Fertilization and Weed Control on Christmas Tree Farms
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FERTILIZATION and WEED CONTROL

ON CHRISTMAS TREE FARMS

Christmas trees planted in rows treated with herbicide

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THE PRODUCTION OF HIGH QUALITY CHRISTMAS TREES requires careful attention to all phases of the planting and management program. Good quality nursery stock, properly planted on the correct site, is an essential first step in Christmas tree farming.

In addition, a program of WEED CONTROL and FERTILIZATION will result in shorter rotations, better trees, and higher economic return.

FERTILIZING PLANTATIONS

A quality Christmas tree has dense, luxuriant foliage of good color on a symmetrical crown without excessive height. Retention of second and third year needles is also desirable. These characteristics indicate vigor, which goes hand-in-hand with increased resistance to insects and disease. The proper use of fertilizers can help to produce vigorous, good quality trees.

The short-term rotation of Christmas trees presents a good opportunity for the profitable use of fertilizers. If fertilizers are wisely used they can improve tree quality or grade.

Species with high site requirements such as spruce, Douglas fir, the true firs, and white pine, will almost always respond favorably to adequate fertilization on poorer, sandy soils, and in certain circumstances on more fertile sites. Even red pine, although not a favored Christmas tree species, will show better color

and needle length after fertilization where it is growing on a site so poor as to show severe yellowing. Scotch pine on most sites will not need fertilization, and response to fertilization will be primarily an increase in needle length.

Recognizing the Need

Poor color, particularly during the growing season, short needles and shoot growth, and early needle fall are general symptoms of low vigor. On isolated specimens, these conditions most likely reflect insect or disease attacks or possibly a poor root system. When they occur over larger areas they usually indicate low soil fertility.

Soil tests can characterize soil fertility levels, but only in extreme cases are these tests precise enough to detect the need for tree fertilization. Tissue testing is more accurate in diagnosing tree nutrition needs but is only now practical for research purposes.

Sparse natural weed cover, the presence of mosses and lichens, and patches of bare soil are reliable indications of low soil fertility. Sand blows and highway borrow pits commonly show tree growth inferior to surrounding areas.

Droughty areas, such as dunes and coarse sands, will usually show poor growth. Soil moisture is the limiting factor on these sites. However, on these situations, it is possible to obtain a temporary improvement in foliage color and growth with fertilizer.

Poorly drained areas and low spots in fields often show inferior growth. Trees on sites with poor soil aeration and drainage do not respond very well to fertilizer applications. Also, trees growing in "frost pockets" may show stunted growth and usually will not react to soil amendments.

Fertilizing Established Plantations

In certain situations, such as humus-deficient soils or coarse outwash sands, application of single nutrients like nitrogen or potash may be enough for satisfactory growth improvement of established trees. However, unless we know which elements are deficient, it is good practice to apply a complete fertilizer. The value of the crop and the minor cost of the fertilizer justifies the use of a balanced fertilizer containing the three major nutrients — nitrogen, phosphorus and potassium.

Granular fertilizer with an analysis of 12-12-12, 12-6-12, or 14-7-7 (or grades with a similar ratio) will give satisfactory response in those situations where fertility is limiting. The 2-1-1 ratio is recommended for field soils of sandy loam or loam texture where nitrogen is likely to be the limiting element. The fertilizer should be placed on the ground in a band around the individual trees at the edge of the crown, staying away from the central stem (not closer than 8 inches). This will provide a maximum amount of nutrients at the feeding tips of the roots without giving excessive stimulation to competing weed or brush vegetation.

How Much to Apply

A safe but adequate application for plantation trees that have been established for two to three years would be 4 ounces of the above fertilizer (two-thirds of small frozen juice can is a good measure). For larger trees, one to two years before harvest, ½ to 1 pound of the complete material is a safe application. Trees over 6 feet tall can utilize up to 2 pounds of a complete fertilizer.

Minor element deficiencies of Christmas tree plantations are not known in Michigan. Therefore avoid field crop fertilizers which contain minor elements. While the latter may not do any harm, we have evidence that even small quantities of boron or other minor elements required for field crops may be toxic to evergreens.

How to Apply

For hand application of small areas, the material can be carried in a 12-quart pail and measured with a cup or can cut to hold the desired quantity when level full. Machine application of the fertilizer in a narrow surface-applied band along the row may be feasible. A number of plantations have been treated by hand broadcast or with mechanical spreaders. This method is probably the only practical approach for large acreages. However, there is more loss of material by leaching and excessive stimulation of unwanted weed growth with broadcast treatment.

Applications of *liquid fertilizers* to the foliage have been suggested. Coniferous foliage which is not in a succulent stage can withstand rather high rates of salts — three to four times the concentration usually applied to orchard crops. A foliage spray at the rate of 15 pounds of urea per 100 gallons of water has improved color of red pine and spruce when applied in mid-July after terminal growth is completed. The spray is applied to just wet the foliage.

When to Apply

The best results have been obtained from soil applications made in the spring, just prior to the start of new growth usually between April 1 and May 10 depending on year and location. There may be some loss of materials if heavy rains follow application on areas of coarse soils before root growth has properly started.

Mid-summer foliage applications in the harvest year may improve foliage color without excessive height stimulation. Mid-summer soil applications of fertilizer have not improved foliage color of plantation trees in the year of treatment. Some growth improvement has been obtained the following spring, but it is generally less than that obtained by spring applications of equivalent amounts.

Liquid fertilizer applications should be made early in the spring or after terminal buds have formed. Treatment during the period of rapid top growth (May and June) can cause foliage burn and is not recommended. Growing season foliage sprays should be applied between July 15 and August 15.

At Time of Establishment

Rapid development of newly planted trees and the avoidance of so-called "planting shock" would be a real advantage to Christmas tree growers. Even shortening the rotation by a single year would represent a significant economic return. With some species, such as Scotch pine, there is not too much difficulty in getting the plantations off to a good start, as long as satisfactory stock and good planting methods are used. *Fertilizing Scotch pine at the time of planting is not recommended.*

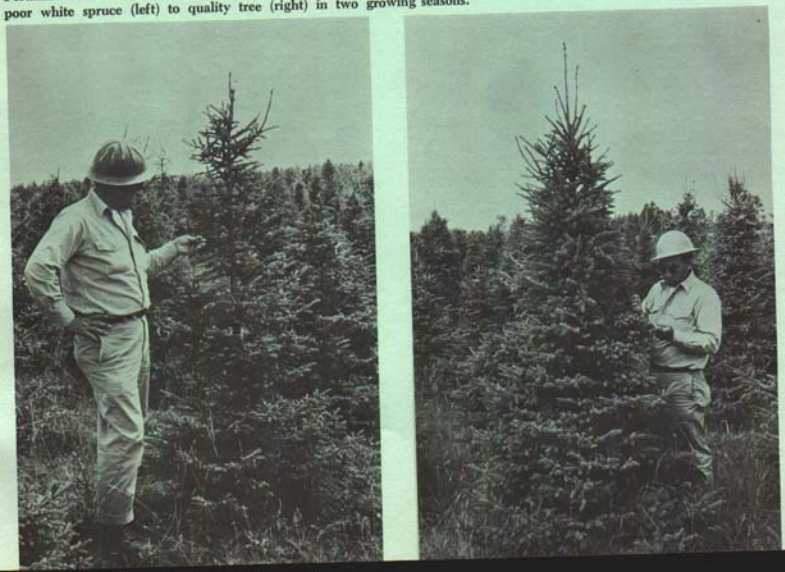
For the more site-demanding species it is quite a different story. There are many instances of spruce and also fir plantings which have practically "stood still" for three or four years before showing any good growth. This problem is primarily a combination of fertility, water availability, and weed competition.

Placing ordinary chemical fertilizer directly in the planting hole in contact with the roots is usually unsatisfactory and may cause heavy mortality. Similarly, fertilizer placed around *newly planted trees* in a band may stimulate excessive weed growth. Unless this is done in combination with chemical weed control, it may actually be harmful.

Generally, fertilizing at the time of planting requires special formulations of slow-release materials, either in pelleted or granular form, and placed below and to the side of the root systems to avoid chemical injury.

Pelleted tree fertilizers containing urea-formaldehyde nitrogen and superphosphate phosphorus have been somewhat successful in the Western states with fir and spruce. These pellets, which weigh approximately 9 grams, can be used with relative safety directly in the planting hole. Experience in Eastern Christmas tree farming areas has shown little response to this type of treatment, and injury has resulted in some plantations.

Fertilization in season before harvest. One pound of complete commercial fertilizer broadcast under crown upgrades poor white spruce (left) to quality tree (right) in two growing seasons.



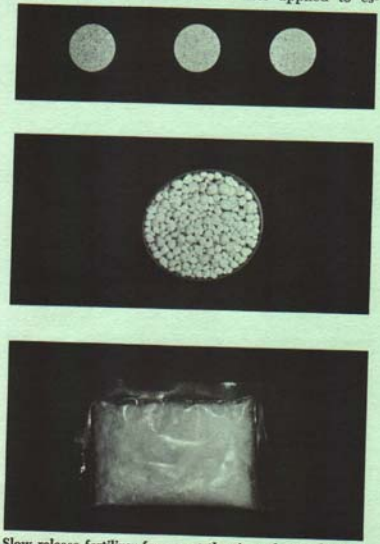
Two relatively new materials – magnesium ammonium phosphate (8-40-0) and magnesium ammonium potassium phosphate (7-40-6)–have been successfully used at the time of planting to provide for slow-release, long-term fertilization. General experience from both research and field demonstration plots shows that even these slowly available materials should be isolated from the root system of new plantings by *at least two inches of soil to avoid chemical injury.*

A packet containing one ounce of soluble fertilizer (20-10-20) enclosed in a perforated plastic sack has been developed for direct placement in the planting hole. This technique is the safest and most effective method of adding slow-release fertilizer at the time of planting.

New plantings may not respond to fertilization until the second growing season.

What Does it Cost?

With a short rotation tree crop such as Christmas trees, the value return from fertilization when needed is quite high. Commercial fertilizer applied to established plantings costs about 4 cents per pound (less in ton quantities). When low soil fertility is lowering the quality of the trees this insignificant investment can make the difference between a No. 2 and a Premium grade tree. (A man can treat a hundred or more trees per hour under ordinary conditions.)



Slow release fertilizer for use at the time of tree planting. Top: 9-gram pressed tree pellet. Middle: Metal ammonium phosphate. Bottom: Soluble complete fertilizer in perforated plastic sack.

Tree pellets cost about 1 cent each. The metal ammonium phosphates cost 2½ to 3½ cents per 2-ounce application. The perforated plastic sacks are more expensive and may be justified only for selected plantings of high value species such as spruce, Douglas fir or the true firs.

Yellowing of Scotch Pine

One of the questions most frequently asked is what to do about the yellowing of Scotch pine. Research experiments have tested the efficiency of commercial fertilizers and sprays as a technique for overcoming the yellowing of Scotch pine. Results of these experiments are almost completely negative. We know that yellowing is an inherited characteristic related to the seed source of the stock. Generally, the change in color is a response to changes in temperature and light quality. In some years the yellowing is more severe than in others. This can be related to the particular climatic conditions during that season.

We cannot recommend any soil or foliage application of nutrients to help this situation. As a matter of fact, fertilizer is not generally recommended on Scotch pine plantings. This species is an excellent forager for plant nutrients on even the poorest sites. The problem with it is usually one of retarding excessive growth to get good shape for Christmas trees, rather than growth stimulation.

The real solution to the problem of winter yellowing of Scotch pine is to start with seedlings from the proper seed source. Seed sources recommended for Christmas trees in Michigan are the French blue and Scotch highland. The Spanish blue have the best color, but have suffered some winter injury on several sites.

CONTROLLING WEEDS

Controlling weeds is an important consideration from planting time to harvest. Weeds in Christmas tree plantations compete with trees for soil, moisture, and nutrients. They often compete for space and result in poorly shaped trees. During the first few years, weeds frequently hide the tree rows which may result in injury to some rows during mowing operations. Reduced survival, stunted growth, poor foliage color, and prolonged rotations caused by weed competition have been clearly demonstrated in research plots.

Scalping or Furrowing

A limited control of weeds can be obtained by scalping or furrowing at the time of planting.

There is no question but what removing the upper sod layer and laying it away from the tree area does temporarily eliminate weed competition. There is also some evidence — although it is somewhat conflicting — that furrows provide catchment areas for precipitation and give some protection from the sun and drying winds. In the past, effective plantation establishment would have been difficult, if not impossible without furrowing, especially on heavy-sodded areas.

There are some disadvantages of the furrows, however. From a soil fertility standpoint, scalping a furrow removes the most fertile part of the soil profile, namely the topsoil, and the tree roots are frequently placed in the relatively infertile subsoil. Trees are sometimes covered by erosion of the soil from the side, and where the furrows are planted across slope or on somewhat of a grade, water running in the furrows frequently creates a serious erosion problem. In certain instances the furrows also serve as runways for destructive rodents, such as mice and rabbits. Of equal importance are the mechanical barriers that these furrows create to the movement of people and machinery within the plantation. Even if we discount the vociferous objections of hunters and other people who cross the land, the mere fact that you have a physical impediment to the movement of spray rigs, mowing machines, and, ultimately, harvesting equipment is, in itself, a good reason to look for a better way of establishing trees in areas of heavy weed competition without the furrow.

Mowing

Many growers are now eliminating furrowing from their planting operations. Some growers get satisfactory control by mowing alone. These methods have some use in managed plantations but are often not sufficient to do a good job, particularly on the more fertile soils. In addition, by the time the weeds are large enough to mow they have already taken their toll of moisture and nutrients.

Some growers have tried clean tillage before planting followed by cross cultivation for the first two or three years after planting. This is an expensive operation and hardly suited to any but small operations located close to the owner's residence and machinery. Some injury to roots and tree crowns is inevitable during each tillage operation. Even at best, clean tillage and cultivation of Christmas trees is inferior both in quality and cost to a good combination of chemical weed control and limited mowing. The clean cultivation of fields prior to plantation establishment will often aggravate, rather than reduce, weed problems. Ordinarily it is better to limit soil preparation and weed control measures to the planting strip.

The best weed control is accomplished with herbicides.

Use Herbicides Effectively

The proper application of four common herbicides, simazine, amitrole, 2,4,5-T, and dalapon, either alone or in combination can provide adequate weed control in almost all plantation situations. Frequently one mowing operation followed by recommended weed control will provide the necessary release to get new plantings off to a good start and out of the weeds.

Amitrole and 2,4,5-T are absorbed directly from plant surfaces and are transported throughout the plant. Simazine is taken up primarily through the root system. It does not leach readily through the soil but remains in the surface layer. Undesirable levels may accumulate, particularly in coarse soils through repeated applications. Dalapon is absorbed by the foliage and the roots. It is primarily used for grasses such as quack grass. Use of a wetting agent improves its efficiency.

The common weed control herbicides, except for 2,4,5-T, are usually used in water sprays. The recommended rate of herbicide per acre is more important than the amount of carrier. Users are cautioned to follow manufacturer's instructions carefully to avoid injury to plants and equipment.

The recommendations listed in the table on page 8 will provide satisfactory and economic control of weeds under the five most common plantation situations. These techniques have been successfully used by growers in the principal Eastern Christmas tree production areas.

How Much Does Weed Control Cost?

In most plantation rotations, it will be necessary to apply herbicides for two successive growing seasons. In plantations that are established with the simazine treatment at planting time, a follow-up with simazine in the second growing season is usually adequate to keep the plantation rows free of weeds. Ordinarily it is then a simple matter to mow between rows until such time as the trees are well established above the competing vegetation.

The material cost of common herbicides is given in Table 1.

Table 1 — Retail Costs of Common Herbicides

Herbicides	Cost	Rate Per Acre Treated	Cost Per Acre of Plantation*
Simazine 80W	$2.50 lb.	5 lb.	$4.17
Amizine	2.85 lb.	7 lb.	6.65
Dalapon	.97 lb.	15 lb.	4.85
2,4,5-T (4 lb. acid equivalent)	9.30 gal.	variable	variable
Amitrole-T	9.35 gal.	2 gal.	6.23

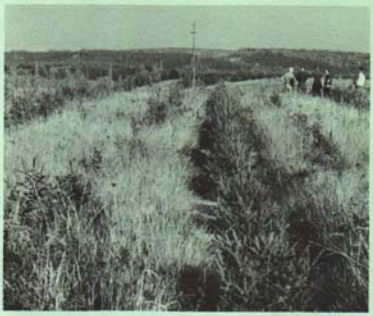
* *To treat 2-feet wide band in plantations with rows 6 feet apart.*

Labor and equipment costs must be added to the material costs in the weed control operation. Several rules of thumb may be used effectively. Directed spray applications with back pack pumps usually require from three to four man hours per acre of plantation. Band applications over the top of trees as with simazine go somewhat faster and run about two to three man hours per acre of plantation.

All of these herbicides can be applied mechanically either in conjunction with the planting machine or on separate tractor-mounted rigs with proper arrangement of booms and nozzles. Many operators will find that they can operate just as well with hand-operated equipment as they can with mechanized rigs.

Where the operation can be mechanized, a rule-of-thumb figure for the Northern Christmas tree growing region would be $6.00 an hour for the use of equipment and operator. Our experience shows that band treatments or complete coverage take between a half and three-quarters of an hour of operation per acre. A comparison of material, equipment, and labor costs shows that costs are about equally divided between material and the cost of getting it applied.

The cost of hand application of a directed spray (Table 2) was between ¾ and one cent per tree per treatment.



Fertilization plus weed control for quality trees (five years after planting). Taller rows of white spruce in center and far left and far right have been fertilized at the time of planting and protected by intensive weed control in row.

WHEN USING HERBICIDES!

1. Read and follow directions and precautions on label.
2. Use nozzles with replaceable tips which give a coarse, low pressure, flat fan spray when using amitrole, simazine or dalapon. Suggest 8002 Teejet or equivalent.
3. Keep amitrole, amitrole-simazine combinations, and 2,4,5-T off the foliage of evergreens.

Tree planting without furrows. This balsam fir was spring-planted by machine without turning furrow in heavy quack grass sod which had been sprayed the preceding fall with 20 pounds of dalapon per acre. After planting, 5 pounds/acre of simazine 80W was sprayed over the trees.

Table 2. – Weed Control Costs – Directed Spray – 2 Foot Band – 1962*

Spacing	Area (acres)	Trees per acre	No. Trees	Labor per Tree (cents)	Amizine (cents)	Total per Tree (cents)
6 x 6	3.0	1,200	3600	.50	.50	1.0
5 x 5	2.5	1,750	4375	.40	.50	0.9
4 x 5	2.5	2,100	5250	.35	.40	0.75

* *Rhinelander Paper Co., Wisconsin: White spruce plantations treated with direct spray of amizine in 2-foot wide band using amizine at 8 pounds per area; back pack pumps equipped with Monarch nozzle ¾ x #39 – 160° held 16 inches above ground at 30 psi.*

4. Calibrate your sprayer. Use water for trial run on road or driveway.
5. Use agitator in sprayer with simazine or combination herbicides containing simazine.
6. The rate of chemical applied per acre is more important than amount of water.

These suggestions are based on manufacturer's recommendations and research at Michigan State University. No endorsement of any particular commercial product is intended or implied.

CAUTION

Safe and effective dosages are recommended in this publication — to exceed these may result in damage to the trees.

Black spruce planted in heavy weed cover on poorly drained soil has been released with a directed spray of simazine plus amitrole (left). Without weed control, trees on this site are choked by weeds (right).

These spruce trees were planted in a clean-tilled field. A post-planting treatment with simazine 80W has kept row relatively weed free for two growing seasons (left). Trees planted in clean-tilled field without weed control are stunted (right) or dead.

Weed Control in Christmas Tree Plantations

Plantation Conditions	Control Measures	Remarks
1. New plantings in annual weeds and grasses, when established vegetation has been deadened or clean tilled; also when trees are planted in furrows.	2-4 pounds per acre of active simazine* — in 50 to 100 gallons of water. (Five pounds of 80W has 4 pounds of active simazine.) On coarse sands use 2 pounds per acre rate.	Apply in coarse, low pressure (20 to 30 psi) water spray in 24 to 30 inch band over planted trees right after planting. Not necessary to keep spray off trees. Spray should wet soil in treated strip. For example: Five pounds of 80W should treat 3 acres when rows are 6 feet apart.
2. As above with weed trees and shrubs	Before planting, cut woody brush. Use a low volatile ester of 2,4,5-T, 3 parts concentrate in 100 parts of diesel oil, as a stump spray. If large numbers of multiple stems make cutting impractical, a basal spray to thoroughly wet root collar zone with same material is suggested. After planting, apply simazine treatment above (1).	This can be done after planting but only during dormant season (October to March) with care to avoid getting spray on new trees.
3. New plantings on heavy sod. (When no weed control has been accomplished the preceding fall.)	Treat proposed planting strips with 2 gallons per acre of Amitrole-T† in 50 to 100 gallons of water. Wait 7 to 10 days before planting. Use of furrows should not be necessary. After planting use 4 pounds per acre rate of simazine. Repeat simazine treatment following spring if new weeds appear. Mow between rows when necessary. **ALTERNATIVE:** Mow field strips just before planting. Plant in slit or hole without turning sod. Wait until rain refirms soil around roots. Use directed spray of simazine-amitrole combination (see control measure under condition 5).	Amitrole-T is most effective in spring when weeds are actively growing (4 to 6 inches tall). Thoroughly wet foliage. Use coarse, low pressure (20 to 30 psi) spray.
4. Projected plantings for following season in heavy sod, particularly quack grass.	Mow proposed planting strips in late summer. After 3 to 6 feet of new growth appears, treat (before October 1) planned planting strips with 2-feet wide band of dalapon at rate of 15 to 20 pounds in 100 gallons of water per acre of treated strip. Plant following spring in strip and follow planting with control measures in (1) above. Repeat simazine treatment early in second season if weeds start to grow in planted strip.	See No. 1. Mowing may be necessary to control grass between rows. A small amount of wetting agent will increase effectiveness of dalapon. Use of amitrole fortified with ammonium thiocyanate (sold as Amitrol-T) at 2 gallons per acre rate may be substituted for dalapon.
5. Established plantings. Heavy weeds and grasses around trees seriously affecting growth.	Mow, if possible. When weed regrowth starts, use directed spray of simazine-amitrole combination‡ at rate of 7 pounds per acre in 100 gallons of water spray early in season. Wet foliage of weeds and grass. (For spot treatment — 1 cup of mixture in 4 gallons of water should treat about 1,200 square feet.	Important to keep spray off foliage. Leaves may turn white and then drop off: Spruce more resistant than pine and can probably withstand foliage spray before buds break. Use coarse spray working close to ground and up to stem of trees. Avoid drift.

* Simazine 80W (simazine) is absorbed through root system. It persists in upper layer of soil. Soil surface *should not* be disturbed after treatment.

† Amitrole (amino-triazole) is absorbed mainly through the foliage. It works best when weeds are in young succulent stage. The effect shows up first as a whitening of foliage (destruction of chlorophyll). Acts slowly — may be a week before reaction is noticed. Commercial concentrates of Amitrole-T contain 21% amino-triazole.

‡ A mixture of 3 parts simazine and 1 part amitrole. Kills established weeds and gives a residual control of germinating weed seeds. The amitrole component may damage evergreen foliage. Should be used as a directed spray — on the weeds and off the trees. Sold under trade name AMIZINE. A LIQUID-AMIZINE recently on the market has a more desirable ratio of the two herbicides; however, it should be used at 4 times the rate of the powdered AMIZINE. *Examples:* instead of one cup of AMIZINE in 4 gallons of water, use 1 quart of LIQUID-AMIZINE in 4 gallons of water.

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