

IPM FOR SHRUB PRODUCTION



EDITED BY AMY FULCHER

• 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.

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Please remove page & return to Amy Fulcher, UT Extension Specialist & Assistant Professor for Sustainable Ornamental Plant Production.
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• CHAPTER 2 •

FOSTER AND SIMILAR HOLLY



by Mark Halcomb,
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• Section 1 •

Highlights

1. The most common Foster holly is Foster #2.
2. Foster hollies are pest resistant, making them the perfect beginning to adopting IPM practices.
3. They can be used as specimen plants, foundation plants, or hedges.
4. The Foster Hybrid Group was selected in the late 1940s by E.E. Foster of Foster Nursery in Bessemer, AL.
5. Red Hollies were introduced in the mid-1990s.



Male in middle, females with fruit to the sides.

Introduction and Selections

Foster holly, *Ilex xattenuata*, is a popular, large, evergreen shrub used as specimens, hedges, or in foundation plantings in landscapes throughout much of the US. *Ilex xattenuata* 'Fosteri' represents a group of hybrids from which a number of clones were selected. The most common is Foster #2, a female selection with heavy fruit. Female plants produce red berries

that persist through the winter. Males, for example Foster #4, are needed for fruit set. Foster hollies are fast growing and pest resistant, making them ideal for IPM. The US Nursery Industry produced 10,778,206 hollies in 2007 at an estimated value of \$112,940,000 (USDA, 2009). Many of these are Foster hollies and other hollies with similar traits (Table 2.1).

Table 2.1. Select Foster, Red, and other hollies with similar characteristics or used similarly in landscapes.

NAME	DESCRIPTION
Foster and Similar Holly Selections	
'Blazer'	Compact, slower growing plant with greater fruit set than Foster #2, 1/3 inch diameter fruit. Reaches 6' by 3' in 15 years.
'Big John'	A pyramidal male with glossy, dark green foliage. It produces no fruit.
Carolina #2	Good dark green form with heavy, bright red fruit. It looks a little open in youth, becoming fuller with maturity.
Dixie Dream™	Denser, more uniform and slower growing, without Foster hollies pyramidal form. It may be a better plant in the landscape, having less rampant growth as plant matures.
Dixie Flame™	A seedling from Tanager but unlike Tanager, will withstand heat much better and has very prolific large berries.
Dixie Star™	Lustrous dark green leaves and a tight growth habit. It is actually a better replacement for Foster holly (C. Pounders, pers. comm.).
Foster #2	The industry standard. Glossy green leaves with spiny margins, pyramidal growth is compact but still requires much shearing. Prolific producer of red berries.
'Greenleaf'	Becoming more popular in the southeast. It has a strong growing pyramidal form with glossy, medium green spiny foliage. Margin is somewhat undulating, bright red fruits at an early age, leaves and stems cold hardy to -22 F degrees.
'Nellie R. Stevens'	Small broad pyramidal shrub 15-25' tall. Leaves are a shiny, deep green. Plant is heavily laden with fruit red 1/4 to 1/3 inch diameter. Pollinated by <i>I. cornuta</i> . Vigorous and fast growing.
Red Hybrid Hollies - new growth is red on all	
Arcadiana™	Tightest branching, abundant fruit.
Cardinal™	Foliage similar to 'Mary Nell', pyramidal.
Festive™	Extremely shiny dark green, most spiny leaf margins, broad pyramid. Observed with poor fruit set.
Liberty™	Orange red fruits form in clumps; large, shiny, dark green leaves. One of the most attractive.
Little Red™	Extremely spiny leaf margins, rounded habit.
Oakland™	Shiny, dark green leaves.
Oak Leaf™	Tall pyramidal shape, long, larger oak leaf-shaped leaves, fastest growing of the initial 5 released. Observed with poor fruit set.
Patriot™	Heavy fruit set, smaller plant and leaves, lustrous foliage, margins serrated.
Robin™	One of the best. Most like 'Nellie R. Stevens'

• Section 2 •

Highlights

1. Cutting propagation is easy for Foster hollies.
2. Use a 1000 to 3000 ppm IBA quick dip or talc for cuttings.
3. Remove flowers and fruit to increase rooting percentage.
4. Good sanitation practices can reduce or eliminate the need for certain pesticides during propagation.



Propagation & Production

Propagation

Ilex xattenuata 'Fosteri' is thought to be a cross of *Ilex cassine* and *I. opaca*. Seed propagation of Foster holly will yield 50 percent *I. opaca*. Cutting propagation is more commonly used. Unlike some or all selections of *I. aquifolium*, *I. latifolia*, *I. opaca*, *I. purpurea*, and *I. rotunda*,

which are difficult to root, Foster holly roots readily (Dirr, 2009, Galle, 1998). Collect 6-8 inch semihardwood cuttings. Strip the leaves from the bottom 1/3 stem length of cuttings and stick from August to November in 2 pine bark fines, 1 part peat and 1 part perlite, by volume (Galle, 1998). Foster hollies can be potted after 6-10 weeks. A 1,000 to 3,000 ppm IBA quick dip or

talc is often used, but up to 10,000 is recommended (Berry, 1994; Galle, 1989). A table for propagating several holly taxa is available (Berry, 1994). Removal of flowers and/or fruit increased rooting percentage, number of roots per cutting, and root dry weight (Keever et al., 1989.). Oryzalin (Surflan®) applied during propagation reduced rooting percentage, primary root number, and root quality (Thetford and Gilliam, 1991). Good sanitation is a principle of IPM and an excellent strategy in propagation where pesticide options are limited.

Site Selection

Hollies require a well-drained soil. A hard pan or fragipan will impede internal drainage and lead to reduced plant health and growth and increase the chance of root rot infection. Afternoon shade could be beneficial. Container production can occur in full sun or light shade.

Liner Selection

Liners for field production should be at least 12 to 18" tall when transplanted into the field. Consider planting 1-gallon liners for field production, at least for the first crop, to get a good start. Also consider buying rooted cuttings and plant them into a liner row or a transplant bed for 1-2 years with irrigation or pot them into #2 containers to allow them to develop a larger root system before lining them out at the spacing required to grow until harvest size. This frees up some land and helps ensure survival by taking a larger plant to the field. One of every 25 plants, or 4%, should be Foster #4 males interplanted to increase fruit set. The enhanced

pollination and fruit set can be promoted to customers. Consider growing the male #4's for those retailers and landscapers that realize and promote greater fruit set.

Consider also growing *Ilex xattenuata* 'Blazer', 'Big John', *Ilex opaca* 'Carolina #2' and 'Greenleaf' (Table 2.1).

Fertilization

Foster hollies grow best with a soil pH of 5.5-6.0. A medium to high level of phosphorus and potassium is desirable because the crop includes a fruit. Most nursery crops are non-bearing and do not require much phosphorus. Soil test early so that any lime, phosphate, or potash can be broadcast and incorporated prior to planting. Side-dress February 15-March 30 and again in late June with no more than 50 pounds of actual nitrogen per acre.

Table 2.2. Fertilizer weight corresponding to 50 pounds of actual nitrogen per acre of root zone.

POUNDS OF FERTILIZER	FERTILIZER ANALYSIS
150	34-0-0
250	20-10-10
333	15-15-15
385	13-13-13

Field Spacing

High quality Foster holly plants have a wide plant base with full, dense foliage. Full, lower foliage is attained with proper pruning and a sufficiently wide spacing to allow sunlight penetration to the base foliage (See Pruning section).

Spacing of Foster hollies in the field depends upon the anticipated size to be harvested. Foster hollies are sold as conical, upright broadleaf evergreens, and well-grown material will have a height to spread ratio of 3 to 2 (Anonymous, 2004). For example, a 6-foot Foster holly should be at least 4 feet across at the base. A 9-foot Foster holly should be at least 6 feet wide at the bottom. Height is measured where the main part of the plant ends, not the tip of a thin shoot. Height should represent the average height and is not based on the height of one errant shoot.

Plant a minimum of 5 feet apart within the row to harvest a 6-foot Foster holly and 6 feet apart for a 6-8 foot Foster holly. Middles should be at least the width of the widest tractor or implement used in middles plus 2.5 feet per side. For example, a 4' implement + 5' = 9' middle. It is critical that sunlight reach the lower branches to keep them vigorous and actively growly so the foliage will persist and remain dense.

Skip a row or leave a 10-12 foot roadway from which to load and spray. Consider no more than 4-6 rows per block. Also determine penetration of pesticides with water sensitive paper and consider spray penetration when evaluating plant spacing. An air blast

sprayer may be used for pest control. A tree spade requires space to maneuver without damaging adjacent plants. When hand digging, consider how far you can move a 150-250 pound root ball.

Table 2.3. Plant populations on a solid acre, no roads:

4.5 x 5 = 1,936	5 x 5 = 1,742	6 x 5 = 1,452
4.5 x 6 = 1,613	5 x 6 = 1,452	6 x 6 = 1,210
4.5 x 7 = 1,383	5 x 7 = 1,245	6 x 7 = 1,037
4.5 x 8 = 1,210	5 x 8 = 1,089	6 x 8 = 908
4.5 x 9 = 1,076	5 x 9 = 966	6 x 9 = 807

Planting

Avoid deep planting. While not overly sensitive to planting depth, for best plant health and survival ensure that the root ball of container liners or bareroot liners is not below the previous grade. Inspect the previous grade to ensure that it was not too deep. It is also important to avoid throwing additional soil over the root system during cultivation. Replace the disc blade that throws soil with a smaller diameter blade, if necessary.

Harvesting

Six foot Foster hollies are probably a 5-6 year crop, depending on soil type, fertility, moisture, growth rate, pruning, etc. Harvesting occurs the last 2-3 years.

The American Standard for Nursery Stock was written by the American Nursery & Landscape Association (ANLA). It establishes techniques for measuring plants and minimum rootball sizes for particular plant sizes and different plant types. A copy of the standards may be viewed and printed from this link free: <http://www.anla.org/docs/About%20ANLA/Industry%20Resources/ANLAStandard2004.pdf>.

A 6-foot Foster holly would require a minimum of a 24-inch ball, according to Table 26 on page 62 of the 2004 revision of the ANLA's ANSI standards, in the Broadleaf Evergreen section. A portion of Table 26 from the ANLA's ANSI standards is reproduced in Table 2.4. The minimum ball size is stated based on the tree height. These specifications are for hand dug or machine dug balls.

Producers are not legally bound to follow the ANLA ANSI standards, but it is a good business practice and minimizes miscommunication with customers and helps ensure that customers are satisfied with your product.

Table 2.4. Height and rootball dimensions for balled and burlapped Foster holly¹.

BROADLEAF EVERGREENS--TYPE 5	
HEIGHT (FEET)	MINIMUM BALL DIAMETER (INCHES)
4	16
5	20
6	22
7	24
8	27
9	30

¹Table 26 in the ANLA Nursery Standards

• Section 3 •

Highlights

1. Foster holly is an inherently pest resistant plant.
2. No serious abiotic or wildlife problems affect Foster hollies.
3. Growing pest resistant plants is an important part of IPM and reduces plant mortality and need for pesticide application.
4. Be sure to monitor growing conditions to prevent pest problems --excess water and high pH should be avoided.



Holly leafminer on American holly (L; Dan Herms), Southern red mite (R; Tracy Wootten). Images courtesy of Bugwood.org

Integrated Pest Management (IPM)

Insects

Foster holly is generally free of serious insect and mites but can be affected by spittlebug, Southern red mite, and holly leafminer, as can other hollies. Refer to UT Extension publication 1589 for a complete list of potential insects at: <https://>

utextension.tennessee.edu/publications/Documents/PB1589.pdf.

Spittlebug

Twolined spittlebug, *Prosapia bicinta*, has increasingly become a problem on Foster and other hollies. Hollies are a favorite of the adult spittlebugs. Twolined spittlebug adults look like

black leafhoppers with two red strips across the width of the back and are about 1/3 inch long. Eyes and abdomen are bright red. In the late summer and early fall, adults feed on hollies and other plants. Holly leaves become splotchy, yellow, and drop prematurely from feeding damage. Braman and Ruter (1997) tested the susceptibility of cultivars with *I. cassine* or *I. opaca* parentage. Severe damage was seen in 'Savannah', 'Carolina #2', 'Eagleston', 'East Palatka', 'Foster #2', and 'W.J. Bean', *I. cassine* (red fruit), *I. cassine* (yellow fruit), and *I. integra x rugosa*. Cultivars included in the research with no damage included 'Shamrock', 'Winter Red', 'Burford', 'Wetumpka', 'Warrens Red', and 'Kathy Anne Batson'.

Southern Red Mite

Southern red mite, *Olygonychus ilicis*, is the most prominent mite pest of hollies in the Eastern US. It is a cool season mite and can have several generations per year. It is more problematic in the spring and fall and other periods of cool weather. Like all mites, the Southern red mite is extremely small. It is reddish brown, contrasting somewhat with the leaves. Use a hand lens to scout upper and lower leaf surfaces. Tap or shake branches over white paper and look for slow moving dots--these are mites. They will make a red streak if wiped across the paper.

Holly Leafminer

Leafminers, *Phytomyz spp.*, make the foliage unattractive and can cause leaves to drop. The adult holly leafminer is a small black fly. Young adults emerge in mid spring based on weather conditions and stage of holly leaf growth. Emergence of a particular holly



Weed control and timely pruning are essential to producing Foster hollies that are full at the base.

leafminer species usually coincides with with flowering of a preferred *Ilex* host species and should be used to schedule control measures unless a systemic is used, in which case, timing is more flexible. The female pierces through the leaf surface and lays eggs inside the leaf. The piercing damages leaves and causes puckering. Larvae hatch in 3-4 days and start to mine the leaves. There can be more than one generation.

Biotic Disease

There are no major diseases of Foster holly. *Rhizoctonia solani*, cutting root rot, *Cylindrocladium scoparium*, cutting rot, and *Pythium*, can affect cuttings while in propagation (Galle, 1998).

Too much moisture during propagation and overwatering during container production can lead to root rot as can planting in low lying or poorly draining soil. Crowned beds should always be used to drain water in container blocks.

Abiotic Disease

There are no major abiotic disorders of Foster and similar hollies. All hollies prefer acidic soil, approximately 5.5 pH. Foster hollies are tolerant of urban conditions, flooding (Ruth et al., 1995), and alkaline soil. Under alkaline conditions, iron chlorosis may occur on some hollies, particularly deciduous hollies. Iron chlorosis is identifiable by yellow leaf tissue separated by veins that remain green (interveinal chlorosis).

Wildlife

There are no major wildlife problems with Foster holly.

Weed Management

Weeds must not be allowed to shade out lower foliage. This will reduce development of lower branches and foliage, diminishing

plant quality. Several herbicides are labeled to provide preemergence control.

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: IPMPro 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>.

• Section 4 •

Highlights

1. Pruning is essential to producing salable, high quality Foster hollies.
2. Plan for two or more shearings per year.
3. Develop a wide base to ensure sun exposure.
4. Be sure that lower foliage receives adequate light by preventing weed growth.
5. Unlike pruning deep into heavier wood, pruning the tips of plants does not result in fuller growth.
6. Consider using plant growth regulators to produce higher quality.



Leave a central leader and cut the remaining branches hard to develop dense branching at the base

Pruning

A Foster holly will not grow full on its own. The key to producing high quality Foster hollies is at least two shearings per year, so the plant develops a wide base and dense lower foliage. Full lower foliage is attained with sufficiently

wide spacing and weed control around the plant; this allows optimum sunlight penetration to the bottom foliage. Unsheared, natural Foster hollies are not salable. Whether planted on the corner of a house or as a screen, the foliage must

be full. Maintaining only one central leader is essential.

The best times to prune are generally winter (November through March) and late June. Avoid August, September, and October.

The succulent, new growth that develops in response to the pruning cuts can be killed by the first frost as there will not be sufficient time to harden if pruned late in the summer. Prune

into a pyramidal or conical shape with a wide base as mentioned in the ANLA Nursery Standards and discussed here under spacing.

Researchers observed that pruning at the tips of young plants does not result in fuller plants, while pruning deeper into the heavier wood produces several breaks on the stems resulting in fuller and denser growth¹ (Midcap, 2000). Cutting the plants hard into heavier wood appears to be the best way to thicken the foliage and grow a salable plant. Manual hedge shears or powered shears can be used. Hand pruners are not efficient for this purpose. Keep tools sharp and disinfect with sanitizer frequently (See Table 1.6).

¹Note: these results represent a single season of data.



Regular pruning is necessary to avoid bare spots that reduce plant value.



To produce high quality Foster hollies, prune hard early in production to develop a full, well-branched base. Top image: plant has no growth from the base and will be bare. Lower image: plant has growth sprouting from the base and will be a more full, desirable plant.

Plant growth regulators (PGRs) can be useful tools in producing a high quality plant and reduce the need for labor intensive pruning. Cutless 0.33G (flurprimidol), a turf product now marketed as TopFlor for the nursery industry, reduced shoot elongation of Foster holly when applied at 0.5 lb./A. Flurprimidol is a root absorbed class B gibberellin biosynthesis inhibitor. Atrimmec® (diagegulac sodium) is a chemical pincher that works by disrupting apical dominance by disrupting cell wall integrity. Atrimmec® at 4440 ppm also reduced shoot elongation, eliminating the need for frequent pruning during production. Off-Shoot-O and Trim-Cut didn't control growth of Foster holly (Banko and Stefani, 1995). Promalin® (a combination of cytokinin and gibberellin 4 and 7) applied with latex paint in June and September did not increase branching* (Midcap, 2000).



• Section 5 •

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