with Hedge Shears and Pruning Combined						
Trees under 3 ft.	9	0	23.40	0	2.50	59
Trees 3 to 5 ft.	9	0	29.07	0	2.50	73
Trees over 5 ft.	9	0	33.59	0	2.50	84
Pruning only	15	0	15.73	0	2.50	39

Vegetation Control Costs

Mowing costs vary between $8 and $14 an acre and are similar regardless of the equipment (table 4). The major differences occur in the labor and capital investment needed. Consequently, growers will probably choose equipment based upon labor and capital availability, equipment versatility in other uses, and the tree spacing considerations previously discussed.

All growers indicated they mowed their plantations between two and four times a year. The actual number of mowings will depend on site conditions, the amount of rain, and other unpredictable variables. Consequently, growers using these figures should multiply them by three or four to estimate annual costs and labor requirements.

Twelve of 34 growers controlling vegetation used herbicides in addition to mowing. Therefore, this cost should also be included in estimates.

Using herbicides alone for control may be the most desirable because of lower costs. This must be balanced against the probability that more than one application may be needed and there may be less complete control in the rows between the trees.

Table 4. Reported Vegetation Control Costs per Acre and per Thousand Trees, 1972

Type of Vegetation Control	Nmbr. Obs.	Hours Required		Cost Per Hour		Total Cost
		Equipment	Labor	Equipment	Labor	
Mowing - Cost Per Acre						
30 HP Tractor	4	1.25	1.25	$ 7.85	$3.50	$14
12 HP Tractor	15	1.84	1.84	1.27	3.00	8
6 HP Tractor	12	2.33	2.33	1.73	3.00	11
2 HP Lawnmower	6	3.22	3.22	1.25	3.00	14
Herbicide - Cost Per Thousand Trees						
Hand Application	8	0	2.31	0	3.00	16 a/
12 HP Tractor & 50 Gal. Sprayer	3	0.81	0.81	2.55	3.00	14 b/
30 HP Tractor & 100 Gal. Sprayer	4	0.74	0.74	6.38	3.50	16 c/

a/ Includes 3.3 lbs. Princep at $2.80/lb. Assumes spot application.

b/ Includes 3.5 lbs. Princep at $2.80/lb. Assumes strip application.

c/ Includes 3.2 lbs. Princep at $2.80/lb. Assumes strip application.

Miscellaneous Costs

Insect control, fertilization, and artificial coloring costs will not be incurred by many growers. For example, only three growers used artificial coloring and only nine applied fertilizer. Insect control was more common and should probably be included in cost estimates although the year it will occur is usually unpredictable.

Insect control costs were $19 per thousand trees for hand application and $22 per thousand trees for mechanical application (table 5). These costs are similar and choice of method will probably depend upon whether the grower must treat his entire plantation or just individual trees. Hand spraying is likely to be the most economical for individual trees but mechanical spraying should prove best when the entire plantation must be treated.

Table 5. Reported Miscellaneous Cultural Costs per Thousand Trees, 1972

Type of Cost	Nmbr. Obs.	Hours Required		Cost per Hour		Total Cost
		Equipment	Labor	Equipment	Labor	
Insect Control						
Hand Sprayer	12	0	3.11	0	2.62	19 a/
12 HP Tractor and 50 Gal. Sprayer	8	2.02	2.02	2.55	3.00	22 a/
Artificial Coloring						
12 HP Tractor and 50 Gal. Sprayer	3	10.99	10.99	2.55	3.00	169 b/
Fertilization						
Hand Application	8	0	2.73	0	3.00	15 c/
12 HP Tractor and Spreader	2	0.58	00.58	3.03	3.00	17 d/

a/ Includes 1.25 gal. of Sevin at $8.50/gal.

b/ Includes 18.0 gal. of Greenzit at $6.00/gal.

c/ Includes 149 lbs. of 10-10-10 at $4.50/cwt. Assumes individual tree application.

d/ Includes 343 lbs. of 10-10-10 at $4.50/cwt. Assumes broadcast application before planting.

HARVESTING AND MARKETING

Harvesting is the manner in which trees are removed from the plantation and brought to the place of sale. Marketing is the manner in which the trees are sold. A grower may harvest all trees in one year (clearcutting) or some trees each year for several years (partial cutting). He may market trees by selling them on the stump (selling stumpage), cut and stacked "at the roadside", delivered f.o.b. to a retail lot, at his own retail lot, by running a "choose and cut" operation, or by a combination of these.

The marketing method will determine the harvesting operations. For example, selling clearcut stumpage only requires indicating the trees to cut, but retailing requires cutting and transporting trees to the retail lot, manning the lot and making sales to the consumer. Revenues increase as the marketing system approaches the consumer but so do the costs. The final choice of harvesting and marketing method must be a balance between these increasing costs and revenues, the availability of growers' time or other labor, and the degree of risk associated with the method.

Harvesting

A great deal of risk is assumed when trees are cut. The product will deteriorate physically and will also become obsolete if not sold before December 25. Risk is minimized if the trees are sold before they are cut. Growers should insist on a written contract before cutting as further market assurance. Of course, the grower assumes all of the risk when he sells trees at his own retail lot.

The size and shape of the trees rather than their physical age determine the year of harvest. The trees should be about six or seven feet tall and well shaped. Some trees are usually held in the plantation an extra year or two to improve either of these characteristics. Further, the price per tree is often dependent upon height; consequently, growers do not want to cut their trees too soon. Therefore, harvest age varies between plantations however, eight years is common in Virginia.

Clearcutting

Clearcutting is the least expensive and most efficient cutting method. The crew can cut all trees as they come to them and not lose time searching for the next tree. They are also unhindered by the residual plantation.

Partial Cutting

Partial cuts are used because trees become marketable in different years. Further, some trees may be grown to ten or twelve foot heights for sale to commercial establishments. In practice, most growers use partial cuts and remove all the trees in two years.

The primary advantage of partial cutting is increasing the total revenues by increasing the number of merchantable trees or the selling price per tree. This is accomplished by harvesting the best trees during the first year and using the growth between the harvests to improve the height and shape of the remaining trees. The extra year can turn a nonmerchantable tree into a merchantable tree or increase the price per tree. In addition, the cash flow is improved by harvesting trees as soon as they become merchantable.

There are several disadvantages. First, trees cut in the first year might increase in value if left till the second year. Trees should be left if their increased value is greater than the return which can be obtained by cutting them and reinvesting the revenues. This is the concept of financial maturity as developed by Duerr, Fedkiw and Guttenberg (1956).

A second disadvantage is that plantations are usually not regenerated until all trees are cut. This means the harvested part of the plantation is now growing trees and the production cycle is delayed for the number of years between the first and final cut.

A final disadvantage is that partial cut costs are somewhat higher than clearcut costs. This, of course, is inconsequential when selling stumpage and appears to be insignificant on the average.

The choice between a partial or clearcut depends on the individual case. The total revenue expected from a partial cut must be compared to that expected from a clearcut. This requires estimating for each method the number of trees sold and the price per tree as well as lost production and differential harvesting cost. The financial analysis program presented later can then be used to analyze these estimates. Usually, a partial cut is preferable if it causes an appreciable increase in total revenue and does not extend beyond two or three years.

Harvesting of Balled Trees

Balled trees are dug from the ground with part of their roots, wrapped in burlap, and sold to the consumer for indoor use during Christmas and subsequent outdoor planting. Balled trees can be marketed at roadside, at the retail lot, or directly to the consumer. To date, we know of no one buying stumpage for balled trees.

Many Virginia growers are interested in balled trees although only three interviewees sold them in 1972. Growers believe the planting feature will cause substantial demand and that consumers will pay a higher price for a younger tree, thus improving financial gain.

There are at least two disadvantages. First, holes remain in plantations where trees were removed. These can hamper future mechanized management practices and possibly lower soil productivity. Second, growers interviewed did not use mechanized harvesting and hand harvesting takes a great deal of labor. The grower is thus faced with the difficulty of finding labor and added harvesting cost.

As always, adoption of the practice depends on the individual case. Each grower must balance his estimated increase in costs and revenues to make the decision.

Marketing

The marketing method chosen determines many of the harvesting operations which the grower must perform (table 6). Therefore, the choice of marketing method must be based upon not only price differentials but also upon the availability of labor, harvesting equipment, and the grower's time to supervise or perform these operations. There are additional advantages and disadvantages to each of the marketing methods.

Table 6. Harvesting Operations Required for Marketing Method

Harvesting Operations Grower May Perform	Marketing Method				
	Sell Stumpage	Sell at Roadside	Sell to Retail Lot	Retail	Choose and Cut
Tag Trees to Cut	X	X	X	X	
Cut Trees		X	X	X	X
Transport to Roadside		X	X	X	X
Load on Truck		X	X	X	
Transport to Lot			X	X	
Unload Truck			X	X	

Sales on the Stump

The grower sells the right to enter his plantation and to cut and remove trees when marketing on the stump. The grower needs only to designate the trees to cut and does not have to organize and execute any of the other harvesting operations. This simplicity, perhaps, explains why this was the second most popular marketing method in 1972. Seven growers sold 4,805 trees (17 percent) in this manner.

There are, however, several disadvantages. First, the price per tree is lowest and it can be difficult to control which trees are cut as well as damage to the residual plantation. The grower should designate the trees to be cut beforehand and then be present during the harvest to see that all these trees, and only these trees, are taken and that the remaining trees are not damaged.

Sales at the Roadside

This marketing method requires the grower to cut and transport his trees to the plantation roadside or some central location adjacent to an all-weather road. He usually also loads the trees on the buyer's truck. Nine of the interviewed growers sold a total of 14,284 trees (50 percent) in this manner in 1972.

Sales at the roadside, on the average, bring a higher price per tree than stumpage sales and also allow control over the trees cut and the damage to the residual plantation. This is offset by the costs of cutting and transporting the trees to roadside and possibly loading them on the buyer's truck.

Sales to a Retail Lot

Sales to a retail lot require that the grower perform the additional operations of transporting and unloading his trees at the lot. About 14 percent of the trees were marketed in this manner in 1972.

The price received for these trees again averaged higher than the preceding marketing methods although there were the additional costs. Transportation costs to the lot vary with the distance traveled and although this information was not directly available we were able to estimate that the average one-way distance traveled was between 50 and 75 miles.

Transportation cost should be easy to estimate once the destination is known. All that is needed is an estimate of the number of miles, the machine rate for the truck, the number of hours per trip, and the number of trees carried per trip.

All growers unloaded the trees at the retail lot. This cost is negligible or non-existent because the truck driver would have to wait while his truck was unloaded and hence the grower would incur the cost of the driver's time anyway.

Sales to the Consumer at a Retail Lot

This marketing method brought the second highest price. Although we did not investigate the costs of this marketing option, they should be easy to estimate. Rental costs for the lot, city retail license fees, the number of manhours required to run the lot, and perhaps incidental costs such as electricity and advertising should be included. An article by Leuschner and Bell (1973) may be helpful in estimating potential revenues.

Choose and Cut

In a choose and cut operation the consumer comes to the plantation, walks through a designated area, and chooses the tree he desires. The consumer may either be given a bow saw to cut the tree or the grower may cut the tree for him. The grower may help the consumer transport the tree to the parking lot and tie it to his auto.

The major advantage of choose and cut is a higher price per tree. The major disadvantage is that the grower must have someone on the plantation during those hours when customers are likely to arrive. It is estimated that, at current rates of sale, it requires over 500 manhours to sell 1,000 trees.

However, labor for choose and cut operations is a fixed cost because the grower must be on the plantation throughout the advertised hours of business. The cost per tree (in dollars or manhours) can be decreased by increasing the number of trees sold per hour. This, of course, reaches an absolute maximum because one man can only serve a limited number of customers in an hour.

A variation which shows promise is to combine choose and cut with clear-cutting. The first year a plantation could be opened for choose and cut in order to obtain higher prices. The second year the plantation could be clear-cut to avoid the opportunity cost of idle acreage and to facilitate planting.

Baling

Christmas trees may be baled individually in plastic nets to prevent excessive drying, to protect them from damage in transport, and to make them easier to handle. The process requires feeding a tree butt first into a funnel which contains the netting, and then pulling the tree through the funnel while the netting encloses the tree.

This process usually requires two to four men on a production basis in addition to the cost of netting. The average cost for the five growers using the procedure was $0.33 per tree and a serious question may be raised about whether the average price per tree was raised by this amount because of baling. This is particularly the case in Virginia where trees are cut shortly before

they are sold and are transported short distances. There were no observations of baling with string. Again, the decision to adopt this practice must be made on an individual basis balancing the additional costs and revenues.

Costs and Revenues

Harvesting operation costs are based on responses to the Financial Questionnaire while revenues are from the Growers Questionnaire. The reader is again cautioned to use data carefully because they are responses to questionnaires, have varying numbers of observations, and are averages which may differ from the costs and revenues which individual growers will experience.

Harvesting Costs

All costs associated with harvesting and marketing are included in this category for convenience even though some might be categorized as marketing rather than harvesting costs. The first step in harvesting, which is needed only for a partial harvest, is to tag or otherwise mark trees for cutting. Twelve growers reported an average cost of $18 per thousand trees for this operation (table 7). This cost is understated because time spent supervising and inspecting cutting on a stumpage sale is not included. Tagging costs would not be incurred for clearcut harvests or for the final partial cut.

The next step in harvesting is to cut the trees. The least expensive method was clearcutting with a saw mounted on a 12 horsepower tractor ($16 per thousand trees). The least expensive partial cut method was a saw mounted on a 12 horsepower tractor ($37 per thousand trees) followed by hand cutting with a chain saw and hand cutting with a bow saw. Based on cost only, clearcutting is better than partial cutting and mechanized cutting is better than hand cutting. Labor requirements are also least in the above order.

However, these figures should be used cautiously because of the few observations for tractor mounted and bow saws and because the machine rates vary with the number of hours a year a machine is used. For example, the chain saw rate is based on 100 hours a year use. A grower must harvest 5,000 trees a year (100 hrs./yr. $\div$ 19.47 hours per thousand) to experience this rate. If a grower only harvested 2,500 trees a year he would use the chain saw 50 hours and the machine rate would be $2.47 per hour. This results in a total harvesting cost of $106 per thousand trees which almost equals the cost of the bow saw. A grower may still use the chain saw if labor is scarce because it requires half as much labor.

The trees must next be transported to the roadside. Growers interviewed used three methods: dragging them by hand, loading them on a trailer pulled by a 30 horsepower tractor, and loading them on a truck. Reported costs were $91, $160, and $664 per thousand trees respectively. Average loads per trip were 44 trees for the tractor-trailer and 48 trees for the truck.

Table 7. Reported Harvesting and Marketing Per Thousand Trees, 1972

Harvesting Operation	Nmbr. Obs.	Hours Required		Cost per Hour		Total Cost
		Equipment	Labor	Equipment	Labor	
Tag Trees for Harvest	12	0	4.55	$ 4.00 a/	$3.00	$ 18
Clearcut						
12 HP Tractor Mounted Saw	1	3.30	3.30	1.71	3.00	16
Partial Cut						
Bow Saw	2	0	40.00	0	3.00	120
Chain saw	11	19.47	19.47	1.20	3.00	82
12 HP Tractor Mounted Saw	2	7.77	7.77	1.71	3.00	37
Transport to Road						
Hand	7	0	34.75	0	2.62	91
30 HP Tractor and Trailer	4	10.24	35.52	6.50	2.62	160
Truck	4	87.50	153.33	3.20	2.50	664
Loading on Trucks						
Roadside	10	0	32.00	0	2.62	84
Retail Lot	7	0	17.08	0	2.62	45
Truck to Retail Lot	7	32.66	58.97	3.20	2.62	259
Baling	5	20.89	62.66	177.50 b/	2.50	334
Choose and Cut by grower or consumer	17	0	503.82	0	2.50	1,260
Balled Trees	3	0	240.50	0	2.62	630

a/ Cost of plastic tie tape. Assumes four rolls of tape at $1.00 per roll.

b/ Cost of netting. No equipment cost included.

Direct comparison of these costs is impossible because the distance traveled for each method was not available and probably differed. However, hand transportation is probably the least expensive alternative if the distance is short because it avoids the fixed cost of loading and unloading trees. The tractor-trailer alternative is probably best for longer hauls because the tractor will travel over the terrain faster.

Loading trucks at roadside and unloading them at the retail lot are the next costs encountered. Loading at roadside took an average of 32.0 manhours per thousand trees and unloading at retail lots an average of 17.08 manhours. This differential probably exists because it is easier to unload than load and because the retailer probably assists with the unloading.

The average cost of transporting trees to the retail lot was $259 per thousand trees. This cost depends on the distance traveled hence the average figure cannot be applied to all cases.

Only five of the interviewed growers baled their trees--generally when they were to be shipped long distances or when customers specifically asked for the service. The operation usually took a crew of three men, one man bringing trees to the funnel, another stuffing the butt end into the funnel, and a third pulling the tree through the funnel. The fairly high cost of $0.33 per tree indicates this practice should be used only when specifically requested or when the grower is paid for the service. These costs are understated because the cost of the funnel is not included.

Revenues

The average price per tree for sales on the stump was $2.59 (table 8). These prices were fairly consistent for all growers and species. This was also the case for the $2.95 average for sales at roadside. The average prices for the other marketing methods had a greater amount of variability and are therefore less precise revenue estimates.

Price variations can occur for several reasons. First, tree quality may have varied. Data were not available to analyze price-quality differences although Leuschner and Bell (1973) found they existed at the retail level. Tree height is a second factor unaccounted for because of insufficient information. Ordinarily, a higher price is paid for taller trees.

Finally the greater price variability in the latter marketing methods may indicate the growers' ability to find lucrative outlets. One would expect that most stumpage and roadside sales are to wholesalers who have access to a larger supply of trees and also have a more rigid price structure. These sales may not leave much room for bargaining. However, as growers deal with smaller buyers there is a greater chance of finding someone willing to pay a higher price or willing to pay for some added service.

Table 8. Reported Price per Tree and Number of Trees Sold by Species and Marketing Method, 1972

Marketing Method	White Pine	Scotch Pine	Fraser Fir	Balsam Fir	Douglas Fir	Spruces	Unknown	Total
Sales on Stump								
Avg. Price	$2.73	$2.37	$ 2.10				$ 2.50	$2.59
No. Trees	3,475	530	650				150	4,805
Sales at Roadside								
Avg. Price	2.48	2.99	2.60			3.32	3.25	2.95
No. Trees	1,856	8,618	1,050			460	2,300	14,284
Sales to Retail Lot								
Avg. Price	5.47	3.13		10.00		3.17	4.00	5.25
No. Trees	2,300	745		400		330	95	3,870
Sales at Retail Lot								
Avg. Price	5.07	8.50					6.75	5.80
No. Trees	765	15					540	1,320
Choose and Cut								
Avg. Price	4.88	5.59	2.50		5.00		5.34	5.32
No. Trees	741	2,419	100		150		415	3,825
Balled Trees								
Avg. Price	8.76		2.50				8.81	6.57
No. Trees	74		200				290	564
Total								
No. Trees	9,211	12,327	2,000	400	150	790	3,790	28,668

Statements about price differences between species cannot be made, except for white pine, Scotch pine, and Fraser fir, because there are not enough observations. Price differences between white and Scotch pine and Fraser fir are relatively small in the stumpage and sales at roadside categories and no species is consistently higher priced than the other. For example, the price of white pine is greater than Scotch pine for stumpage sales but smaller for sales at roadside.

Price differences are greater in other marketing methods but neither of the pines is consistently higher priced than the other. Fraser fir is consistently lower priced and we can offer no explanation other than to speculate that these may be younger or smaller trees harvested early. These observations may indicate that there is no real price difference between the two pines and that the grower can base planting decisions on other factors.

However price differences by marketing methods appear significant. Sales on the stump and at roadside are much lower than sales to retail lots, sales to consumers at retail lots, and choose and cut operations. Prices of balled trees are much higher than those for other marketing methods. Although the revenues increase as the grower sells his trees closer to the final consumer, so do the costs, and these and other factors should be analyzed when choosing a marketing method.

Analysis of Marketing Methods

Average costs and revenues can indicate which marketing method may be more profitable. This assumes, of course, that the averages represent the individual. However, this may not be the case; therefore individuals should satisfy themselves that the data are representative and substitute their own estimates if they are not.

Where full costs are known, sales to a retail lot appear to be the most desirable marketing method, followed by choose and cut, sales at roadside, and sales on stump (table 9). Sales on the stump may be preferable to sales at roadside (if the choice is restricted to these two methods) because the average net revenues are only about $100 less and stumpage sales require much less organization.

Margins, rather than net revenues, are calculated for sales at a retail lot and balled trees because some costs are unknown. The margin for sales at a retail lot is only $162 ($4,833 - $4,671) greather than net revenues for sales to a retail lot, assuming the lot is run by one person for two weeks. This $162 must cover lot rental and other costs, including the risk of not selling the trees. Retailing therefore hardly seems worth the added effort and sales to a retail lot may be a better alternative.

The margin for marketing balled trees is $817 ($5,488 - $4,671) above net revenues for sales to a retail lot. However, this margin is calculated assuming the trees are only transported to roadside. Costs of loading,

Table 9. Average Net Revenues by Marketing Method, 1972
(per thousand trees)

Sales on Stump			
Revenue $2.59 x 1,000		$2,590	
Costs			
Tag Trees		18	
Net Revenue			$2,572
Sales at Roadside			
Revenue $2.95 x 1,000		$2,950	
Costs			
Cost from "Sales on Stump"	$18		
Partial Cut - Chain Saw	82		
Transport to Road-Hand	91		
Load on Truck	84		
Total Cost		$ 275	
Net Revenue			$2,675
Sales to Retail Lot			
Revenue $5.25 x 1,000		$5,250	
Costs			
Cost from "Sales at Roadside"	$275		
Transport to Retail Lot	259		
Unload at Retail Lot	45		
Total Cost		$ 579	
Net Revenue			$4,671
Sales at Retail Lot			
Revenue $5.80 x 1,000		$5,800	
Costs			
Costs from "Sales to Retail lot" a/	$579		
Estimated Labor	388		
Other Unknown Costs	?		
Partial Cost		$ 967	
Margin			$4,833

Table 9 - continued

Choose and Cut				
Revenue	$5.32 x 1,000		$5,320	
Costs				
Manhours on Plantation		$1,260		
Chain Saw Equip. Cost		23		
Total Cost[b]			$1,283	
Net Revenue				$4,037
Balled Trees				
Revenue	$6.57 x 1,000		$6,570	
Costs				
Digging & Burlaping Trees		$ 630		
Transport to Road--Tractor-Trailer [a]		452		
Other unknown costs		?		
Partial Cost			$1,082	
Margin				$5,488

---

a/ Assumes lot is open for two weeks from 10:00 a.m. to 10:00 p.m. on weekend, 12:00 noon to 10:00 p.m. on weekdays and that only one person is on the lot at a time. Wage rate assumed was $2.62/hr.

b/ Assumes hand transportation to parking lot. Labor for cutting included in Manhours on Plantation.

c/ Assumes 4 times equipment cost (11 trees per load) and 2 times labor cost (2 men to load tree).

transporting, and unloading must be added to this estimate if it is unlikely that customers will purchase trees at roadside. This may well make the margin unattractive considering the weight and cumbersome nature of balled stock.

In summary, from a strictly financial view, sales to a retail lot and possibly balled stock are the most attractive marketing methods, followed by either choose and cut or sales at a retail lot. Sales on the stump and sales at roadside are the two least attractive methods.

Individual growers may rank the marketing systems in a different order for several reasons. First, their costs, revenues, and/or the harvesting operations performed may differ from those used in the analysis. Second, the analysis does not include time spent in organizing harvesting and marketing operations although time spent in performing the operations is included. More time must be spent in organizational matters as the marketing system comes closer to the consumer. Consequently, a grower having other demands on his time may choose a less demanding marketing system, such as stumpage sales.

Finally, the grower may have difficulty obtaining labor for harvesting operations. Labor requirements generally increase as the net revenues increase (table 10). All methods, except sales of stumpage or at roadside, require more than four man weeks labor per thousand trees. Labor with the necessary skills may not be available for large harvests, particularly when it is only employed for a few weeks. These considerations again show the necessity of each grower determining the marketing method best for him.

FINANCIAL ANALYSES OF CHRISTMAS TREE INVESTMENT

The basic financial criterion for investing in a project is to invest if the project's returns are higher than those from any other investment alternative. This means, for example, that it is better to put your savings in a bank which pays five percent rather than four percent interest.

There are, however, other factors to consider. One of the most common is the amount of risk. Most savings accounts are insured to a maximum of $20,000; therefore, this investment is relatively risk free. The Christmas tree grower, on the other hand, bears a greater risk because of the danger of insect attack, changing market demand, and other items previously discussed. People usually expect to be compensated for greater risk and so the grower may want an extra five percent return on his investment, or a total of 10 percent.

Another consideration is the ability of the investor to withdraw from the investment. Investors usually expect to be compensated for the inability to withdraw. It is easy to withdraw money from a bank account but a grower must either wait until his trees mature or find a buyer for the immature plantation. Thus, the grower may want an extra three percent return to compensate for this factor or a total of 13 percent.

Table 10. Estimated Labor Requirements by Marketing Method
(manhours per thousand trees)

Harvesting Operation	Sales On Stump	Sales at Roadside	Sales to Retail Lot	Sales at a Retail Lot	Choose and Cut	Balled Trees
Tag Trees	4.55	4.55	4.55	4.55		
Partial Cut-Chain Saw		19.47	19.47	19.47		
Dig and Burlap Trees						240.50
Transport to Road--Hand		34.75	34.75	34.75		71.04 [a]
Load on Truck		32.00	32.00	32.00		?
Transport to Retail Lot			58.97	58.97		?
Unload at Retail Lot			17.08	17.08		?
Man Retail Lot				148.00 [a]		
Manhours on Plantation					503.82 [b]	
Total Manhours	4.55	90.77	166.82	314.82	503.82	311.54
Total 8 hour Mandays	0.56	11.35	20.85	39.35	62.98	38.94

[a] Values assumed because no data available (see t. 9, fn. a & c)

[b] Cutting and transporting to parking lot included.

Finally, some people may simply enjoy working with plants and prefer to earn added income by growing Christmas trees rather than in some other manner. In this case, the grower may prefer to give up some income, perhaps one percent return, just to grow trees. In that case, he would require a return of 12 percent on his investment.

Other factors can affect the rate of return which individuals require to invest, but are too numerous to discuss. However, each individual can decide what his return should be by starting with his best alternative, such as a savings account.

Investment Criteria

It is important to use compound interest when the costs and revenues occur over a period of years. Compound interest accounts for the fact that expenses incurred in future years cost less because the investor can use the money during the intervening years, and that revenues received in future years are worth less because the investor does not have the money to use in the intervening years. There are several widely used investment criteria based upon these principles. Two are Present Net Worth (PNW) and the Internal Rate of Return (IRR).

Present Net Worth

PNW is the algebraic sum of the discounted costs and revenues from a particular investment.[3/] The resulting figure is the gain or loss from an investment in today's dollars over and above the interest rate used for discounting.

For example, a Christmas tree plantation with a PNW of $5,000 at 12 percent interest means that the investor could expect to earn 12 percent on his investment and still have $5,000 left over. This also means that the investment is earning over 12 percent because there is a $5,000 surplus.

PNW's are sometimes negative. For example, a -$5,000 PNW at 12 percent would mean the grower needs $5,000 more revenue in today's dollars in order to earn a 12 percent return. It would also mean that the rate of return on the investment is less than 12 percent because an additional $5,000 is needed to raise the return to 12 percent.

3/ The formula is: $PNW = \sum_{t=0}^{n} (R_t - C_t)\ (1/(1+i)^t)$

where: R = the revenues which occur in the t th. year
C = the costs which occur in the t th. year
i = the interest rate used for discounting
t = the year in which the cost or revenue occurs, where t = 0, 1, 2, . . . n.

Internal Rate of Return

The PNW will decrease as the interest rate used for discounting is increased, and vice versa. It is possible to find a negative PNW for any investment simply by making the interest rate large enough. There will be some interest rate where the PNW is zero as long as there was a positive PNW at some lower, positive interest rate. The interest rate where the PNW is equal to zero is called the IRR.[4/]

IRR is the annual compound percent return which an investment earns. It is comparable to the interest rate which a grower could earn by putting his money in a bank. For example, an IRR of 12 percent on a plantation could be compared to a five percent savings account. It means the grower earns an extra seven percent on his investment to recompense him for added risk, having his money unavailable, and the other factors discussed.

This brief discussion is not sufficient to fully familiarize an uninitiated person with PNW and IRR. However, it is hoped that it will suffice to interpret the results of the following financial analysis program. Those interested in learning more about PNW or IRR should consult books in the fields of corporate finance, investment and capital theory, or engineering economy. One such book is written by Bierman and Smidt (1971).

Christmas Tree Investment Analysis Program

Sellers (1974) wrote a computer program called the Christmas Tree Investment Analysis Program (CTIAP) which incorporates these investment criteria. The program is applicable to investment analyses in other states even though it was developed for Virginia Christmas tree plantations.

CTIAP requires the user to supply information about the planned cultural operations, the marketing method and certain general information. The general information required is:

1. The length of the production cycle. This is the number of years from planting until the last tree is cut.

2. The interest rate the grower wishes to use.

3. The number of acres in the plantation.

4/ IRR is the interest rate, i, where the following condition holds:

$$\sum_{t=0}^{n} (R_t)\ (1/(1+i)^t) = \sum_{t=0}^{n} (C_t)(1/(1+i)^t)$$

where all variables are as previously defined.

Table 11. Example of a Cost Summary from CTIAP

YEAR 1			
5.000 ACRES PURCHASED FOR $ 250.00 PER ACRE		$ 1250.00	
5.000 ACRES SITE PREPARE	WITH TRACTOR/MOWER	$ 53.74	
5.000 ACRES SITE PREPARE	WITH TRACTOR/SPRAYER	$ 105.45	
7.200 M TREES PLANTED	WITH BY HAND	$ 617.94	
COST OF HAND TOOLS,TAX,ETC.		$ 28.50	
TOTAL COST IN YEAR 1 IS			$ 2055.63
YEAR 2			
1.080 M TREES REPLANTED	WITH HAND TOOLS	$ 88.40	
15.000 ACRES MOWED	WITH 12 HP MOWER	$ 117.85	
COST OF HAND TOOLS,TAX,ETC.		$ 7.50	
TOTAL COST IN YEAR 2 IS			$ 213.75
YEAR 3			
6.480 M TREES SHEARED	WITH PRUNING UNDER 3'	$ 379.08	
15.000 ACRES MOWED	WITH 12 HP MOWER	$ 117.85	
1.620 M TREES INSECTICIDE	WITH HAND SPRAYER	$ 30.41	
COST OF HAND TOOLS,TAX,ETC.		$ 15.75	
TOTAL COST IN YEAR 3 IS			$ 543.09
YEAR 4			
6.318 M TREES SHEARED	WITH PRUNING UNDER 3'	$ 369.60	
10.000 ACRES MOWED	WITH 12 HP MOWER	$ 78.57	
6.318 M TREES HERBICIDE	WITH 12 HP TRACTOR	$ 90.32	
COST OF HAND TOOLS,TAX,ETC.		$ 7.50	
TOTAL COST IN YEAR 4 IS			$ 545.99
YEAR 5			
6.128 M TREES SHEARED	WITH KNIVES 3' TO 5'	$ 317.89	
15.000 ACRES MOWED	WITH 12 HP MOWER	$ 117.85	
COST OF HAND TOOLS,TAX,ETC.		$ 34.50	
TOTAL COST IN YEAR 5 IS			$ 470.24

Table 11. (continued)

YEAR 6					
6.005	M TREES SHEARED	WITH KNIVES 3' TO 5'	$	311.51	
15.000	ACRES MOWED	WITH 12 HP MOWER	$	117.85	
1.501	M TREES INSECTICIDE	WITH HAND SPRAYER	$	28.18	
	COST OF HAND TOOLS,TAX,ETC.		$	7.50	
TOTAL COST IN YEAR 6 IS					$ 465.04
YEAR 7					
5.885	M TREES SHEARED	WITH KNIVES OVER 5'	$	348.24	
15.000	ACRES MOWED	WITH 12 HP MOWER	$	117.85	
5.885	M TREES FERTILIZED	WITH HAND APPLICATOR	$	87.66	
	COST OF HAND TOOLS,TAX,ETC.		$	7.50	
TOTAL COST IN YEAR 7 IS					$ 561.25
YEAR 8					
5.797	M TREES SHEARED	WITH KNIVES OVER 5'	$	343.04	
15.000	ACRES MOWED	WITH 12 HP MOWER	$	117.85	
0.500	M TREES HARVESTED	WITH BY HANDSAW C & C	$	629.77	
	COST OF HAND TOOLS,TAX,ETC.		$	7.50	
TOTAL COST IN YEAR 8 IS					$ 1098.16
YEAR 9					
5.214	M TREES SHEARED	WITH KNIVES OVER 5'	$	308.54	
15.000	ACRES MOWED	WITH 12 HP MOWER	$	117.85	
5.214	M TREES COLORED	WITH 12 HP TRACTOR	$	881.14	
5.214	M TREES HARVESTED	WITH CLEAR CUT	$	81.04	
5.214	M TREES TRANSPORTED	WITH LOADING AT ROAD	$	437.14	
5.214	M TREES TRANSPORTED	WITH TRUCK TO BUYER	$	1350.50	
5.214	M TREES TRANSPORTED	WITH HAND TO ROADSIDE	$	475.25	
	COST OF HAND TOOLS,TAX,ETC.		$	7.50	
TOTAL COST IN YEAR 9 IS					$ 3658.96
TOTAL COSTS, ALL YEARS, IS					$ 9612.11

4. The cost per acre of the plantation.

5. The total cost of property taxes and hand tools, such as planting bars and shears, and the year in which the cost is incurred.

The grower must also indicate the cultural practices that he will use and for each specify:

1. The equipment used to perform the cultural practice.

2. The year or years in which the practice will be performed.

3. The number of acres or the number of trees the practice will be applied to.

The following marketing information must be supplied for each marketing method which the grower plans to use:

1. The number of trees to be sold by that method.

2. The tree species.

3. The year of the plantation's life in which the harvesting and marketing will occur.

CTIAP will then calculate a financial analysis based on the costs and revenues presented in the preceding pages. These average costs and revenues may be changed to use individual estimates. The program prints four reports: a cost summary, an income summary, a cash flow-financial analysis, and a list of the cost assumptions used for the calculation.

An Example of CTIAP

The following example will help clarify the CTIAP's requirements and the reports and their uses. The cost summary contains much of the production cycle information and some of the general information which must be provided (table 11).

For example, the grower has specified that in year 1 he purchased a five acre plantation for $250.00 an acre and that he has planned to prepare the site with a 30 horsepower tractor-mower and a mechanical application of herbicides. In addition, he has chosen to hand plant with a 5.5' x 5.5' spacing and has spent $28.50 for hand tools, property tax and other items.[5/] The total cost in the first year is $2,055.63.

5/ 5.5' x 5.5' = 30.25 square feet per tree. (43,560 sq. ft./acre) ÷ (30.25 sq. ft./tree) = 1,440 trees per acre. 1,440 trees per acre x 5 acres = 7,200 trees planted.

Table 12. Example of an Income Summary from CTIAP

```
 250 SCOTCH PINE       SOLD CHOOSE AND CUT       AT $ 5.59 PER TREE $ 1397.50
 250 WHITE PINE        SOLD CHOOSE AND CUT       AT $ 4.88 PER TREE $ 1220.00
             TOTAL INCOME IN YEAR  8 IS                                $  2617.50

                                                    YEAR  9
2607 SCOTCH PINE       SOLD AT RETAIL LOT        AT $ 3.13 PER TREE $ 8159.91
2607 WHITE PINE        SOLD AT RETAIL LOT        AT $ 5.47 PER TREE $14260.29
 5.00 ACRES SOLD AT $  250.00 PER ACRE                              $ 1250.00
             TOTAL INCOME IN YEAR  9 IS                               $ 23670.20

                                          TOTAL INCOME, ALL YEARS IS  $ 26287.70
```

The grower estimated that in the second year he would replant 1,080 trees (which implicitly assumes 15 percent mortality in the original planting) and that he would control vegetation by mowing three times (3 x 5 acres = 15 acres) with 12 horsepower tractor. He also spent $7.50 on property taxes. The total estimated cost for the second year is $213.75.

The other cultural practices planned are evident if the reader will study the cost summary. The assumed mortality rates (calculated from the numbers of trees sheared, planted, and replanted) were:

Year	Assumed Mortality
1	15%
2	10
3	3 1/2
4	3
5	2
6	2
7	1 1/2
8	1 1/2

The chosen marketing methods are also evident from the entries in years eight and nine as well as from those in the income summary (table 12). Five hundred trees are to be sold by choose and cut in year eight and the remainder are to be clearcut and sold to a retail lot in year nine.

Note that the program assumes that the plantation site is sold at the end of the rotation. This may or may not occur but "selling" the land implicitly charges interest on the money invested in the land. Note also that all of the costs and revenues correspond with those previously presented in the discussion of cultural, harvesting, and marketing practices.

The cash-flow financial summary recapitulates the preceding calculations and reports the financial criteria (table 13). The first column contains the year in which the cost or revenue occurs and the second and third columns contain the total costs and revenues, respectively. The fourth and fifth columns contain the yearly and accumulated net cash flows.

These columns are extremely important for financial planning. The yearly net cash flow indicates the amount of cash the grower must have available to perform the planned management activities. Note that during the first seven years the grower does not receive any revenues. The fifth column, the accumulated net cash flow, is simply the algebraic sum of the fourth column. It indicates for any year the amount of money the grower has invested to date in his plantation. Thus, the grower has invested $3,336 in the first eight years.

The grower must have these financial reserves available or else he will not be able to perform the planned management activities. He can make arrangements for these funds if he knows the amounts and the years in which they are needed. Alternatively, he can change his management plans to fit the funds available.

Table 13. Example of a Cash Flow – Financial Summary from CTIAP

YEAR	TOTAL COST	TOTAL REVENUE	YEARLY NET CASH FLOW	ACCUMULATED NET CASH FLOW	PRESENT NET WORTH AT 12.000 %	INTERNAL RATE OF RETURN	BREAK-EVEN PRICE PER TREE
1	$ 2056.	$ 0.	$-2056.	$-2056.			
2	$ 214.	$ 0.	$ -214.	$-2269.			
3	$ 543.	$ 0.	$ -543.	$-2812.			
4	$ 546.	$ 0.	$ -546.	$-3358.			
5	$ 470.	$ 0.	$ -470.	$-3829.			
6	$ 465.	$ 0.	$ -465.	$-4294.			
7	$ 561.	$ 0.	$ -561.	$-4855.			
8	$ 1098.	$ 2618.	$ 1519.	$-3336.			$ 1.71
9	$ 3659.	$23670.	$20011.	$16676.	$ 4334.24	26.788%	$ 2.61

The final three columns contain financial criteria to assist in deciding whether or not the proposed investment is likely to be sound. The PNW is the first criterion presented and in this case, tells the grower that he will earn 12 percent on his investment and still have $4,334.24 left over in today's dollars. The IRR is higher than 12 percent because the PNW is positive and equals 27 percent in this illustration. This can be compared to a five percent savings account and indicates that the investment will provide an extra 22 percent return to cover risk, etc.

The final criterion is the break-even price per tree. This is the average price per tree the grower must receive in the year the trees are sold in order to pay the costs attributable to those trees and still earn his chosen interest rate, in this case 12 percent. In other words, the grower needs an average price per tree of $1.77 for the 500 trees sold in the eighth year in order to earn 12 percent on his investment in those trees. He needs an average price of $2.67 per tree for the 5,214 trees sold in the ninth year in order to earn 12 percent on the money invested in them. One reason the break-even price is so much higher in the ninth year is that the grower must pay harvesting and transportation costs.

The break-even price can be used in at least two ways. First, it may help decide if the price per tree offered is acceptable. The grower can always refuse an offer if he thinks another buyer will pay more or if he thinks the price will be higher next year. Second, the grower can use the break even price to assess the marketing risk. For example, the grower only needs $1.71 and $2.61 a tree to earn his 12 percent return (table 13). These price requirements may be compared to the current market price of $5.32 and $5.25 and subjective judgment made about receiving required price.

The final report contains the cost assumptions used in the analysis (table 14). This report is used to judge whether the costs, both in number of hours and costs per hour, are reasonably close to those expected. Individual estimates may be substituted by a special procedure if they are not.

Using CTIAP

CTIAP is a flexible tool for the financial analysis of Christmas tree investments. It contains data to assess the financial feasibility of a particular investment or management decision and also facilitates planning. The preceding example shows how a potential investor may use CTIAP to judge financial feasibility. In this case, the investment is probably sound if the cost and revenue assumptions are accurate.

The program may also provide guidelines for choosing management systems. The grower first makes a base-line computer run with the management regimes and marketing methods he is using or plans to use. Next, he projects his costs and revenues under alternative management regimes and/or marketing methods. A second computer run is made with these projections using the same interest rate as before. The base-line and alternative PNW's are then compared and the system with the highest PNW is financially preferable.

Table 14. Example of a Cost Assumptions Report from CTIAP

OPERATION/EQUIPMENT	EQUIPMENT COST PER HOUR	EQUIPMENT HOURS PER UNIT	LABOR COST PER HOUR	LABOR HOURS PER UNIT	MATERIAL COST PER GAL/LB	MATERIAL GALS/LBS PER UNIT
SITE PREPARATION						
TRACTOR/MOWER	$ 7.85	0.91	$ 3.50	1.03	$ 0.00	0.00
TRACTOR/SPRAYER	$ 6.38	0.92	$ 3.50	0.92	$ 16.00	0.75
PLANTING						
BY HAND	$ 0.00	0.00	$ 2.50	21.49	$ 32.10	1.00
REPLANTING						
HAND TOOLS	$ 0.00	0.00	$ 2.50	19.90	$ 32.10	1.00
SHEARING						
KNIVES 3' TO 5'	$ 0.00	0.00	$ 2.50	20.75	$ 0.00	0.00
KNIVES OVER 5'	$ 0.00	0.00	$ 2.50	23.67	$ 0.00	0.00
PRUNING UNDER 3'	$ 0.00	0.00	$ 2.50	23.40	$ 0.00	0.00
MOWING						
12 HP MOWER	$ 1.27	1.84	$ 3.00	1.84	$ 0.00	0.00
INSECT CONTROL						
HAND SPRAYER	$ 0.00	0.00	$ 2.62	3.11	$ 8.50	1.25
HERBICIDE						
12 HP TRACTOR	$ 2.55	0.81	$ 3.00	0.81	$ 2.80	3.50
COLORING						
12 HP TRACTOR	$ 2.55	10.99	$ 3.00	10.99	$ 6.00	18.00
FERTILIZATION						
HAND APPLICATOR	$ 0.00	0.00	$ 3.00	2.73	$ 4.50	1.49
MARKING						
BUNDLING						
HARVESTING						
CLEAR CUT	$ 1.71	3.30	$ 3.00	3.30	$ 0.00	0.00
BY HANDSAW C & C	$ 0.00	0.00	$ 2.50	503.82	$ 0.00	0.00
TRANSPORTING						
HAND TO ROADSIDE	$ 0.00	0.00	$ 2.62	34.79	$ 0.00	0.00
TRUCK TO BUYER	$ 3.20	32.66	$ 2.62	58.97	$ 0.00	0.00
LOADING AT ROAD	$ 0.00	0.00	$ 2.62	32.00	$ 0.00	0.00

For example, suppose a grower wanted to examine the feasibility of clear-cutting and selling stumpage for all of his trees in year 8 instead of the current two year harvest. He estimates that all trees could be sold at $3.00 per tree (slightly higher than the average found in this study). The PNW at 12 percent of this marketing method is $3,884 compared to $4,334. The grower should not market his trees in year eight on the stump but should use the previously planned method. Similar changes can be made in the estimates until, by trial and error, the best method is found.

Other changes in management regimes can be similarly examined. These might include different methods of site preparation, shearing or vegetation control as well as different marketing methods. The grower can make the program reflect his own particular advantages or disadvantages by including his own cost and revenue estimates.

CTIAP can also help determine how long to let trees grow. To do this the price per tree and the number of trees that would be sold must be estimated for a range of years. A separate analysis is made for each year and the one with the largest PNW is financially most desirable.

For example, suppose the grower was trying to decide which year to clearcut and sell stumpage on his plantation and estimated the following:

Year	Number of Trees Sold	Price Per Tree
4	None	$
5	None	
6	6,005	0.50
7	5,885	1.25
8	5,797	2.25
9	5,710	2.50
10	5,625	2.50

A separate computer analysis is made for years six through 10 and the plantation is harvested at the age with the highest PNW.

Using CTIAP for planning is equally important. Projections of cash and manpower requirements can be developed by combining the information presented in its reports. A manpower budget for plantations begun in any one year can be developed by identifying the cultural practices and the number of acres of trees they will be applied to from the cost summary (table 11). These are multiplied by the manhour requirements from the cost assumptions (table 14) to find the annual manhour requirements (table 15).

This provides a budget for a single plantation but most growers will want to plant a few acres each year to generate a steady stream of income. The preceding labor budget for a single plantation may be summed over several years to estimate the total labor requirements each year (table 16). This example assumes that the management regime is the same for each plantation and that the same number of acres are planted each year. Appropriate changes can be made if it is not the case.

Table 15. Example of Calculation of a Labor Budget

Year	Practice	Number Units Treated	Manhours Per Unit	Total
1	Site prepare with tractor/ mower	5 a.	1.03	5.2
	Site prepare with tractor/ sprayer	5 a.	0.92	4.6
	Plant trees by hand	7.2 M Tr.	21.49	154.7
	Annual Total			164.5
2	Replant trees by hand	1.080 M Tr.	19.90	21.5
	Mow with tractor/brush hog	15 a.	1.84	27.6
	Annual Total			49.1
3	Shear with pruning	6.480 M Tr.	23.40	151.6
	Mow with 12 HP Mower	15 a.	1.84	27.6
	Insecticide with hand sprayer	1.620 M Tr.	3.11	5.0
	Annual Total			184.2
.				
.				
.				
9				

Table 16. Example of a Summary Labor Budget
(manhours)

Year Plantation Begun	Year 1975	1976	1977 . . .	1985
1975	164.5	49.1	184.2 . . .	
1976		164.5	49.1 . . .	
1977			164.5 . . .	
.				
.				
.				
1985				
Total Labor	164.5	213.6	397.8 . . .	

The summary budget demonstrates how labor requirements explode as more plantations are started. The potential grower should be certain that he has adequate labor available to fill these requirements. Also note that a similar summary can be made for cash requirements.

The Availability of CTIAP

CTIAP has been submitted for inclusion in the Computerized Management Network (CMN) developed and maintained by the Extension Division, Department of Agricultural Economics, Virginia Polytechnic Institute and State University. This system is designed so all local extension agents will have access to a variety of computer programs via long distance phone lines and portable computer terminals.

Further inquiries about using CTIAP should be directed to your local extension agent or:

Harold W. Walker, Director
Computerized Management Network
301 Hutcheson Hall
Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061

A General Financial Analysis

It should be clear by now that the authors firmly recommend that each grower analyze his own case. Nonetheless, the public is interested in the general question of potential profitability because of curiosity and to ascertain whether more detailed analysis is worthwhile. This section is included to answer these needs.

The preceding CTIAP analysis (tables 11 to 14) was constructed using cultural and marketing practices which were both economically and culturally attractive. The criteria for choosing a practice were both low cost and the percent of growers using the practice. Thus, the analysis was considered indicative of the best returns a grower could expect if his costs and revenues equalled the average. However, many growers will not have average costs; consequently, we calculated financial analyses 50% above and below the average to obtain high and low cost estimates. Note that only the hourly equipment and labor requirements were changed and not the cost per hour or the price per tree.

Land is one of the largest cash outlays and is made in the first year thereby increasing its importance. It is also one of the more variable investment costs because it is closely related to local conditions. Therefore, we varied land price from $100 to $1,000 dollars per acre in the general analysis.

Finally, the grower's time spent performing cultural, harvesting and marketing operations was included at $3.00 per hour. His time for managerial functions such as bookkeeping, finding buyers, and other overhead items was not included because of the difficulty in quantifying it. The analysis was made on a before tax basis because of large differences in individual tax status and to maintain general comparability with alternative investments such as savings accounts.

The results of this analysis indicate that the IRR's from Christmas tree plantation investments may vary between 13 and 41 percent (table 17). This appears a very satisfactory return on investment, even after adjusting for risk. Also, it should be borne in mind that many types of risk can be decreased by adequate preparation on the grower's part. We therefore conclude that investment in a Christmas tree plantation can be a good alternative for small investors who are willing to expend the time and effort to manage a plantation on a business-like basis.

Table 17. Internal rate of return from hypothetical Christmas tree investments, 1972

(percent)

Land Price per Acre	Low Cost Operations [a/]	Average Cost Operations	High Cost Operations [b/]
$ 100	41	31	24
250	34	27	21
500	27	22	17
750	23	19	15
1,000	20	17	13

a/ Equipment and labor hours decreased 50%.

b/ Equipment and labor hours increased 50%.

Literature Cited

Bierman, Harold, Jr. and Seymour Smidt, 1971. The capital budgeting decision, 3rd Ed. Macmillan Publishing Co., Inc., New York. 482 p.

Bell, Lester E. and Donald P. White. 1966. Technical manual for Christmas tree growers. Nitrogen Division, Allied Chemical Corp., New York, 126 p.

Duerr, William A., John Fedkiw, and Sam Guttenberg. 1956. Financial maturity: a guide to profitable timber growing. U.S. Dept. Agr. Tech. Bul. 1146, Government Printing Office, Washington, D.C.

Gill, C. E., 1972. Growing Christmas trees in Virginia. Div. of For. and Wildlife Sciences, VPI & SU, Ext. Pub. 507. Blacksburg, Va. 14 p.

Leuschner, William A. and Enoch F. Bell. 1973. Price-quality relationships in the Roanoke retail market. The American Christmas Tree Journal, XVII(4):11-13.

Sellers, William A. 1974. Economic aspects of Christmas tree production and marketing in Virginia. Master's thesis, Virginia Polytechnic Institute and State University, Blacksburg, Va. 173 p.