IPM for Shrub Production

Edited by Amy Fulcher

UT Extension

UK Ag Horticulture

• Preface •

This manual is dedicated to Mr. Mark Halcomb, retired University of Tennessee Area Nursery Extension Specialist, who worked tirelessly to assist nursery producers large and small. His endless devotion to the Tennessee nursery industry was the rising tide that lifted all ships.

This manual is funded by USDA Extension IPM Grant in partnership with University of Kentucky Integrated Pest Management Program. The Nursery Crops project team, lead by Amy Fulcher and Win Dunwell, expresses appreciation to Dr. Ric Bessin, Ms. Patty Lucas, and Dr. Douglas Johnson for their support, Dr. Frank Hale and Dr. Alan Windham for their careful review of this document, and Ms. Andrea Menendez for early phases of document preparation and copy editing.

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We hope that you enjoy your complimentary copy of IPM for Shrub Production! Please help us gauge how effectively this book meets your needs so that we can continue to develop helpful resources! Please make your best estimate rather than leave questions blank.

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Please remove page & return to Amy Fulcher, UT Extension Specialist & Assistant Professor for Sustainable Ornamental Plant Production.
Email: afulcher@utk.edu, Fax: 865-974-1947, Mail: 2431 Joe Johnson Drive, Rm 252 Ellington Plant Science Bldg., Knoxville, TN 37996

• CHAPTER 4 •

YEWS

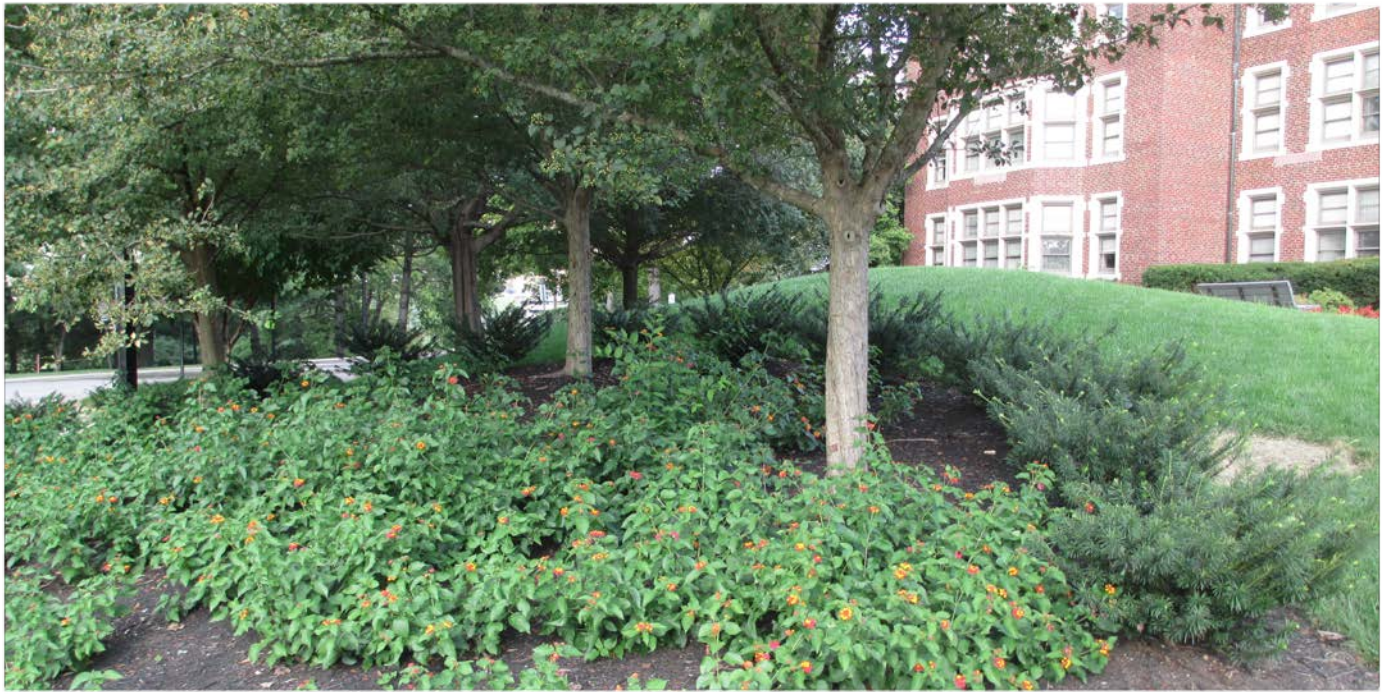
by Mark Halcomb,
UT Extension Area Nursery Extension Specialist

and

Amy Fulcher,
UT Assistant Professor for Sustainable Ornamental Plant Production and Landscape Management

Highlights

1. Taxus is an exceedingly common plant, with annual production valued at over $40,000,000.
2. Commonly produced yews in Tennessee are Taxus x media and Taxus cuspidata.
3. Taxus can be used as screens, hedges, foundation plants, in masses or as specimen plants.
4. Some Taxus are sources of taxol, a cancer fighting compound.



Introduction

Taxus, or yew, is a versatile, trouble-free, evergreen shrub commonly produced by nurseries. It has been considered overused by some landscape designers. However, it has remained a workhorse that has earned its place in the ranking by the nursery and landscape industry. The US nursery industry produced 3,439,104 yews valued at $40,638,000 in 2007 (USDA, 2009). In Tennessee, commonly produced yews are *Taxus* x *media* and *Taxus cuspidata*. Characteristics of commonly produced *Taxus* are in Table 4.1.

Table 4.1. Commonly produced yews in Kentucky and Tennessee.

SCIENTIFIC NAME	COMMON NAME	TYPE	MEASUREMENT	HABIT
Taxus cuspidata 'Capitata'	Capitata Japanese Yew	4	Height	Cone, pyramidal
Taxus cuspidata 'Densa'	Dense Spreading Japanese Yew	2	Spread (width)	Spreading
Taxus x *media* 'Densiformis'	Densiformis Yew	2	Spread (width)	Semi-spreading
Taxus x *media* 'Hicksii'	Hicks Yew	5	Height	Broad upright

Yew is very versatile in the landscape and can be used as a screen or hedge, foundation plant, in masses, or even as a specimen plant. Some species can grow 50' tall, although smaller cultivars are available. Yew has symmetrical, dark green foliage, has a moderate growth rate, is resistant to most insects, mites, and diseases, and tolerates sun and shade. As a pest resistant plant, yew is an ideal plant to produce using integrated pest management, or IPM, techniques.

Taxus are in demand as field grown, balled and burlapped plants and as containerized plants. Containerized refers to growing plants in the field, digging the rootball and placing it in a container with enough media to make it stable, creating the effect of having been produced in the container. Some *Taxus* are produced in containers.

Some *Taxus* species are sources of taxol, a cancer-fighting compound. Taxol is most concentrated in the bark of Pacific yew, *Taxus brevifolia*, and in the needles of *Taxus* x *media* 'Hicksii.' In the early 1990s, Zelenka Nursery in Grand Haven, MI grew 100,000 pounds (fresh weight) for the National Cancer Institute to help meet the emerging taxol shortage crisis and ease the demand for the harvest of Pacific yew for bark, which affected delicate ecosystems. A precursor to taxol found in twigs and needles of the European yew (*Taxus baccata*) and the Himalayan yew (*Taxus wallichiana*) allowed laboratory synthesis of taxol, easing the demand for bark from Pacific yews and collection of clippings from yews in eastern US nurseries (Hansen et al., 1994).

Highlights

1. Pest-free, adaptable plant.
2. Wet soil is cause of most death.
3. Mainly propagated by stem cuttings.
4. Taxus are not normally propagated by seed except for T. cuspidata 'Capitata'.
5. Yew seeds are highly poisonous and can cause death.

Taxus rooting in ground beds

Propagation

Yews are mainly propagated by stem cuttings taken in the late summer through winter (Dirr, 2009; Richey, 1986; Sabo, 1976). Most selections root readily. Cuttings placed under mist in a greenhouse root faster that those in cold frames but require more infrastructure and energy. High rooting percentages result from both greenhouse and cold frame-rooted cuttings.

For greenhouse propagation, collect 6-8 inch cuttings after several frosts in late fall/early winter and root in 100% perlite with 70F bottom heat and mist. Maintain the air temperature at 50-55F. Rooting is rapid (2 months), but be sure secondary roots have developed before harvesting the cuttings (Hartmann et al., 1997).

For cold frame propagation, collect larger, 8-10 inch cuttings (new growth with a piece of the previous year's growth at the base). To provide a wounding treatment, strip needles from the base of cuttings. After storage, the cuttings are recut and treated with 8,000 ppm talc or 5,000-10,000 IBA quick dip and placed in ground beds. Rooting is slow continuing into summer (Hartmann et al., 1997).

At some nurseries, yew cuttings are taken in late summer/early fall and then kept in cold storage until labor is available to root. This allows control over the cold storage conditions (eliminating exposure to temperature fluctuations that can occur outdoors), flexibility to delegate labor to time-sensitive tasks, and the ability to stick cuttings when weather is unfavorable for outside tasks. Therefore, storage conditions of yew cuttings can be important. Generally, storage conditions should be cold and damp. The warmer the storage conditions the more detrimental desiccating conditions become (Bruce and Rowe, 2000). Research with *Taxus* x *media* cultivars showed that 32°F was the ideal storage temperature for both rooting percentage and root mass.

In general, *Taxus* are not propagated by seed. However, Japanese yew, *T. cuspidata* 'Capitata', is usually propagated from seed. Seeds require a 68F stratification period in moist peat moss for 3 months after which they are subjected to 4 months of cold storage (Hartmann et al., 1997). Production from seed propagation is very slow. Plants require 2 years in a seed bed, 2 years in a lining out bed, and 3-4 years in a field nursery to grow to a marketable size. Seeds prices vary widely by species (Table 4.2).

Table 4.2. *Taxus* seed prices, 2012.

SPECIES	MASS		
	OUNCE	1/4 POUND	1 POUND
T. baccata	$14.80	$42.20	$78.05
T. chinensis	$6.80	$19.35	$35.80
T. cuspidata, spreading	$14.80	$42.20	$78.05
T. cuspidata capitata	$22.45	$63.95	$118.30

Yew seeds are highly poisonous and can cause death. Be certain all employees are aware of this by placing signs in English, Spanish, and any other pertinent languages in work areas as well as verbally communicate this with employees. Livestock can also be harmed or killed by ingesting yew seeds.

Highlights

1. Require well-drained soil, are tolerant of full sun.
2. Soil with a pH between 6.0-7.0 and a medium level of phosphorus and potassium is best for production.
3. Fluctuating temperatures and excess fertilizer can lead to plant damage or death.
4. Yews are sold as spreading, upright, or conical coniferous evergreens.
5. Be sure not to plant yews too deeply.

Production

Site Selection

Yews, like dogwood or peach, require very well drained soil. Select a site without a fragipan or hardpan, where water never stands. Yews are tolerant of full sun and do not need shade during production.

Fertility

Yews grow best with a soil pH of 6.0-7.0. A medium level of phosphorus and potassium is desirable. Soil test early enough so that any lime, phosphate, or potash can be broadcast prior to planting. Yews commonly turn a pale green to a

yellowish green color during the winter, possibly affecting sales.

Field-grown *Taxus*:

The normal UT Extension recommendation for all shrubs and conifers is no more than 50 pounds of actual nitrogen per acre applied in late February and again in late June (Table 4.3). This represents 100 pounds actual nitrogen per acre per year. Growers may encounter recommendations for more nitrogen from states farther north. UT Extension doesn't recommend higher nitrogen rates because late growth may not harden before low temperatures in early winter and be damaged. Kentucky and Tennessee are prone to fluctuating temperatures in the fall, winter, and spring. Fluctuating temperatures, as well as excess fertilizer, can create conditions that stimulate early spring and late fall growth and ultimately lead to plant damage and/or death.

Table 4.3. Fertilizer weight corresponding to 50 pounds of actual nitrogen per acre of root zone.

POUNDS OF FERTILIZER	FERTILIZER ANALYSIS[1]
150	34-0-0
333	15-15-15
250	20-10-10

[1]Nursery crops generally use a 3-1-2 ratio of nitrogen, phosphorus and potassium. Using a "high" middle number almost always over-applies phosphorus. This wastes phosphorus and the loss of phosphorus in runoff leads to eutrophication. Currently, phosphorus mines are expected to be depleted in as little as 50 years.

Container-grown *Taxus*:

Use controlled release fertilizer, medium or high rate.[1] If liquid fertilizer is used, cease applications by mid-September.

Field Spacing

Spacing of yews in the field depends upon the species, cultivar, anticipated size to be harvested, and equipment that will be used to maintain fields and dig plants. Yews are sold as spreading or upright (conical or pyramidal) coniferous evergreens.

Taxus cuspidata 'Densa' and *Taxus* x*media* 'Densiformis' are classified as type 2 spreaders; *Taxus cuspidata* 'Capitata' is classified as a type 4, cone type, upright pyramidal; and *Taxus* x*media* 'Hicksii' is classified as a type 5 broad upright type (Table 4.4).

Type 2 conifer spreaders will be wider than they are tall. Type 4, cone-type pyramidal should have a height to spread ratio of no less than 5 to 3, according to the ANLA ANSI standards. A type 5 broad upright conifer should not have less than a 2 to 1 height to spread ratio. Plant spreading *Taxus* a minimum of 3-4 feet apart within the row. Middles should be at least the width of widest tractor or implement used in middles plus 2.5 feet per side. For example, 3' implement + 5' = 8' middle.

Plant upright yews a minimum of 3-4 feet apart within the row. Middles should be at least the width of widest tractor or implement used in middles plus 2 feet per side. For example, 3' implement +

4' = 7' middle. It is critical that sunlight reach the lower branches so they remain healthy and covered by needles.

Plant populations on an acre depend on the spacing. Examples are given in Table 4.4.

Table 4.4. Plant populations on a solid acre, no roads.

3 x 4 = 3,630	3.5 x 4 = 3,112	4 x 4 = 2,723
3 x 4.5 = 3,227	3.5 x 4.5 = 2,766	4 x 4.5 = 2,420
3 x 5 = 2,904	3.5 x 5 = 2,489	4 x 5 = 2,178
3 x 5.5 = 2,640	3.5 x 5.5 = 2,281	4 x 5.5 = 1,980
3 x 6 = 2,420	3.5 x 6 = 2,074	4 x 6 = 1,615
3 x 7 = 2,074	3.5 x 7 = 1,778	4 x 7 = 1,556

Remember to leave a 10-12 foot roadway from which to load and spray. Consider 4-6 rows per block of upright yews. An air-assisted sprayer is convenient for pest control. An air-assisted sprayer may be able to penetrate the foliage on 4 or more rows of upright yews, but use water sensitive paper to gauge spray penetration. A tree spade will also require space to maneuver without damaging adjacent plants. A 4-row block makes 50 percent of the plants accessible to a spade. Spreading *Taxus* could probably be planted with more rows per block.

Planting

Exercise caution so as to not plant too deep. Yews are very sensitive to planting depth and will not tolerate excessive soil over the root system. It is also critical to prevent cultivation from throwing additional soil over the roots. Some producers replace the disc blade that throws the soil with a smaller diameter blade.

Rooted cuttings can be potted up and grown for an additional 1-2 years to produce a larger container liner. Container liners have a comparatively long shelf life and can accommodate rainy weather and other transplanting delays that bareroot liners cannot. Bareroot liners must be protected from freezing and drying out while in storage and should be planted early enough in the spring to allow root growth before hot summer weather occurs.

Irrigation can improve growth, even of tolerant plants like Taxus.

Highlights

1. Insects are not generally a problem, but some possible pests include black vine weevil, Taxus mealybug, grape mealybug, and Fletcher scale.
2. Biotic diseases include phytophthora root rot.
3. Abiotic diseases include desiccation, heat, flooding, and nutrient deficiencies.
4. Deer can be a serious problem. Consider Cephalotaxus.

Phytophthora root rot, Photo credit: John Hartman

Integrated Pest Management (IPM)

Insects

Taxus are seldom attacked by insects; however, several insects can attack *Taxus*. Refer to UT Extension publication 1589, Commercial Insect & Mite Control for Ornamentals, https://utextension.tennessee.edu/publications/Documents/PB1589.pdf for a list of potential insects.

Black Vine Weevil

Black vine weevil is also referred to as the *Taxus* weevil. All adults are black, female, and cannot fly. Adult feeding damage appears as notching in

the needles. Scout for damage in the center of the plant near the main stems. The larvae are legless, c-shaped, white with brown heads, and can be found in the first 2-40 cm of soil around the roots. This is the most destructive stage for this weevil. While adult damage to the leaves and needles rarely affects plant health or survival, larvae feed on both feeder and large roots, often resulting in the death of the plant. There is usually one generation per year. If Taxus weevil adults overwintered in container plants in polyhouses, begin treatments for adults in March-April in Tennessee. Otherwise, treat for adults at ground level and above every three weeks from May-September. Larvae can be treated in the soil or substrate from May-September. It is best to treat for both adults and larvae (different insecticides are often used).

Fletcher Scale

Fletcher scale is a soft scale. It weakens the plant, causes foliage to drop, and causes a crust of sooty mold to form on twigs and needles. One generation occurs per season. Scale overwinter as nymphs, mature and lay eggs in May, and hatch in June. These scale do not travel far, and thus, become concentrated on individual branches. Plant damage becomes obvious as juvenile scale continue to grow in the spring. Because all eggs hatch around the same time, this scale is easily controlled with a single insecticide application. Dormant oil applications are also effective.

Grape Mealybug

This mealybug overwinters as an egg. The crawlers can be yellow to brown, while the adults are about 6 mm, dark purple, and covered with a white waxy powder. There are about two generations produced a year.

Taxus Mealybug

This mealybug feeds on the inner bark tissue of the trunk and branches. Damage results in sparse foliage and honeydew caked with sooty mold. The mealybugs collect in clusters in the crotches of twigs and branches. Live young are born in early summer, and first-stage nymphs overwinter in bark crevices. Two or more generations occur each year in Kentucky and Tennessee. Taxus mealybug control can be improved by using dormant oil or horticultural oil sprays when dormant (February-March). Sprays of horticultural oil and other recommended insecticides should be applied from May-June for best results.

Biotic Diseases

Taxus is susceptible to needle blight, twig blight, and other fungal-borne disease as well as the fungus-like phytophthora root rot. Phytophthora root rot can be a problem in the field, container, or landscape if the site is poorly drained or during very wet periods. Selecting a well-drained site is an important component to using IPM for Taxus. Refer to UT Extension publication 1234 for a complete list of potential diseases.

Phytophthora Root Rot

Phytophthora is a soil-borne, fungus-like organism. It overwinters in soil or substrate, especially that which has experienced a high

level of moisture. When water is present, chlamydospores or oospores germinate to form sporangia. Minimizing the conditions that favor the production of sporangia is one reason it is important to carefully manage water in nurseries. Sporangia form on plant surfaces and can separate and be splashed or blown to healthy plants where they release swimming spores called zoospores. Zoospores can swim in water in the soil or container substrate and are attracted to plant roots, swimming right to them. Symptoms appear when temperatures are high and plants are growing. Infected roots will turn tan-brown. Roots are killed off, leading to wilted foliage. Foliage may also turn a yellow or bronze color, and the plant may experience branch dieback. Make sure soil is well drained. Avoid over-irrigating and planting too deeply. Prune out infected material and test recycled irrigation water before using.

Phytophthora root rot on Taxus*. Photo credit: A. Windham*

Abiotic Problems

Desiccation will cause needles to brown or yellow in the winter. Try to locate *Taxus* fields where they will not be exposed to strong winter wind. Yew doesn't tolerate extreme heat. Growers desiring yew as a crop for the south may want to seek *Taxus floridana*, a native to Florida with extreme heat tolerance or *Cephalotaxus*. *Taxus* is intolerant of flooding and will die or grow poorly in flooded or poorly drained sites.

Wildlife

Unfortunately, deer browsing is a serious problem for *Taxus* producers. Consider *Cephalotaxus* if deer repelling and exclusion measures are unsuccessful. *Cephalotaxus* does not have the name recognition of *Taxus* and can't be grown in some colder regions in which *Taxus* grows well.

Weed Management

Weeds must be removed quickly or prevented altogether so that lower foliage is not shaded out. Weed competition can also reduce growth, which can increase production time, and weeds can harbor insects and mites that vector diseases.

Pesticide Recommendations

For chemical controls for insects, mites, and disease-causing pathogens, refer to the UT Insect and Plant Disease Control Manual (Redbook) https://ag.tennessee.edu/EPP/Pages/TFS.aspx

or download the app developed by UT in collaboration with other southern universities: IPM*Pro* at http://wiki.bugwood.org/IPMPro_app. Refer to Tables A and B: Preemergence and Postemergence-Nursery Crops under the Weed Control heading at http://www.utextension.utk.edu/mtnpi/handouts.html for a complete list of labeled pre and postemergence herbicides for most common woody ornamentals. For pest identification contact your county extension office or the UT Soil, Plant, and Pest Center http://soilplantandpest.utk.edu. For cultural information on these and more pests, consult http://utuknurseryipm.utk.edu.

Highlights

1. Tolerant of drastic pruning into old wood.
2. Make sure sunlight reaches all parts of the plant equally by keeping the base wide and the upper canopy more narrow.
3. Do not prune after May so plants retain a natural appearance.

Taxus *should be full and dense. This plant has a "hole" that will diminish its value.*

Taxus *are tolerant of fairly severe pruning; buds will break on thick, older wood when pruned.*

Pruning

Taxus is extremely tolerant of drastic pruning of old wood. However, in production, regular pruning should take place so that extreme pruning isn't necessary to produce a high quality plant in a relatively short period of time. Use hand or motorized shears to cut the longest branches back as often as necessary. Frequent shearing will increase the number of branches.

Encourage low branching by keeping the upper canopy more narrow (even if only slightly) than the base of the shrub so that sunlight can reach the lower branches. For cone shaped selections this occurs naturally. Avoid pruning between August 15 and first killing freeze. Avoid pruning plants that will be harvested after May so plants will look natural.

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