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TAXUS PRODUCTION IN THE U.S.A.

RALPH SHUGERT

Zelenka Evergreen Nursery
16127 Winans Street
Grand Haven, Michigan 49417

The genus *Taxus* is probably one of the finest narrow-leaved evergreens for use in the landscape. The literature tells us that *Taxus* fossils have been found between layers of sandstone and shale originating about 150,000 years ago. (1) The genus has long been associated with religion and most of the Christian churches were built in yew groves throughout England. In the United States, the genus appeared in horticulture in the mid-1800's and much of the early popularity was due to the work of T. D. Hatfield, who was the head gardener at the Hunnewell Estate at Wellesley, Massachusetts (2).

There has been quite a bit of controversy as to exactly how many species of *Taxus* truly do exist. There are at least 3 species relatively universally accepted - *Taxus baccata* (English yew), *T. canadensis* (Canadian yew), *T. cuspidata* (Japanese yew). In the United States the English yew is only hardy in certain areas of the country. This species is not hardy in my state of Michigan.

The Canadian yew is a native species ranging from Virginia to the Great Lake Forests in the U.S.A. This plant, unfortunately, only thrives well in the shade and cannot tolerate full

sun. To my knowledge, the only hybrid being grown in the United States today is *Taxus* × *hunnewelliana*. Apparently, this hybrid is a chance cross between *T. canadensis* and *cuspidata*.

The Japanese yew was brought into the United States from Japan in the late 1860's and has been crossed with *T. baccata* to give the *Taxus* × *media* forms. The majority of the *Taxus* grown in the United States are *T. × media* cultivars. *T. cuspidata* 'Capitata' is also widely grown and is generally propagated sexually, which will be discussed later.

The major area of *Taxus* production in the U.S.A. is from the East coast to about the Mississippi river. The largest single producer of *Taxus* is Zelenka Evergreen Nursery, located at Grand Haven, Michigan, which is made possible by the very favourable microclimate of Lake Michigan. This nursery has approximately 1,000 acres of field production plants, approximately 5,000,000 plants in liner beds and is sticking approximately 2,000,000 cuttings annually. In addition to the cutting propagation, 350 lbs of *T. cuspidata* 'Capitata' seed are sown annually.

In addition to Western Michigan, there are sizeable *Taxus* production in Southern and Western Illinois and in the northeast corner of Missouri. Only a relatively small amount of production occurs west of the Mississippi river and below the Mason-Dixon line (along the southern border of Pennsylvania) and virtually no production in the Southern or Southwestern states, due to extreme summer heat and the fact that plants in this genus do not grow well in excessively warm soil temperatures.

The propagation techniques used at Zelenka Nurseries, are outlined below:

SEXUAL PROPAGATION

The sexual propagation of *T. cuspidata* 'Capitata' is handled differently than in most U.S.A. nurseries. All of the seed of this cultivar comes from Japan and is received in March or early April. It is stratified in sand boxes, outside, for a minimum of 12 months. Seed of this cultivar must have 12 months stratification; if it does not receive the full 12 months, the seed will lie for an extra year after sowing before germinating.

After the 12 month stratification period the seed is removed from stratification boxes and the sand is washed from the seed, which are then sown in wooden flats at the rate of 1,000 seeds per flat. Germination ranges from 30 to 35 percent, depending on viability; the flats are maintained in poly covered houses for two years. After germination, the polyhouses

are covered with shade cloth during the summer and held in houses with no heat. At the end of the second year, seedlings are removed from the flats and transplanted to a liner bed using a 10 row planter. These beds are in large lathhouses, 2,000 feet by 200 feet. The plants are held for three years before planting in the field.

ASEXUAL PROPAGATION

1. **Taking cuttings.** *Taxus* cuttings are taken in the fall after they have been subjected to several hard, killing frosts. In western Michigan, this is late October to early November. Cuttings are harvested either by machine or by hand. The bulk of the cuttings are harvested with a modified pull type combine which has a cloth belt. This combine will accommodate two field rows, or one liner bed of ten rows. This technique has reduced the harvest cost of cuttings considerably, since two people can harvest the equivalent of 200,000 cuttings in four hours, where in the past it took a crew of 16 to 20 people eight hours to accomplish the same number.

2. **Preparation of cuttings.** Cuttings are handled at Zelenka's both stripped and unstripped. The majority of the 2,000,000 cuttings stuck annually are not stripped. It is our belief that wounding a *Taxus* cutting is not necessary and the labor saving is considerable. The fear of decayed needles in the medium, eventually causing basal decay of the cutting, is unfounded. The cultivars that are hand cut are normally those plants that do not accommodate the machine, or plants that are going to be saleable the following spring, so great care is taken when taking cuttings from those plants.

All benches are labeled for cultivar, the farm these cuttings come from, as well as the usual other data — stripped/unstripped, hormone, etc.

3. **Sticking.** The cuttings are stuck in raised sand benches with bottom heat and minimal top heat. The bottom heat starts at 70°F (21°C) and as rooting progresses, the bottom heat is reduced to 60°F (15°C). The cuttings are stuck by using a board and knife, slitting through the sand, and two people stick, facing each other, starting in the center of the bench working towards the aisle. The sticking rates are 2,000 cuttings per hour, per person, and these crews work a 9 hour day. All *Taxus* cuttings are hormone-treated. Zelenka uses Wood's Rooting Hormone as well as Chloromone. The strengths of both of these liquid hormone products varies with the cultivar and condition of the wood.

4. **Culture.** After the plants are stuck in the benches, the watering is either by hand, or by manually operating the mist controls. It is important to create high humidity with a mini-

mal amount of water in the medium. This is one genus of plants that "does not like it's feet wet". Preventative spray programs are used primarily for fungus gnat problems and any other insect that might appear during the life of the crop. After rooting, which normally is in late February or early March, a liquid fertilizer program is employed through the mist lines.

5. **Harvest.** The cuttings are lifted from the benches in early to mid-May. They are well-rooted to this point, with both primary and secondary roots, but the fear of planting out and encountering a late spring freeze in late May is always a concern. If benches are needed for early softwood crops, the cuttings can be pulled, packed in wax lined boxes, and stored at 35°F (2°C). This has been done for several years and cuttings have been stored for 60 to 70 days with perfect survival after planting. After cutting removal, the benches are cleaned, and prior to sticking the next crop, they are cleaned with a Clorox bleach (1:10) to the point of run-off through the drain holes in the benches. There are some trial benches of perlite/sand combinations which are being used for the 1984-1985 crop.

LINER FARM PLANTING

Prior to planting at the liner farm the beds are prepared and the final treatment is a tank mix of Treflan and Lindane which is roto-tilled into the beds. The rooted cuttings are planted with a 10 row planter, and a crew of 12 people will plant 90,000 rooted cuttings in a 10 hour day. After planting, only a preventative spray program and minimal herbicide applications are carried out. The plants are fertilized annually, using a fertilizer formulation to allow 100 lbs of actual N per acre per year.

The top pruning is carried out with the combine, described previously for harvesting cuttings. Root pruning at the end of the second year is done using a Swiss made machine, "Fobro", which has a vertical root pruner attachment as well as the horizontal root pruning blade. Tunnels are fixed to a draw bar and cover the plants to avoid damage. The harvest is at the end of the third growing season and we do not fall-harvest these plants. We try to coordinate our liner farm harvesting in the spring to coincide with the field planting. Plants are harvested with the "Fobro" multi-row lifter shaker and the root pruning blade allows mechanical pruning rather than hand pruning prior to field planting.

FIELD PLANTING

As the plants are planted in field rows, the ground preparation is very similar to that at the liner farm, also using a pretreatment of Lindane and Treflan. The planting is done

using a two-row planter, with the rows 40 in. apart, and a three-row planter which allows the harvest of 8 to 10 in. and 10 to 12 in. plants. Field culture consists of cultivating frequently; the fertilizer treatments are based on soil analysis, but are usually about 100 lbs of actual N per acre per year. The herbicide application is primarily Princep which is applied by air in both spring and fall. The insecticide/pesticide spray program is again primarily preventative; the Fletcher scale is the most serious insect problem encountered.

The field harvest is unique in that Zelenka Nurseries uses a technique known as ball and pot rather than ball and burlap. The plants are balled out of the soil and then placed in a plastic container for sale. The nursery will harvest quite a few units in the fall and these are stored in unheated polyhouses for shipments in February and March. We normally can get into the field around the middle of March for the spring-dug plants. Plants are brought in from the field on 4-steer wagons after being run under a water rack and then placed in holding areas by cultivar and size. As the orders are gathered for loading, the order gatherers pick up the amount, cultivar, and size required for the order and take them to the loading docks. Most of the orders that leave the nursery are on shelves, using aluminum racks and boards. We rarely "tier-stack" orders. The nursery has the capability of loading 49 semi-trailer trucks daily from three shipping docks. A total of 1,026 semi-trailers were shipped in April, 1985.

SUMMARY

It is obvious that the climatic conditions of lower Western Michigan are extremely favourable for *Taxus* production. The combination of the microclimate from Lake Michigan, the light sandy loam soil, and favourable weather conditions all are very important attributes. This area of Michigan normally receives 100 inches of snow during the winter and the normal ranges in temperature are -5°F in winter to 90°F in summer.

The genus *Taxus*, has an extremely high landscape value. "The high quality appearance and maintenance-free aspect result in *Taxus* being classed as the best shrubby needle-type evergreen for landscape use" (3). I would most certainly have to echo these comments. The attributes of this plant cannot be over-emphasized.

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