Hemlock Production

(draft)

Tsuga canadensis (Canadian Hemlock)

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Seedling Production

Cones ripen Sept--Oct. Brown cones should be harvested as soon as they mature to prevent losses due to the release of the winged seeds. Cones collected just as they turn tan will open readily upon drying. A pound of cleaned seed contains about 187,000 seeds. Maintain moisture content between 6-9 percent. Seed stored at 41 F degrees in sealed containers can remain viable for 4 years. Dormancy is variable. Stratification accelerates and improves total germination. Cold, moist stratification at 33 to 41 F degrees for 1-4 months is recommended.

You may request specific information on fumigation and bed construction and management, but here are a few comments. Select a well drained site in full sun. Collect and have a soil sample of the area tested. Beds are usually 4 x 48 feet, running north-south if possible. Place cross-ties, landscape timbers or 2x6's around edge to hold the soil in place and provide something to nail to.

Broadcast any lime, phosphate and potash. Add 2 inches of pine bark flakes or fines, till in; add another 2 inches and till in. Avoid adding sand. Peat moss is okay, but won't last as long as the pine bark and is surely more expensive. Crown the bed length wise and rake the bed smooth. Fumigate each bed with 3-1lb. cans of Methyl Bromide equally spaced in the bed when the soil temperature is more than 60 degrees. Fall is good. Cover and seal air tight with poly before releasing the gas.

Something must be built to support the shade cloth and poly. Scrape lumber, PVC pipe bows and wire can be used. A 5.5 - 6 foot length of concrete reinforcement wire can be bowed over and nailed to the timbers. Multiple sections of wire are placed side by side, moving down the bed. The shade cloth and poly are stretched over the wire and held in place with a nailed strip.
Sow 40-50 seed per square foot in March after stratification into fumigated beds in full sun, but under shade cloth. Grow them 1-2 years in the seedling bed and 1-2 years in a transplant bed for a total of at least 3 years.

Liner Selection and Care

Hemlock seedlings are difficult to grow in an open field, under full sun. They are easily damaged in hot sun and their small size makes them susceptible to frost heaving the first winter if fall planted. The area producers that plowed theirs with a mule, say, to not plant a hemlock in the field that's not big enough to shade its own root system.

Conifer seedlings are produced as 2-0, 1-1, 2-1 or 2-2's. The numbers refer to the number of years in the seedling bed and transplant bed respectively. A 1-0 is only 1 year old and is too small to go straight to the field. A 2-2 is 4 years old.

If buying your hemlock seedlings, consider planting the (1-1, 2-0, 2-1) seedlings into a liner row or transplant bed for 1-2 years with irrigation. Let the seedlings grow a larger root system before being spaced out to ball. This frees up some land. It also allows the expected mortality to occur without tying up land for 5 years. Provide shade as mentioned below. A vigorous 2-1 or 2-2 can go straight to the field.

Before producers began collecting and planting seed into beds; producers collected 12 inch seedlings from the wild and grew them for 1-2 years in beds under natural shade. It is necessary to prune off one-third to one-half of the top on collected seedlings before transplanting them into a transplant bed. Cut off any damaged roots. All of this helps to prevent excessive moisture loss while an adequate root system grows and becomes established.

Collected seedlings should be shaded the first year with 30 percent shade if above 2000 feet elevation and 50 percent shade if below 2000 feet or on a south or west facing slope. Frequent irrigation will be necessary for the first month or so.

Site Selection

Hemlocks require a very well drained soil, like dogwood and peach. Select a site without a fragi-pan; where water never stands. They will do perhaps 30 percent better at the higher elevation on the Plateau at 1800 feet, than at 900 feet in the valley. The Plateau can have areas of rock outcroppings and shallow soil over bedrock. A shallow soil will not keep a hemlock alive during a drought.

Avoid a field with a full southern exposure or a field with sweeping drying winds. Hemlocks are native to the mountains. The environment in which they do best is difficult to duplicate at lower elevations.

Fertility

Hemlocks grow best with a soil pH of *5.0--6.0. A medium to high level of phosphorus and potassium is desirable. Soil test early enough so that any lime, phosphate or potash can be broadcast prior to planting. Request calcium and magnesium in addition to the basic test of phosphorus, potassium and pH. Apply Dolomitic lime if lime is recommended.

Sidedress Feb-March and late June with no more than 50 pounds of actual nitrogen per acre. Avoid getting fertilizer on the foliage, for fear of burn. Many producers hand fertilize when they can't perform other tasks. They put the recommended amount in a circle at the drip line. Examples of 50 lbs. of actual nitrogen per acre: 150 lbs. 34-0-0 or 250 lbs. 20-10-10 or 385 lbs. 13-13-13 or 333 lbs. 15-15-15 per acre.

North Carolina also base their recommendations on the nitrogen content, but on a rate per plant. They recommend 1/4 ounce of actual nitrogen per 1 year old plant; ½ ounce per 2-3 year old hemlock; and 1 ounce nitrogen per plant for plants 4 years and older, regardless of the analysis.

If using 34-0-0, the 1/4, ½ and 1 oz. rates require 3/4, 1.5 and 3 ounces respectively of actual 34-0-0. If using 15-15-15, the actual amounts would be 1.5 oz. for each 1 year old hemlock, 3 oz. for each 2-3 year tree and 6 ounces for each plant 4 or more years old. This is by weight.

Consider spreading and incorporating **chicken litter** prior to planting if available. Each ton may supply 30-30-30 in actual nutrients; releasing half of the nutrients during the first growing season applied. New ground (timber just cleared) can take up to 4 or 5 tons per acre, spread and plowed in prior to planting. No additional fertilizer would be required the first year. Only half of what UT recommends would be required the second year. Soil testing medium in phosphorus and potassium should receive no more than 2 tons per acre. Caution: Strive for a good even spread. Too much nitrogen can burn young, tender hemlock roots.

Field Spacing

Spacing of hemlocks in the field depends upon the size expected to be harvested. Hemlocks' are sold as conical or pyramidal coniferous evergreens and properly grown material should not be less than a 5 to 3 height to spread ratio, according to the ANLA Nursery Standards. For example, a 5 foot hemlock should be at least 3 feet across at the base. A 7 foot hemlock should be at least 4 feet wide at the bottom. The height of coniferous evergreens is measured midpoint between the upper-most whorl and the tip of the leader.

Plant a minimum of 5 feet apart within the row to harvest a 6 foot Hemlock and 6 feet apart to produce a high quality 8 foot hemlock. Middles should be at least (width of widest tractor or implement used in middles plus 2.5 feet per side = 4' implement + 5' = 9' middle. It is critical that sunlight reach the lower branches to keep them vigorous and strong, so they will remain long.

Plant population per acre at various spacings (no roadways):

5x5 = 1,742	6x6 = 1,210	4.5 x 5 = 1,936
5x6 = 1,452	6x7 = 1,037	4.5 x 6 = 1,613
5x7 = 1,245	6x8 = 908	4.5 x 7 = 1,383
5x8 = 1,089	6x9 = 807	4.5 x 8 = 1,210
5x9 = 966		

Remember to skip a row or leave a 10-12 foot roadway to load and spray from. Consider 4-6 rows per block. If hand dug, how far do you desire to carry 500 pounds? An air blast sprayer will be required for pest control. An air blast sprayer should be able to penetrate the foliage on 4-6 rows of dense hemlock foliage. A tree spade will also require space to maneuver without damaging adjacent plants. A 4 row block offers 50 percent of its plants to a spade.

Planting

Some producers favor September, some November. September can be good at the 1800 foot elevation; November safer at 900 feet. Can vary with the year. Hemlock liners have been heaved out of the ground during the winter, but fall planting is best otherwise. Dipping the roots in Terrasorb just prior to transplanting into the field is a good idea.

Exercise caution to not plant too deep. Hemlock are very sensitive and will not tolerate being too deep. It is also critical not to allow cultivation to throw additional soil over the roots. Some producers replace the disc blade that throws the soil with a smaller diameter blade.

Irrigation

Water can be very critical during the first two years, any serious droughts and to facilitate fall digging. Few producers have irrigation, but it is good insurance. It is no fun trying to haul water. NC State Univ. research found that irrigation produced a foot more growth in 4 years.

Insects

Refer to UT Ext. pub. 1589 for a complete list of potential insects and the recommended controls. Hemlocks will likely be attacked by Eriophyid or rust mites, spider mites or spruce mites periodically. The Eriophyid or rust mites are difficult to impossible to see with a 10x hand lens.

Collect numerous 2-3 inch samples of foliage from inside random plants located in the middle rows; where sprays would be the hardest to reach. Place in a plastic bag and refrigerate until it can be taken to local Extension office and sent to the UT Diagnostic Clinic.

Different miticides or insecticides are required sometimes. Kelthane is recommended for all three; but overuse can lead to resistance. Dormant oil kills all life forms and is very effective in late winter.

Disease

Refer to UT Ext. pub. 1234 for a complete list of potential diseases and the recommended controls. Phytophthora Root Rot can be a problem if the site is poorly drained or during very wet periods. Strive to select a well drained site.

Herbicides

Refer to UT Ext. pub. 1226 for a complete list of pre and post-emergent herbicides. Weeds must not be allowed to shade out lower foliage. Devrinol, Factor/Barricade, Gallery, Kerb, Pendulum WDG, Pennant, and Princep/Simazine are labeled for pre; and Envoy, Fusilade T/O, and Vantage are labeled for post use.

Be extremely cautious with Roundup. Producers have severely damaged and even killed 1-3 year old plants by spot spraying weeds, held away from the hemlock. The weeds spring back, slapping the hemlock foliage with the wet weed foliage, transferring the Roundup. A year later, the hemlock will have a dead side; and sometimes dead roots directly below.

Pruning

Quality Hemlocks require more than 1 annual shearing. Avoid pruning within 6 weeks of frost, but they can be pruned in mid to late winter if they need it. (Late pruning would force a flush of growth that would surely be winter killed.) There is no demand for natural, unsheared Hemlock. Maintain 1 central leader.

The tool used may be manual hedge shears or powered shears. Many find the branches not stiff enough for a knife. Consider the SAJE powdered device for speed and uniform appearance. It shears hemlock, upright hollies and pines easily. The motor is carried on a backpack frame and powers a 6 foot sickle bar held at an angle while the operator walks around each tree. Uneven terrain can make the task more difficult. The SAJE is heavy and most workers like to rest every hour or so. But the uniform quality is amazing and makes the effort well worth the trouble. Every tree will look like the first. A 2 foot extension is available. Several local producers like theirs. A source is 1-800-530-7218.

Remember to be alert for snakes, wasps and hornets. Drink liquids and be alert for heat exhaustion. Don't do this type of work alone in remote areas. Wear the proper safety equipment. Leg guards, boots and protective gloves are essential when shearing with a knife. Carry a stick in the idle hand or hook a finger in your belt to keep it busy and avoid cutting it.

The traditional pruning method is pruning to a salable 60 percent taper during the winter and maybe again in mid-summer. North Carolina State University research found that a foot of extra vertical growth was obtained in 4 years by selecting one single

leader to grow and not cut it, never limiting vertical growth until the plant reached 6 feet tall or the salable height desired. Sides were sheared to maintain taper and encourage branching to make the plant full.

Harvesting

Six foot Hemlock's are probably a 5-6 year crop; depending on soil type, fertility, moisture, growth rate, pruning, etc; with harvesting occurring the last 2-3 years.

Digging the Correct Size Ball

The American Standard for Nursery Stock was written by the American Nursery & Landscape Assoc. (ANLA) (formerly the American Assoc. of Nurserymen, AAN). It establishes techniques for measuring plants and rootball size for particular plant sizes and different plant types. A copy of the Standards may be obtained by contacting the ANLA at 202-789-5980 ext 3019 for a few dollars.

A naturally grown hemlock that has never been pruned can be dug with the ball sizes listed in Table 16 on page 21 of the Standards, in the Coniferous Evergreen section. A portion of Table 16 is reproduced below. The minimum ball size is stated based on the tree height. Rather straight forward, but how do you measure the height of a natural hemlock and be fair to the buyer. After all, the leader may be 24-30 inches taller than the first side branch. Figure 18 on page 19 of the Standard states, "The upper limit for determining average height for type 4 conifers (hemlock) is midpoint between the uppermost whorl and the tip of the leader." The drawing helps the explanation.

Section 3.2.1, page 21 has an interesting statement: **"Note:** Where it has been a cultural practice to shear, prune, disbud or otherwise impede the natural growth rate of this group of plants, ... trunk diameter shall be used to determine the minimum ball size of trees. Measurement of trunk diameter shall be made within 6 inches above ground level. Minimum ball diameters shall be those established under Section 1.3.1 "Shade Trees", Types 1 and 2 on Table 5. Ball depth shall also be established as in Section 1.3.4 (Ball Depths)." A portion of Table 5 is reproduced below. These specifications are for hand dug or machine dug balls.

A 6 foot sheared hemlock with a 3 inch trunk would require a minimum of a 32 inch root ball; while a natural hemlock would require a minimum of a 22 inch root ball. Sheared hemlock trees require a larger rootball than natural hemlocks to survive. It makes sense because a sheared tree has more needles to be fed and watered.

Producers are not legally bound to follow the ANLA Standards. Buyers should ask if a nursery follows the Standards before placing an order or include it on the bid sheet or Spec. Sheet. Producers must be watchful of plant QUALITY. Ball size and condition is a major consideration.

Table 16

Natural Hemlock

Height	Minimum Ball Diameter
4 feet	16 inches
5 feet	20 inches
6 feet	22 inches
7 feet	24 inches
8 feet	27 inches
9 feet	30 inches
10 feet	34 inches
12 feet	34 inches
14 feet	42 inches
16 feet	46 inches
18 feet	50 inches

Table 5

Sheared Hemlock

Caliper	Minimum Ball Diameter
1 1/4	18 inches
1 ½	20 inches
1 3/4	22 inches
2	24 inches
2 ½	28 inches
3	32 inches
3 ½	38 inches
4	42 inches
4 ½	48 inches
5	54 inches
5 ½	57 inches
6	60 inches
7	70 inches

'Sudden Death Syndrome'

Hemlocks seem to be able to die with no obvious reason, at any age. When troubleshooting, consider: roots too deep, roots damaged by insects or voles, drought, busted bark at soil line caused by freezing temperatures, soil too wet, too hot, roots too severely pruned at planting, over-fertilized, etc. Some liners can hang on for 1-3 years, never thrive and die one by one.

If seedlings died a few days to a few weeks after being transplanted: Did roots dry out in storage, in transit, on transplanter? Did the top dry out from drying winds following transplant? Was the soil very dry at transplanting, with no rain or irrigation? Was the bed fumigated and the gas not allow to escape prior to transplant?

Container Production

Hemlocks in containers require 47-50 percent shade during the growing season and over-wintering houses covered with white poly.

References:

"American Standard for Nursery Stock", American Association of Nurserymen, ANSI Z60.1-1996, approved Nov. 6, 1996, Section 3: Coniferous Evergreens. Obtainable by calling 202-789-2900.
Bir, Dick. 1986. Conversation. Dick is NC State Univ. Ext. Nursery Specialist in Western NC. 828-684-3562
Dirr, Michael A. 1998. Manual of Woody Landscape Plants, Stipes Publishing, Champaign, IL. 5th ed.
North Carolina Agr. Ext. Service, Nursery Crops Production Manual, chapters on Producing Conifer Transplants and Growing Hemlock.
Peek, Bobby. NC State Univ. Agr. Ext. Service, Buncombe County Ext. office, Commercial Hemlock Production handout, 1984.
Tilt, Ken. 1987. Conversation. Ken was UT's Extension Nursery Specialist at time; now Auburn's Nursery Specialist. 334-844-5484.

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hemlock March, 2002 crop file

* Hemlock woolly adelgid is being called the single greatest threat to hemlocks in North America, according to USDA Forest Service. The pest has infested 12 states from southern New England to South Carolina and goes as far west as West Virginia. Hemlock is a valuable nursery crop in Ohio and officials there are seeking to keep HWA out of the state. Ohio Dept. of Ag. and ONLA are discussing a quarantine to prevent infested hemlocks from entering Ohio. Tom Harrison, ODA Div. of Plant Industry representative, said the quarantine could go into effect this month. ODA Plant Pest Control office; (614) 728-6400. 8-2002