THE PRODUCTION OF CHRISTMAS TREES IN THE ALGOMA DISTRICT OF ONTARIO

J. E. MACDONALD

GREAT LAKES FOREST RESEARCH CENTRE

SAULT STE. MARIE, ONTARIO

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Frontispiece. Scots pine prepared for shipping.

ABSTRACT

The results of 20 years' experience in producing Scots pine Christmas trees in Algoma are given. Management procedures, including the choice of land, the layout of planting compartments, cultural practices, and harvesting, are dealt with in considerable detail. Local and export marketing methods are considered. Production costs and net returns per acre based on a 10-year crop-rotation period are shown graphically and in tabular form.

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Cover photograph shows a cutter operating the type of power saw commonly used for cutting Christmas trees.

INTRODUCTION

The Christmas tree industry developed comparatively recently in Algoma, spanning about 3 decades. Except for limited local marketing of wildlings, it originated when buyers from the United States began to export large numbers of spruce[1] and some balsam fir to Michigan and Wisconsin.

The introduction of Scots pine Christmas trees and their rapid increase in popularity in the past 25 years has revolutionized the industry in Algoma and elsewhere in Ontario. The first Scots pine plantation established in northern Ontario for the sole purpose of producing Christmas trees was planted in Thessalon Township, east of Sault Ste. Marie, in 1946. This plantation, containing 3,000 trees, came into production in 1953.

ESTABLISHMENT OF THE INDUSTRY IN ALGOMA

The area specifically referred to in this report is part of the District of Algoma; it comprises a narrow band extending along the North Shore of Lake Huron from Sault Ste. Marie to Blind River, and parts of St. Joseph and Manitoulin Islands. Before the 1950's, the industry in this area was largely based on the sale of spruce wildlings. The choicest of these trees were cut on the edge of bushlots and in old fields by local farmers and buyers from the United States. Financial returns to producers were small, ranging from 15 to 25 cents each for trees cut and piled ready for loading on trucks. Tens of thousands of premium spruce were exported at these low prices in the 1940's. It is not surprising that the cream of the crop of spruce Christmas trees was soon removed from Algoma. A shortage of high quality trees developed in the 1950's, forcing prices up to a maximum of 50 cents per tree. Meanwhile, Scots and red pine were increasing in popularity. The demand for spruce declined so that few spruce were exported from Algoma after 1960. The change in demand arose primarily because pine retains its needles longer than spruce.

Actually, the establishment of a bona fide Christmas tree industry in Algoma began when pine trees were planted for that express purpose. The considerable, existing acreages of sandy, submarginal agricultural land furthered its growth. This land had been cleared and farmed during the white pine logging era between 1880 and 1910. Intensive production of hay and oat crops for use in adjacent lumber camps rapidly depleted the shallow, sandy topsoil (Figure 1). Agricultural crops were grown successfully for 10 to 15 years; then some

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The author is an experienced Christmas tree producer who prepared this report under contract to the Great Lakes Forest Research Centre, Sault Ste. Marie, Ontario.

[1] Species names are listed in the Appendix.

of the old fields were pastured for a considerable period, before being abandoned. The light, well-drained soil of these clearings was well suited to the production of pine Christmas trees.

Figure 1. This site was logged for white pine between 1880 and 1910, farmed for a period of time and abandoned. Note drifted sand in the background and Scots pine Christmas tree plantation at left.

Algoma offered both advantages and disadvantages to the prospective Christmas tree grower. In the 1950's, abandoned farms could be purchased for a very modest sum; the soil and climate were suitable for growing Scots pine; and labor was available at reasonable hourly rates. Disadvantages associated with insects, diseases and mammalian pests were foreseeable, and problems from these sources were manageable. The most serious threat to the industry in Algoma, damage by birds, was not anticipated. Other initial disadvantages were limited local outlets for trees, distances to export markets and the problem of attracting wholesalers to an area where relatively small numbers of trees were available. The last of these disadvantages lessened as production increased and the quality of the trees improved. However, it was not until 1969 that competition for Algoma trees was keen enough to place growers in a good bargaining position at the wholesale level.

Three Christmas tree plantations were established between 1946 and 1949. In the next 10 years, about 25 owners became involved in producing Christmas trees on approximately 40 properties. Individual plantations varied from 10 to 100 acres and they contained in all

approximately 1,000,000 trees. Five of the producers lived on the properties where the trees were being grown but none was entirely dependent upon income derived from tree sales. As a result, the quality of management varied greatly. About half the plantations received fair to good attention and the remainder were given a minimum of care; therefore, it is not surprising that only a small fraction of the trees planted attained marketable quality. This condition is common to the Scots pine Christmas tree industry not only in Algoma but also in other parts of Ontario, stemming mainly from owner absenteeism, lack of knowledge of cultural practices, failure to control pests, and the difficulty of securing reliable seasonal help. Although these problems still exist to some degree, a much higher percentage of the trees planted in the past 5 years should reach the market than in the early years of the industry.

THE PLANTATION

Choice of Property

Plantations should be located reasonably close to an all-weather road and railway facilities. The most productive Scots pine plantations are located on sandy, well-drained soils with a minimum of competition from herbaceous and woody ground cover (Figure 2). Bracken is particularly detrimental to the growth of Scots pine because its massive root system impedes planting operations and competes for moisture. Furthermore, the plant shades and suppresses growth of the seedlings for 2 to 3 years. The reduction in growth that results from these factors extends the rotation period of the crop. Finally, a large percentage of the trees that survive and come through the bracken cover lack the vigor required to produce strong bushy trees. Unless the prospective grower is prepared to reduce this competition by cultivation or by using herbicides before planting, sites with a heavy cover of bracken should be avoided for growing Christmas trees. Competition from cherry and poplar is equally detrimental to the establishment of good quality trees.

Air drainage is an important site factor. Experience in Algoma has demonstrated that the best trees are produced on gently sloping land that has good air drainage. Low-lying basins trap cold air, causing excessive winter drying and subsequent loss of foliage.

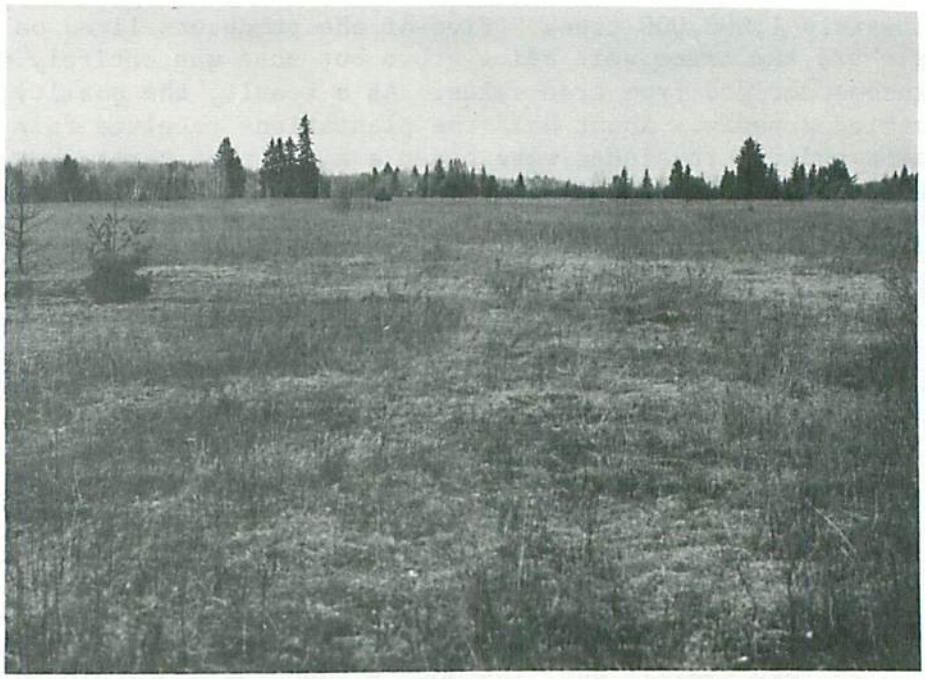

Figure 2. Typical old-field site, suitable for Christmas tree production.

Crop Rotation

Under ideal conditions, a crop rotation period of 9 years is possible for Scots pine Christmas trees in Algoma. In practice, this seldom occurs. Height growth is slow in the first year (4.3 inches in a test plot in 1970) and vigorous terminals are not produced for 2 to 3 years. Differences in seedling vigor and response to shearing, and delays caused by pest damage may extend the completion of cropping to 12 or more years. Therefore, assuming that a prospective grower is planning a continuous cropping program, the area to be planted should be divided into a minimum of 12 compartments. This will provide for emergencies and time for clearing culls and other debris before planting the second rotation.

Compartments should be separated by main roadways about 16 feet wide that will double as fireguards when cultivated. In large compartments, secondary roadways at evenly spaced intervals may also be provided by leaving every 20th furrow unplanted. This will save time in harvesting operations by reducing distances that trees must be dragged for bunching along roadways and hauling to central yarding areas. Yarding time can be shortened further by limiting the length of compartments to about 600 feet or 100 trees per row.

The size of individual compartments will be determined by the total area involved and by planting objectives. In this regard, a word

of caution is appropriate. Regardless of the ultimate scope of the operation, a reasonable limit should be placed on the number of trees planted during the first 2 years. A large percentage of failures experienced in the production of Scots pine Christmas trees in Ontario can be attributed to initial overplanting. There is no substitute for firsthand experience in managing a Christmas tree plantation, and this should be gained before the operation becomes large-scale. Hiring an experienced manager is an alternative, but the seasonal nature of the work militates against continuity in staff for the full rotation period of the crop. Neglect of a plantation for a single year after the trees are 4 years old will drastically reduce, if not eliminate, the possibility of a profitable operation (Figure 3).

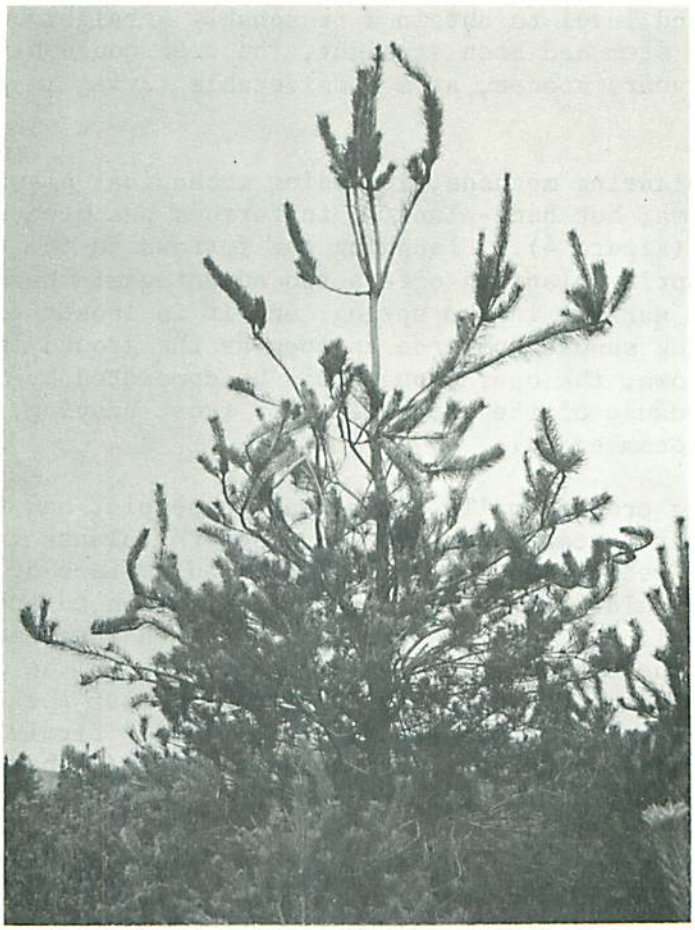

Figure 3. A Scots pine showing the typical results of neglect of shearing and cultural practices.

Planting

Planting stock is available from Ontario Department of Lands and Forests nurseries at a cost of $14.00 per thousand for Scots pine and $10.00 per thousand for other species[2]. Privately owned nurseries also offer stock for sale but at slightly higher prices. Some producers raise their own stock from seed; however, maintaining even a small nursery is very time-consuming and unless production on a very large scale is planned, purchasing planting stock is suggested.

Whatever the planting method used, it is imperative that the trees be set in perpendicularly, to encourage the growth of straight stems. A slanting stem will turn up in the 2nd year of growth, causing a "hook" in the opposite direction; and this process may be repeated for 3 or 4 years. When harvested, the deformed stem must be cut as much as 2 feet above ground level to obtain a reasonably straight butt (handle). Obviously, if the stem had been straight, the tree could have been harvested 1 or 2 years sooner, at a considerable saving in production costs.

Various planting methods, including mechanical planters, have been used in Algoma; but hand-planting in furrows has been employed most extensively (Figure 4). Ploughing the furrows in the fall in preparation for spring planting offers two advantages: the soil under the furrows thaws earlier in the spring, and it is looser for early planting. Planting should commence as soon as the ground is free of frost, and in Algoma, the operation should be completed by May 15 for best results. Because of the probability of frost heaving, fall planting is not recommended.

A planting crew normally comprises two people, one to dig the holes and the other to carry the stock and set the plants in the ground. Assuming that the wedge method is used, the leading face of the wedge should be perpendicular and cut to a sufficient depth to accommodate the roots of the planting stock. The spade is then inserted at an angle to coincide with the bottom of the vertical cut. When the wedge of soil so formed is removed, the plant is placed against the vertical face of the wedge. The soil is then replaced and pressed firmly around the roots to exclude air and prevent drying (Anon. 1947). About 6- by 6-foot spacing is standard (1,200 trees per acre).

Other than from poor planting, crooked stems may result from a heavy fall of wet snow or freezing rain in the fall. Stems that remain prostrate throughout the winter seldom recover naturally. Corrective action may be taken by staking the stems upright, preferably in the spring, before growth begins. Insert wood stakes (3/4 inch x 3/4 inch x 2 feet) firmly into the ground at the base of the stem and bind the tree to the stake at two or three points with strips of rubber band or

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[2] 1972 prices, which presumably are subject to change.

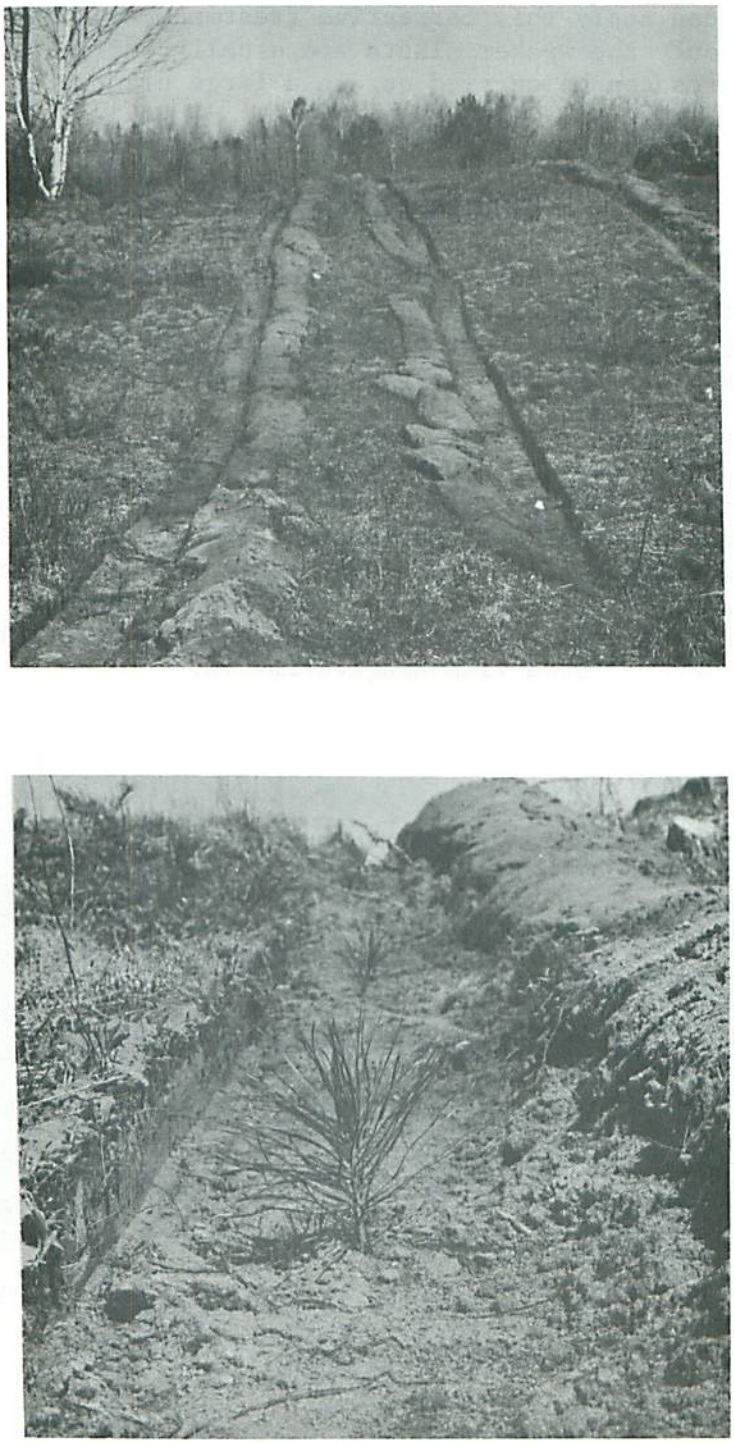

Figure 4. Young plantations established by hand-planting in furrows.

twine. One man can apply this corrective treatment to about 300 trees per day. Since only the weaker plants are usually seriously affected, corrective measures can be carried out in a large plantation in a reasonable length of time.

PRUNING AND SHEARING

In this report, "pruning" denotes the removal of whole branches and excess growth from the base or other segment of the crown of the tree. "Shearing" signifies the control of shoot growth by clipping, and "trimming" is related mainly to shaping the tree.

Secateurs, hedge trimmers and knives are the basic tools used for pruning and shearing operations (Figure 5). Secateurs are employed for pruning, knives and hedge trimmers for shearing. Basal branches, multiple stems and other excess growth are removed with secateurs. The use of hedge trimmers or knives is a matter of choice, depending upon shearing requirements and tactics. Generally, the work can be done more quickly and uniformly with knives, whereas more selective shearing can be accomplished with hedge trimmers.

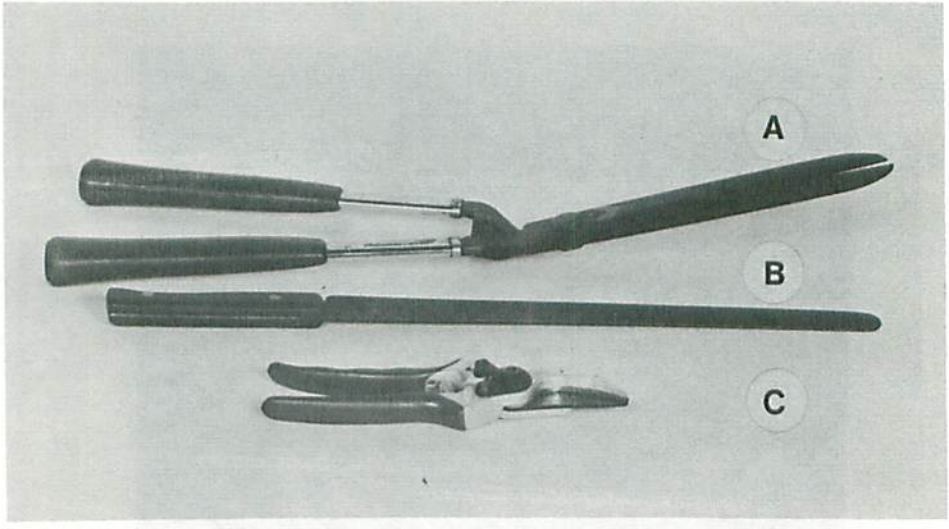

Figure 5. Basic tools used for pruning and shearing Christmas trees A. Hedge trimmer, B. Tree shearing knife, C. Secateur.

Pruning

The practice of pruning branches from the base of the stem of Scots pine (to form a handle) has only been carried out on a limited scale in Algoma. In addition to forming a handle, the principal advantages of basal pruning are to facilitate cutting operations at harvest time and to improve the overall appearance of the plantation for buyer appeal. This operation may be done at any time of year but preferably after annual growth of the tree is completed or when the tree is dormant. When branches are pruned, they should be severed cleanly close to the stem. The height to which the stem is pruned depends upon straightness and the desired length of the handle. If the stem is more than 10 degrees off perpendicular, an extra whorl of branches must be sacrificed to obtain an acceptable handle. In Algoma, basal pruning can be done most effectively when the tree is 4 years old or about 3 feet high. If done earlier, adventitious buds develop and produce a second growth of branches. If pruning is delayed too long, the branches become heavy and difficult to remove.

Some trees produce two or more terminals and an excessive number of lateral shoots in the top whorl. When this occurs, one vigorous terminal and 12 to 15 laterals are retained. The extra terminals are removed when shearing is being done but the laterals may be removed at any time.

Shearing

Objectives, timing and intensity

Shearing has a much greater physiological effect on Scots pine than pruning or trimming, and numerous differences of opinion exist regarding the relative merits of various degrees and methods of shearing. It is unlikely that these differences will ever be fully reconciled because the old mot "beauty is in the eye of the beholder" is very applicable to Christmas trees. The quest for a universal shearing technique is complicated because no single method produces identical results from area to area and year to year. In the final analysis, growers will be obliged to adopt local cultural practices that most nearly produce the kind of tree the consumer demands.

The principal shearing objectives are to improve the shape and to increase the density of the trees. For the most part, consumer demand currently requires the production of trees with about a 70 percent taper and moderate density (Anon. 1969). To define "taper" more precisely, a 90-inch tree with a 70 percent taper would form an isosceles triangle with a 64-inch base (Figure 6).

Figure 6. Tree contour forms a cone with a 40° angle at the apex and 70° angles at the base.

Shearing is done in Algoma during July when the current year's growth is well formed and succulent but before the shoots become hardened off and woody. Clipping the new growth during this period induces the production of adventitious buds in the axils of the needle clusters below the sheared tips of the shoots. Shearing seldom begins before July 1 in Algoma and concludes about July 31; but if the weather is abnormally cloudy and wet in the second half of the month, good adventitious bud formation will result from shearing until the end of the first week in August. The ratio between adventitious and normal bud production on the terminals of Scots pine on the North Shore is about 3.5 to 1 on 6-foot trees. Unpruned terminals produce an average of seven buds whereas pruned terminals average 24 adventitious buds. The number of buds per shoot declines toward the bottom of the crown.

Climate has a significant bearing on the degree of shearing required to produce a premium tree. If identical shearing were applied at selected locations even within the limited area covered in this report, the results could be noticeably different. Although the climate in the North Shore area is very similar to that of St. Joseph and Manitoulin Islands, the vigor of Scots pine and its response to shearing are not the same in these two areas. The more moderate climate of the Islands produces more vigorous growth and longer needles than on the North Shore. As a result, height growth and optimum tree density can be obtained on the Islands with less intensive shearing than on the mainland. This combination of faster height growth and less intensive shearing means that premium trees can be grown more quickly and economically on the Islands than on the North Shore.

Damage by grosbeaks complicates shearing because of the irregular recovery of the crown. Severely damaged terminals produce numerous secondary buds below those that have been removed by the birds, but the shoots that develop are short and slender with no dominant terminal (Figure 7). Moderate damage may result in the loss of buds from only one side of the terminal. Since these will not be replaced by secondaries, a gap occurs on one side of the crown (Figure 8). In some instances, all except the large terminal bud are removed and this produces an abnormally vigorous leader with no laterals. In all instances the only solution to insure recovery of the tree is to shear more severely than normally.

Growth characteristics, vigor and the reaction of individual trees to damage by insects and other agencies may vary considerably within and between plantations. Therefore, to obtain optimum results, shearing procedures must be flexible. This requires well-trained and dependable employees with a genuine interest in the work. However, training an efficient crew is difficult because the work is seasonal and short-term. Experience has shown that something less than perfection must be accepted, particularly when tens of thousands of trees are

Figure 7. Scots pine terminal showing typical damage from feeding by the pine grosbeak.

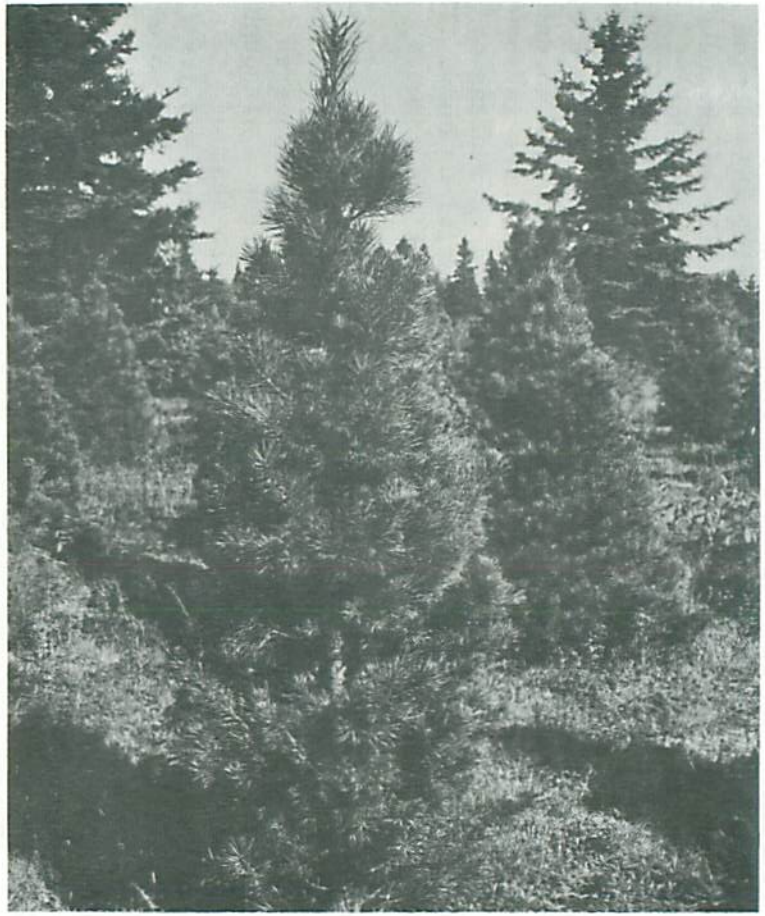

Figure 8. Scots pine tree showing gaps or holes in crown resulting from damage by grosbeaks.

involved. The shearing procedures advocated in this report are applicable throughout Algoma and eastward to the North Bay area.

Procedures

Hedge trimmers are used for shearing the terminals and top whorl; and knives, for shaping the remainder of the crown of trees 3 feet and more in height. Shorter trees are usually sheared with hedge trimmers only.

The shearing crew is divided into two groups, with some workers assigned to shearing terminals and the first whorl with hedge trimmers and the remainder, to shearing the sides of the trees with knives. An experienced worker should train and work along with the first crew. One member of the second crew acts as foreman and is concerned mainly with supervising his group. Most of the labor force used for shearing in Algoma is drawn from secondary schools. As a result, the Christmas tree industry in one area where tree farms are concentrated has become a major source of summer employment for students.

Terminals and primary whorls should be sheared first. Since this is one of the most important steps in plantation management, it warrants careful instruction and close, continual supervision, especially in years when the tops of the trees are sparse and distorted because of bird damage. Even under what might be termed normal conditions, trees differ in conformation; and in theory, the shearing operation should be adjusted to the structure of individual trees. This is an ideal that only exceptional employees will have the interest or ability to attain consistently. However, an acceptably high level of performance may be expected if basic rules for shearing the tops of trees are followed.

The worker should select from the vigorous shoots at the top the one that is most closely aligned with the main stem. This shoot should be sheared at a 45-degree angle to leave an internode of 12 inches (except for crop trees and trees under 3 feet in height). Depending upon the vigor of the trees under 3 feet, the terminals are cut back to 8 to 10 inches in length. (The treatment of crop trees will be considered in the section entitled "The Crop".) Having selected and sheared the terminal, remove any other closely aligned shoots that might compete and form a multiple-stemmed tree. Next, *with hedge trimmers sloping upward at about a 45-degree angle*, shear the top whorl of shoots to form a cone with an apical angle of 40 degrees from the top of the shortened terminal shoot to the bottom of the first whorl. Depending upon their location and degree of slant from the main stem, the individual side shoots should be 4 to 6 inches long or about half the length of the terminal after shearing. Again, *points to stress*

are the angle at which the shears are operated and the creation of a cone-shaped top. If the advance crew does a good job on the top of the crown, a pattern has been set and the work of the main shearing crew will be greatly facilitated. A plywood triangle cut to a 70 percent basal taper is useful to demonstrate the desired conformation of the top sector of the crown.

Shearing the sides of the crown can be done more economically and efficiently with knives than with hedge trimmers. The standard shearing knife has a thin 14-inch blade that is kept razor sharp; consequently, safety measures must be thoroughly explained and demonstrated. A right-handed worker should have the right leg protected from the ankle to the upper part of the thigh by a suitable leg guard consisting of a 10-inch-wide strip of heavy matting or another tough, flexible material, suspended from the waist and made fast at the ankle. When shearing, the worker should proceed in a counterclockwise direction around the tree with the right leg extended. The knife is swung at an angle from the top of the tree downward with a full-armed slanting motion passing to the right of the shielded right leg. A left-handed worker would reverse this procedure. The knife should not be used with an upward motion. The free hand should be kept well away from the path of the knife and should *never* be used to hold any part of the tree when shearing.

Since the taper of the crown has already been established, shearing the remainder of the tree is fairly routine; however, the tendency to "over-shear" with the knife should be avoided. Shearing the bottom branches requires special attention. If left unsheared, they grow rapidly, compete with the harvestable section of the crown and complicate cutting operations. Furthermore, protruding bottom branches are unsightly, downgrading the overall appearance of the plantation. At the latest, the bottom branches should be cut back severely the first year that shearing is done with knives.

THE CROP

Tagging

Trees that are to be cropped in the current year should be tagged by the plantation owner or someone with a knowledge of tree grading and marketing specifications. Marketable trees are sufficiently developed several days before shearing operations begin to make their selection possible with 90 percent accuracy, and this percentage will increase daily until tagging is completed. The tagged crop trees should be bypassed by the shearing crews and trimmed later.

Treatment

Crop trees should not be trimmed until shoot growth is almost complete (about July 10 in Algoma). They should be sheared very lightly to preserve a 70 percent taper but retain a natural, rather than a hedgy, appearance. Depending upon the taper, the terminals may be as much as 16 inches long. As a rule, crop trees may be sheared up until August 10 in Algoma with satisfactory results.

Grading

Christmas trees are graded by color, density, shape and stem alignment. Color and density are relative qualities that cannot be defined in precise terms. However, trees that have yellowed off because of weather conditions should be culled regardless of other factors. A tree with one opening but three good sides is acceptable. Trees with a marked "sweep" in the stem or "hook" in the handle are not saleable. Generally, as stated earlier, the current demand apparently favors a conical tree with about a 70 percent taper and moderate foliage density.

Some export contracts specify that height classes be segregated, but they seldom require the separation of grades. As a rule, buyers will require select, premium and number one trees (U.S.D.A. grading standards) with a specified percentage of selects. Select trees have four good sides, good color, density and stem. Some buyers simply specify that the shipment contain "good saleable trees".

Since grading Christmas trees is to some degree subjective, the most satisfactory arrangement (and one that the grower should encourage) is a joint appraisal of the crop in the field with the buyer (Figure 9). At this time it is advantageous for both parties to have the crop trees tagged. This will pave the way for attaining the most important objective of a joint appraisal, a consensus of the quality of the crop as a whole.

Inventory

Negotiations for the sale of trees are usually initiated in August and terminated in September, well in advance of harvesting operations. A prerequisite to these transactions is an inventory of the numbers and heights of marketable trees. A count of the total number of crop trees can be made either at the time of tagging before shearing, or in the slack period that follows. The second factor in the inventory, a determination of the numbers of trees in each height class, may be obtained from a systematic sample. The nature of this sample should be adapted to the size of the crop and the variation in height of the trees in each compartment.

If the crop is small, the grower may wish to take a complete inventory by measuring the height of all the harvestable trees. However, if the crop is large and the trees in the various compartments are reasonably uniform in height, a 10 percent sample will provide an adequate inventory of each height class. This may be obtained by measuring the heights of all marketable trees in every 10th row, tallying each class and multiplying the results by 10. If the height of the trees in individual compartments varies widely, the grower may increase the sample by examining every fifth row.

An inventory may be obtained very quickly and accurately if the trees are tagged beforehand. Furthermore, the cutting operation can be done more efficiently and economically if the crop trees are conspicuously identified. Plastic flagging tape and moisture-resistant paper strips are most commonly used for tagging. These are tied or stapled to the terminal or a protruding lateral of the crop trees.

Figure 9. Trees tagged for market in the field.

Harvesting

Harvesting expenditures form a considerable part of the cost of producing Christmas trees. Therefore, the operation merits careful planning to reduce the handling of trees to a minimum. A systematic layout of compartments and roads throughout the plantation increases opportunities for efficient harvesting operations. The choice of equipment is important.

Cutting operations for Scots pine begin in mid-October in Algoma and the trees should all be cut by early in November before low temperatures begin to cause yellowing of the foliage. One of the most efficient types of equipment for cutting operations is a gasoline-driven circular saw mounted at the end of a boom (Figure 10). This type of saw is light and manoeuverable. One man under average conditions can cut 1,000 trees per day with this saw. Chain saws and small swede saws have also been used for cutting operations but production is lower per man day and the process is more laborious. Trees should be cut as close to ground level as possible to maintain the height of the tree and reduce the size of the stump. Short stumps rot out quickly and provide minimum obstruction to the movement of equipment when the second rotation is being planted.

Treatment of Stumps after Harvesting

Basal branches near and below ground level keep the stumps alive after the trees are harvested. Unless these branches are removed within a reasonable time after the trees are cut, they grow rapidly and become a major obstacle in preparing the land for replanting. Removing the branches with an axe within a year after cutting is effective. Injecting a silvicide into the stump immediately after cutting in the fall or by May 15 of the following spring produces excellent results. Whatever the method employed, prompt action on this important phase of the management process will save time and money.

Trimming and Butting

Trimming and butting should be done in the field where the trees are cut. A light swede saw with about a 20-inch blade equipped with cutting teeth only is most satisfactory for this work. A combination-type blade with drag teeth is not recommended because it tends to catch on the small branches. If the stem of the tree is straight and has been cleanly cut, no further butt treatment will be required. However, crooked butts should be removed if they are more than 10 degrees off stem alignment. All branches at the base of the stem should be sawn flush with the stem to the height required for a handle (1 inch of handle to 1 foot of tree height, the minimum being 4 inches). Trees

with a "hook" at the base or a "sweep" in the stem that will be obvious when the tree is set in a stand should be culled. Remove the tops of culled trees to prevent their being inadvertently placed in piles of marketable trees.

Figure 10. Cutter operating the type of power saw commonly used for cutting Christmas trees.

Preparation for Baling

Trees should be dragged out to the roads as soon as possible after they are trimmed and butted. The location of roadside piling sites should be marked. This may be done with 10-foot stakes topped with strips of plastic or other brightly colored flagging. The stakes will serve as a guide to shorten haulage time and control spacing of the piles along roadways. The piles should all be positioned on one side of the roads so the trees may be fed directly into the funnel of a baler without turning the equipment around. To prevent drying, the trees should be piled compactly top-to-top with the butts exposed to

allow a minimum of 6 feet of working room between the piles and the point where the funnel of the baler will be located. Obviously, the positioning of the piles from one road to the next should be alternated for convenience in baling.

Baling and Yarding

Numerous types of hand-operated and mechanical balers are available. The choice of baler depends upon the size of crops being handled by the grower and the availability of labor in relation to the capital cost of equipment. A mechanical baler outproduces hand-operated equipment by a wide margin, and its capital cost and maintenance are probably justified for crops exceeding 10,000 trees a year over a 10-year period. Funnel-type hand-operated balers that use twine or plastic netting are standard equipment in Algoma (Figure 11). Trailer-mounted funnels with 14- and 16-inch compression collars equipped for plastic netting process about 300 trees per man day. The same type of equipment using twine for tying the trees handles about 115 trees per man day. Reckoning labor at 2 dollars per hour, and the difference in cost of plastic netting and twine, the expenditure per unit of work is comparable.

Dead needles that accumulate in the foliage and around the stems of the trees as a result of normal shedding should be removed before the trees are baled. Many of these needles are dislodged during harvesting. Any that remain should be removed by striking the butt of the tree sharply upon a solid object before it is passed through the baler.

If haul roads between and through compartments are in good condition and portable baling equipment is being used, it is advantageous to bale export trees directly from piles in the field rather than in a central yard. After baling, the trees should again be piled compactly top-to-top, leaving sufficient working space between the road and the pile for loading. Export trees are usually shipped between November 15 and 25, before snow conditions seriously hamper the movement of transport equipment in the field. The added cost of yarding these trees can be saved unless the contract calls for segregating size classes. Trees that are to be sold locally and delivered in December obviously should be yarded in a sheltered place close to an all-weather road.

Shipping

During the early years of the industry in Algoma, Scots pine and spruce were exported to retailers in the United States by trucks owned or hired by the exporter. Since the advent of wholesaling in 1959, all trees consigned to the United States have been transported by rail. Contractual arrangements for rail shipments include loading on freight cars.

Figure 11. Funnel-type hand baler which uses plastic netting.

Trees are loaded with the butts toward the side walls and the tops lapped in the centre of the car. Each layer of trees should be tramped into place when loaded, to use all available space. When loading is completed up to the sides of the doors, a space of about 6 inches should be maintained between the butts and the doors to prevent jamming when the car is closed. If trees are wet when loaded and the shipment is destined to a distant market in a warm area, precautions should be taken to prevent heating and molding resulting from lack of ventilation during transit. Air circulation can be provided by inserting a length of studding material across the car to prevent the doors closing. The doors are then fastened firmly with heavy wire. Two seals looped together will be required for each door. Since trees are a relatively light, bulky freight, careful packing of as many trees as possible in the cars is particularly important to the buyer. Even though the trees are initially packed carefully, considerable settling will occur. Therefore, 50 to 100 trees may be added if the doors are left ajar so that the car may be "topped off" shortly before the shipping deadline. A standard

40-foot, 6-inch car should accommodate 800 to 900 trees typical of those grown on the North Shore and ranging from 5 1/2 to 8 feet high. About 200 additional trees can be shipped in a 50-foot car. These figures should be reduced by 50 to 100 for trees grown on St. Joseph and Manitoulin Islands, because of the heavier branches and stems produced in these areas.

Domestic shipments up to about 450 miles can be carried more economically by truck transport than by rail, particularly if the trees are consigned to retailers. Savings are realized by loadings at the source and unloading at the retail outlet.

Since Christmas trees are a perishable product, rail shipments are prepaid. Most wholesalers pay shipping charges through guarantee to the carrier at the point of delivery. This requires a letter of credit to the local agent or railway representative responsible for releasing the shipments.

Marketing

A large percentage of the Christmas trees grown in Algoma are exported to the United States. Other distant markets are Thunder Bay in northern Ontario and the larger cities in the Prairie provinces. Until 1959, when a carload of trees was consigned to a wholesaler in Chicago, export sales were largely to retailers in the Detroit, South Bend and Minneapolis areas. Trees for these markets were shipped by truck. Thereafter, the numbers of trees shipped by rail to the United States increased steadily (Figure 12). Scots pine from the Algoma area were among the first to reach the Thunder Bay and Winnipeg markets in the mid-Sixties. The bulk of trees shipped by rail in 1970 were destined for outlets in the mid-western part of the United States and to several cities from Winnipeg to Edmonton in western Canada. Approximately 100,000 Scots pine have been shipped from the Algoma area in the past 10 years. The wholesale value of Scots pine loaded on cars during this period ranged from $.90 to $1.45 and averaged approximately $1.25 per tree.

Export trees are usually sold at an agreed price per unit loaded on railway cars. As stated earlier, it is important that the buyer see the tagged trees standing in the field to avoid misunderstanding later. Although most wholesale buyers are trustworthy, it is good business to have a written contract specifying the number, species, size, grade (as tagged in the field), price and terms of payment properly dated and signed. Bona fide wholesalers will not hesitate to provide a substantial deposit when the contract is signed, followed by a further payment when cutting operations are under way and final payment when the trees are shipped.

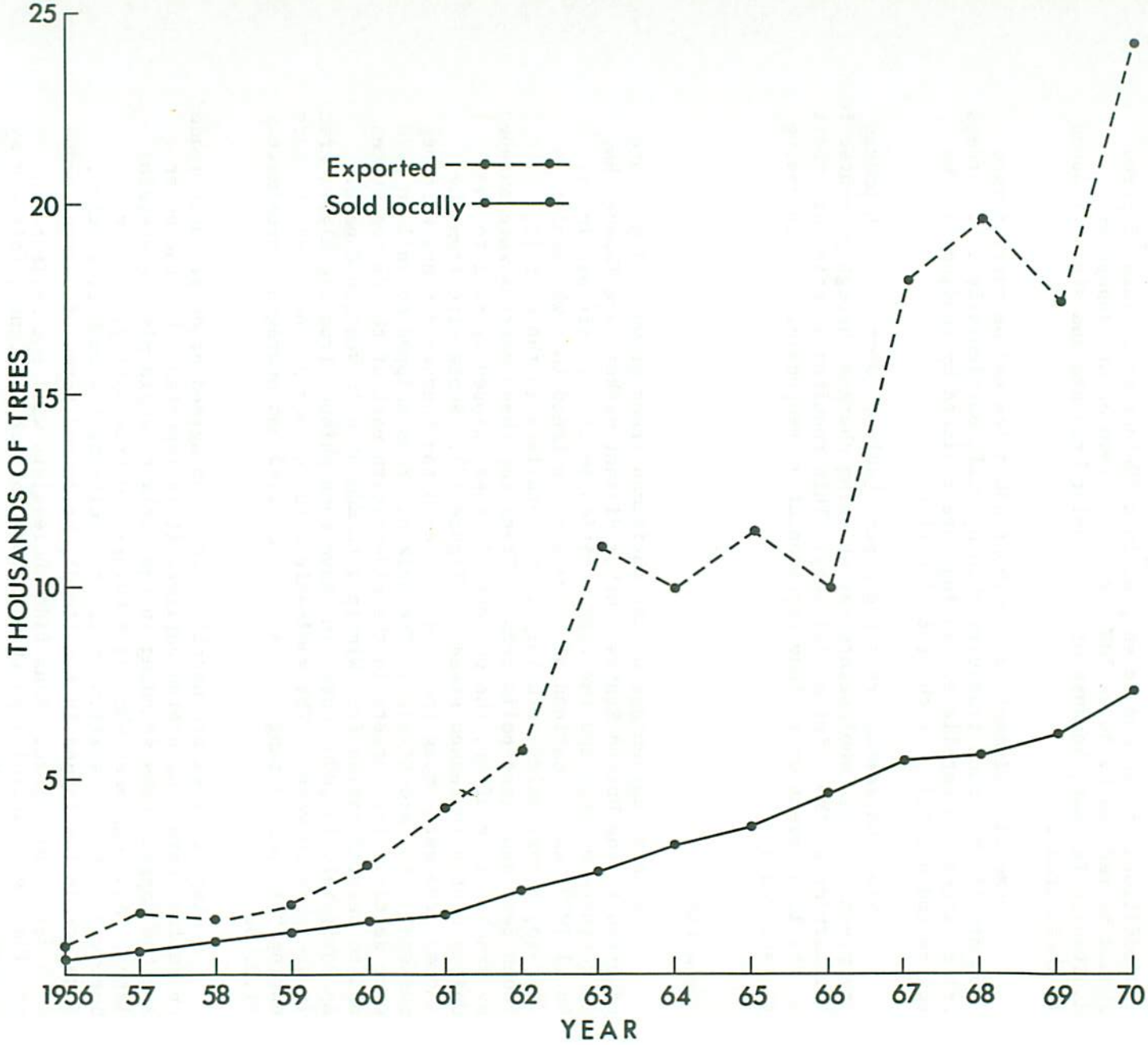

Figure 12. Approximate number of Algoma Scots pine Christmas trees exported and sold locally from 1956 to 1970.

The local market has been important to growers in Algoma, although Sault Ste. Marie is the only urban center in the area. In the early years when small numbers of trees were cropped, local sales provided the first operating revenue for the growers. Later, when larger numbers were being produced and exported, the local market absorbed the overage from carload shipments. A further modest economic advantage accrued from selling directly to the retailer.

The supply of trees now far exceeds the local demand, and creates a condition that tends to restrict returns to the producer and depress the retail value of the trees. It is paradoxical that a Scots pine Christmas tree, representing a 7- to 12-year investment, retails for about half the price of a bouquet of flowers which can be produced in a few months. Although there are several possible solutions to this dilemma, none is easy to attain. The most difficult problem, requiring the cooperation of all growers in the area, is the regulation of the number of trees reaching the local market. Public education regarding the cost of producing good quality trees would be helpful, but in an area where many families until recent years foraged for their Christmas tree on public or private land, the point is difficult to make. Some advantage could probably be gained by more attractive display and sales promotion.

The local sale of pine Christmas trees from tree farms near Thessalon originated in 1956 when 300 red pine were retailed by a service station in Sault Ste. Marie. Scots pine trees were marketed for the first time in 1957; and in 1961, 900 were sold, largely by service stations throughout the city. Local retailers now include service clubs, service stations, church groups and tree growers.

For the past 15 years, the number of Scots pine exported annually has consistently exceeded local sales (Figure 12). In 1970 over 24,000 trees were shipped to distant markets in the United States and Canada, and approximately 7,000 were sold locally in Sault Ste. Marie.

PESTS AND PROTECTION

Grosbeaks

Grosbeaks have caused more damage and loss of revenue than any other pest of Christmas trees in Algoma. The pine grosbeak, and to a lesser extent the evening grosbeak, have invaded Christmas tree plantations along the North Shore in 6 of the past 11 years. Severe bud losses, caused by the pine grosbeak in particular, limit shoot growth to such a degree that the harvest during the year of damage is reduced by as much as 50 percent. Severe damage in two consecutive years has been known to delay the harvesting of 75 percent of the potential crop, and to prolong recovery of the trees for 2 or more years.

During the 1950's, before severe damage by grosbeaks began to have a serious effect on Christmas tree plantations, about 10 percent of the trees in a 6-year-old compartment were marketable, and if no cutting was done until the seventh year, 40 percent of the trees could be harvested. By comparison, damage in the 1960's disrupted harvesting schedules so seriously that, in 1970, trees were still being harvested from at least one 14-year-old plantation.

Damage by grosbeaks extends the length of the production schedule and increases the number of trees that must be culled. Frequent damage increases production costs substantially. Figure 13 shows the effect of the damage in one plantation comprising several compartments of trees in various age classes. Figures for the projected annual harvest are based on the assumption that if no damage occurred the trees would be cut when 7 to 10 years old. A cull factor of 20 percent, the average recorded from the various compartments, was used. The harvest of the remaining trees was reckoned from an approximate cut of 10, 30, 30 and 10 percent, respectively, for the 4-year period.

Variations in the level of the projected harvest simply reflect differences in the number of trees planted from year to year. In spite of bird damage, the gradual increase in the actual harvest between 1958 and 1962 resulted from the cumulative increase in numbers of trees reaching a harvestable age. Little or no grosbeak damage occurred in 1962 and many of the retarded trees were harvested in 1963. In all instances, the harvest showed an increase in years following negligible to light damage.

Grosbeaks are not migratory in the sense that flight paths and wintering areas are predictable. The erratic movement of flocks begins in October in northern Ontario and a concentration of birds may become established for the winter anywhere from the area north and east of Sault Ste. Marie to the southern part of the Province or adjacent states in the United States. Trials of various repellents and "scare" devices to alleviate the grosbeak problem have been unsuccessful to date; however, the seriousness of the problem warrants further experimentation.

Major Insects

No serious insect outbreaks have occurred in Christmas tree plantations along the North Shore. The same does not hold true on Manitoulin Island where severe infestations of the European pine sawfly, the jack-pine budworm, and the pine spittlebug, have caused serious damage.

The white pine weevil, is a perennial pest of Scots pine in Ontario. Control of this beetle in Algoma can be effected by spraying with insecticides in the last week of April or early May before the

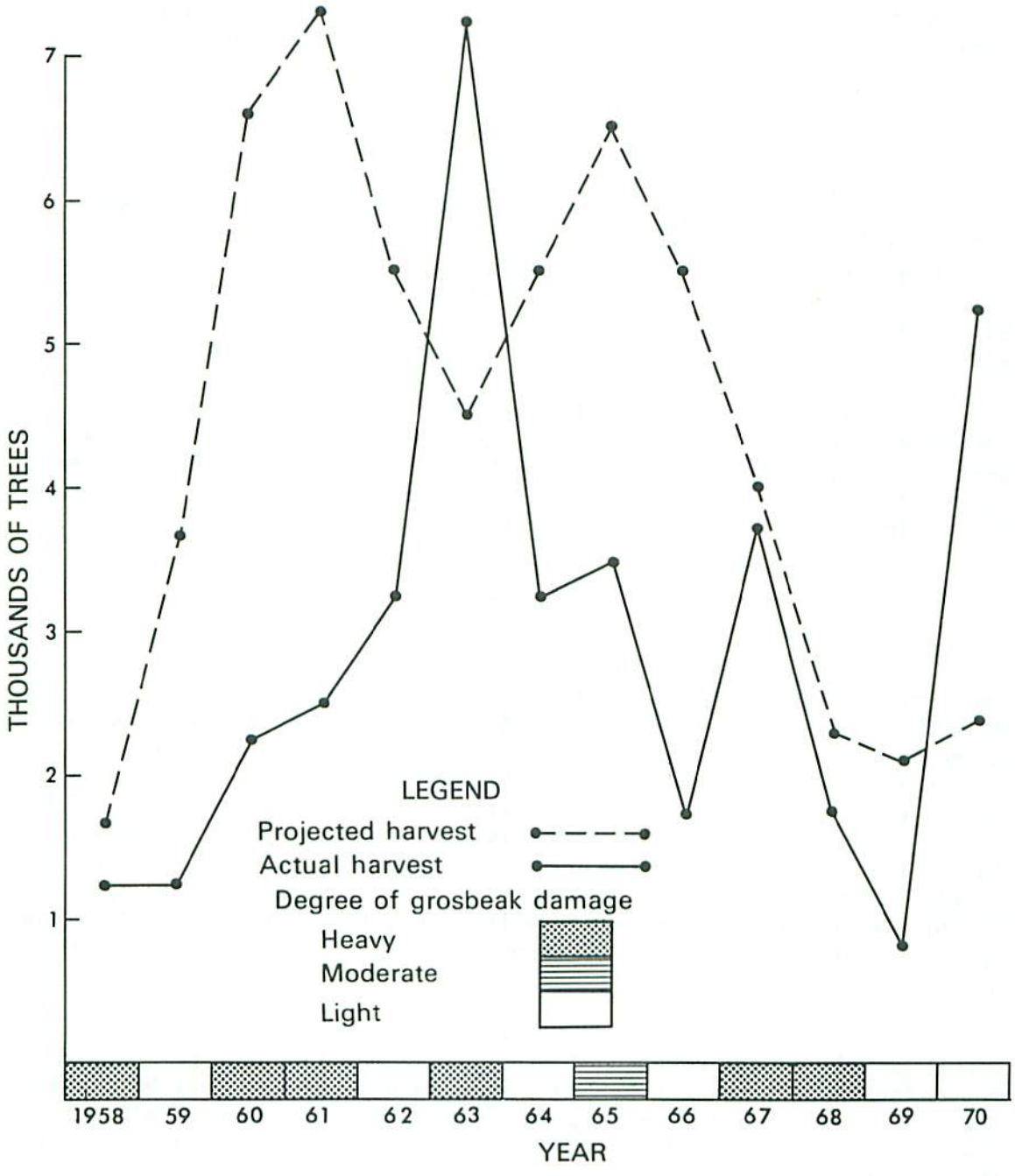

Figure 13. Projected and actual Christmas tree harvest as affected by grosbeak damage.

adults lay their eggs, or by clipping and burning the infected terminals in July before the insects drop to the ground where they overwinter. For up-to-date information on the control of insect pests contact the Canadian Forestry Service, Box 490, Sault Ste. Marie, Ontario.

Mammals

During population peaks, the snowshoe hare causes considerable damage to the tops of small trees and the bottom branches of larger trees, particularly on the fringes of plantations adjacent to dense cover. The only control employed to date in Algoma, during a high population period in the early 1960's, was organized hunting. Since peaks in cycles are widely spaced, the snowshoe hare is not considered a serious pest in Algoma.

In a few plantations with heavy ground cover, meadow mice have caused some tree mortality by girdling. Occasionally porcupines are also responsible for limited losses. Fortunately, during the past 20 years no mammalian pests have caused serious enough damage to prompt control with poison, repellents or the removal of protective ground cover.

PRODUCTION COSTS

Capital costs are incurred mainly for the purchase of land and equipment. These vary considerably depending upon the magnitude of the enterprise. If the operation is modest in scale, the grower may elect to rent or hire the larger, more expensive items of equipment. Another alternative, to avoid excessive capital involvement, is the joint acquisition of equipment by two or more growers whose properties are adjacent. A third possibility is to limit capital investment by renting equipment during the early years of the operation until some revenue becomes available from the sale of trees. In the final analysis, the application of any one of these alternatives will be regulated by the scope of the operation and possibilities for renting equipment on reasonably short notice.

During the first 5 or 6 years of the operation, a tractor, plough and disks are required for preparing the land for planting and for maintaining fire guards. As a rule, since the land may be ploughed for planting either in the fall or spring and the preparation of fire breaks need not be timed precisely, the grower can hire equipment for these operations without undue inconvenience. However, when harvesting operations of any magnitude begin, the timing of the work is more critical and the lack of equipment at the exact times required could pose serious problems.

Depending upon the cost of land, capital expenditures, in the long run, will probably be considerably lower than operating costs. Major operating costs accumulate over the rotation period of the crops from labor for planting, shearing and other cultural practices, harvesting operations and post-harvest cleanup of stumps and other debris. Labor costs have approximately doubled in the past 10 years. This increase has been partially offset by improvements in shearing and harvesting methods and a modest increase in the wholesale and retail value of trees.

Substantial as capital and operating costs may be, under normal circumstances, they are reasonably predictable. However, because damage by birds, insects, weather and other factors cannot be foreseen, the cost of operations does vary greatly from year to year and in different areas, rendering the application of broad cost and revenue projections highly conjectural. Based on accumulative costs for a 10-year crop rotation period and the wholesale price for trees in 1970, the net return from one property in Algoma was reckoned at $64.00/(acre x year). This calculation allowed for a 20 percent cull factor but not interest on the investment over the 10-year period. A breakdown of the major operating costs for the above is shown in Figure 14.

The indicated operating costs are based on hiring labor for the entire operation. If the producer has a small operation and time to devote to it personally, the cash outlay could be scaled down greatly. In instances where tree farming becomes a family enterprise and planting is limited to a few thousand trees a year, little or no cash outlay for labor would be required for several years. In this case, the investment would be in land, planting stock and the purchase or rental of equipment. The probability of a good return would be high.

A review of the accounts of one tree farm in the Algoma District indicates a total, per-acre revenue of $1,440.00, total costs of $801.20 and a resulting profit of $638.80 over a 10-year rotation (Table 1). However, because costs and returns occur at different times during the investment period, both costs and returns should be discounted to the present to evaluate the profitability of the operation.

Discounting with 6, 7 and 8 percent interest rates shows a net present worth of $330, $290 and $266 per acre, respectively. Because discounting accounts for time, it is suggested that the latter figures represent a more realistic estimate of profitability than the indicated net profit of $638.80 calculated above[3].

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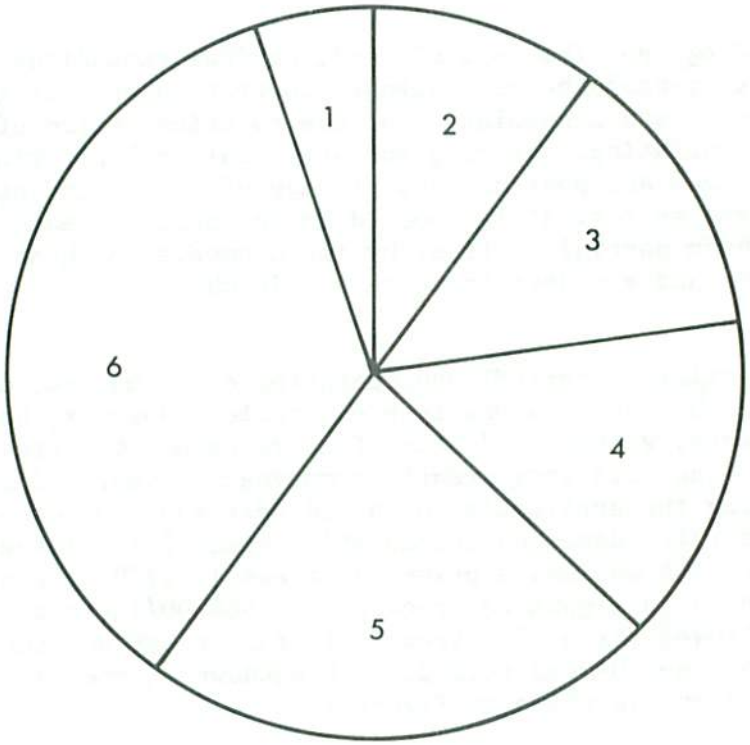
[3] In these calculations, no allowance is made for the cost or value of land.



PHASE OF OPERATION

1 Planting
2 Cleanup of stumps and debris
3 Protection and taxes
4 Materials
5 Cultural practices
6 Harvesting

Figure 14. Comparative operating costs for Scots pine Christmas tree production over a 10-year period.

THE FUTURE OF THE INDUSTRY IN ALGOMA

The future of the Christmas tree industry in Algoma will depend to a large extent upon the strength of the export market and the cost of land and labor. The increase in demand for good-quality Scots pine and the rise in prices paid by wholesalers in the past 2 years are encouraging. If this trend accurately reflects the relationship between supply and demand at the wholesale level, the producer should benefit for about a 10-year period. Possibilities for producing other species of pine for the Christmas tree market during this period are also worth considering.

For several years before 1970, profits from Scots pine Christmas tree sales were limited by low wholesale prices, increased production costs resulting from grosbeak damage, rising labor costs and, in some instances, poor management. Bird damage remains a matter of major concern

Table 1. Summary of costs and returns per acre for Scots pine Christmas tree production (based on 10-year crop rotation)

Yr	Planting $	Pruning and shearing $	Harvesting		No. of trees harvested $	Value of trees harvested[a] $	Post-harvest clean-up $	Annual cost[b] $	Total cost $	Profit or loss $
			Labor $	Materials $						
0	30.00	-	-	-	-	-	-	10.00	40.00	-40.00
1	-	-	-	-	-	-	-	10.00	10.00	-10.00
2	-	10.00	-	-	-	-	-	10.00	20.00	-20.00
3	-	18.00	-	-	-	-	-	10.00	28.00	-28.00
4	-	24.00	-	-	-	-	-	10.00	34.00	-34.00
5	-	32.00	-	-	-	-	-	10.00	42.00	-42.00
6	-	40.00	36.00	14.40	120	180.00	-	10.00	100.40	+79.60
7	-	36.00	108.00	43.20	360	540.00	-	10.00	197.20	+342.80
8	-	20.00	108.00	43.20	360	540.00	-	10.00	181.20	+358.80
9	-	8.00	36.00	14.40	120	180.00	-	10.00	68.40	+111.60
10	-	-	-	-	-	-	80.00	-	80.00	-80.00
Totals	30.00	188.00	288.00	115.20	960	1,440.00	80.00	100.00	801.20	638.80

[a] Based on sale value of $1.50 per tree.

[b] Annual costs include taxes, protection and depreciation on equipment.

to present and prospective growers of Scots pine. The future growth of the industry will depend to a considerable extent upon the solution of this problem. Labor costs may be alleviated to some degree by mechanization and improved management, particularly in large-scale operations.

In the final analysis, the future scope of the industry will be regulated by the availability and cost of suitable land. Several thousand acres of abandoned farmland with light well-drained soil are lying idle or under limited use along the North Shore. Some localities within this area have sufficient suitable land to sustain large-scale Christmas tree operations. The problem in these localities would be to negotiate the purchase of several properties to create a large contiguous unit. There are numerous smaller areas, fields of 20 to 50 acres, that would be suitable for growing Christmas trees on a small scale. Thus it would appear that Algoma offers good opportunities to develop a viable Christmas tree industry, on either a large or small scale.

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Ontario Department of Lands and Forests, 1947. Forest Tree Planting, Bulletin No. R 1.

Ontario Department of Lands and Forests, 1969. Growing Christmas Trees in Ontario, PLF-13-11-10M.

APPENDIX

APPENDIX

COMMON AND LATIN NAMES MENTIONED IN TEXT

Bracken	*Pteridium aquilinum* (L.) Kuhn
Budworm, jack pine	*Choristoneura pinus pinus* Free.
Cherry	*Prunus* sp.
Fir, balsam	*Abies balsamea* (L.) Mill.
Grosbeak, evening	*Hesperphona vespertina vestina* (Cooper)
Grosbeak, pine	*Pinicola encleator eschatosa* Oberholser
Hare, snowshoe	*Lepus* sp.
Mouse, meadow	*Macrotus* sp.
Pine, Scots	*Pinus sylvestris* L.
Pine, red	*Pinus resinosa* Ait.
Pine, white	*Pinus strobus* L.
Porcupine	*Erethigon* sp.
Poplar	*Populus* sp.
Sawfly, European pine	*Neodiprion sertifer* (Geoff.)
Spruce	*Picea* sp.
Spittlebug, pine	*Aphraphara parallela* (Say)
Weevil, white pine	*Pissodes strobi* (Peck)