

# GREENHOUSE PRODUCTION OF BOSTON FERNS

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## Introduction

The Boston fern is actually a cultivar of a wild fern found in Florida called the Sword Fern (*Nephrolepis exaltata*). The sword fern has 3- to 4-foot erect fronds (fern leaf), and was popular as a house plant in the U.S. and Europe in the middle to late nineteenth century. 'Bostoniensis' was discovered by chance in a large shipment of Sword Ferns from a Philadelphia grower to a Boston distributor in 1894. Since then, variants have given rise to one of the largest and most popular groups of fern cultivars.

## Cultivars

The Boston fern easily gives rise to sports or mutations which may or may not be stable. Many of the Boston fern cultivars available today have come about from sports. Though the best cultivars are mostly stable, variations can occur even from vegetatively propagated material. It is impossible to tell how many Boston fern cultivars exist. New ones appear on the market periodically and many have been lost due to changes in consumer demand. The most popular for commercial production today are:

'Bostoniensis': One of the original selections from the sword fern. It is a very large fern with a pendulous, graceful habit.

'Compacta': A very popular, intermediate size fern. It is shorter, more compact and less pendulous than 'Bostoniensis'.

'Dallas': This is a very popular, small size fern which may be sold as 'Dallas Jewel'. The fronds are once divided and the crown spreads rapidly.

'Florida Ruffle': This is an intermediate sized fern with stiff, twice divided fronds which are broader at the base. This creates a dense canopy which may develop disease problems.

'Fluffy Duffy': This is a small fine-textured fern with fronds two to three times divided with extensive overlapping. This creates a dense canopy which can be a problem.

'Massii': A large fern much like 'Bostoniensis' except it is more pendulous and darker green.

Other cultivars include: 'Atlanta', 'Blue Bells', 'Erecta', 'Hillsii', 'Petticoat', 'Rooseveltii', 'Welchii' or 'Whitmanii'.

It is important to choose cultivars based on final plant size and growth habit for a particular container size (Table 1). Generally, large cultivars are more appropriate for larger containers and smaller cultivars for smaller containers. Cultivars should also be chosen based on ease of production under the cultural conditions available. Some of the denser, finer-textured cultivars may develop disease problems under low-light and humid conditions.

## Propagation

Boston fern cultivars are mostly propagated from tissue culture, although stolons or runners harvested from stock plants are still utilized. From either method, plantlets or liners are established in plug trays and marketed by specialized propagators to growers that transplant and finish the plants in final containers. The most common tray sizes are 40, 72, 135, or 273 cells per tray. Most small to medium sized fern growers purchase plug flats from specialized propagators to meet production needs.

## Containers

The majority of Boston ferns are grown and marketed in 8-, 10-, or 12-inch hanging baskets, but 4- to 8-inch pots are also popular. The choice of container size is subject to market demand. Plastic hanging baskets with snap-on plastic or wire hangers are widely used in commercial production. These come in a wide variety of colors, sizes and styles, even those with planting holes on the side of the pot. In selecting a hanging basket, make sure the hangers can be quickly and easily attached to the pots and that the hangers are strong enough to support the weight of the pot, wet media and plant without breaking. Most plastic hanging baskets come with

**Table 1. Appropriate container sizes for Boston fern cultivars**

Cultivar	4-inch	6-inch	8-inch	10-inch	12-inch	>12-inch
'Bostoniensis'	no	no	yes	yes	yes	yes
'Compacta'	no	yes	yes	yes	no	no
'Dallas'	yes	yes	yes	no	no	no
'Florida Ruffle'	yes	yes	yes	no	no	no
'Fluffy Duffy'	yes	yes	no	no	no	no
'Massii'	no	no	yes	yes	yes	yes

either an internal reservoir or an external, detachable saucer. Many growers prefer to remove external saucers at the time of potting to reduce the chance of waterlogged media when plants are small. Saucers are then re-attached when plants are larger or prior to sale. Generally, the 10- or 12-inch baskets are more desirable than smaller sizes because they hold a larger volume of medium and dry out less frequently.

### Potting Medium

The potting medium for Boston fern should be well aerated and well drained, but have a high water-holding capacity so that it will not dry too rapidly. Many commercially prepared soilless mixes sold by suppliers have the characteristics necessary to produce a good crop. This may be the most cost effective alternative for many small growers. However, to mix your own, start with at least 50% course peat and add a drainage material such as perlite (horticultural course grade) and/or vermiculite (No. 3, course grade). Aged pine bark (1/16- to 1/2-inch particle sizes) may also be used for up to 15% to 20% of the mix. Higher percentages of pine bark increase fertilizer requirements. Amendments should include sufficient dolomitic limestone to raise the pH to 5.0 to 5.5. Start with about five pounds per cubic yard. A moderate rate of superphosphate (2 pounds per cubic yard) and a commercial micronutrients formulation designed for mixing with medium (Micromax or Esmigram) can also be added. Follow the manufacturers directions for micronutrient rates.

### Potting

Containers should be filled with moist medium using a minimum of media compaction. The planting depth for the liners should be

shallow or at least no greater than the original depth of the propagation medium. Newly transplanted containers should be watered thoroughly very soon after potting and placed in a greenhouse area with reduced light intensity (2000 foot candles) and high relative humidity until plants are established.

Various production schemes can be used to produce high quality baskets. Some growers transplant to intermediate containers such as 4- or 6-inch pots. Once the pots fill out, they are transplanted to hanging baskets. Other growers transplant liners directly to hanging baskets and hang the baskets in their final location immediately after potting. Another alternative is to place newly planted baskets on benches, pot-to-pot, for a period of 2-6 weeks to get liners established and then hang the baskets in the final growing locations.

### Water

Boston ferns grow most rapidly if maintained evenly moist, but not saturated for a long period. Watering practices should be adjusted for changes in environmental conditions and the age of the plant. Provisions should be made to supply frequent irrigation during warm, bright, summer conditions, especially for mature plants. Hanging baskets and large pots can be watered efficiently using micro-tube irrigation systems. Small pots can be watered using sub-irrigation or by hand using a water breaker. If allowed to get too dry, the foliage of Boston ferns develops a gray cast and growth and runner production slows.

Production areas designed for Boston Fern hanging baskets frequently utilize automated timing systems and some form of micro-tube irrigation. The slow delivery of low volume emitters allows  
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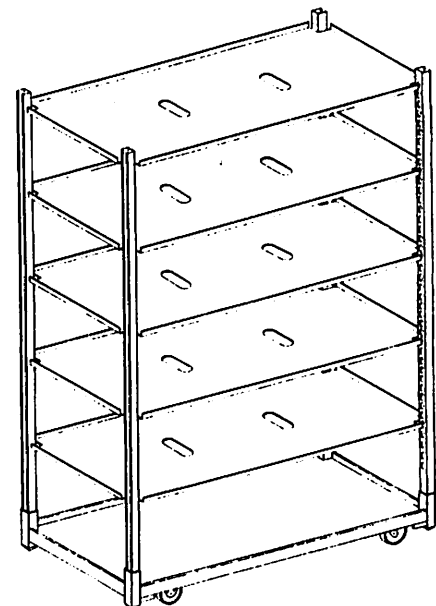
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adequate lateral spread of water or fertilizer to saturate the large media volume of large containers. Adequate irrigation control can also be used to address concerns regarding water conservation and ground water contamination. In fact, application rates that result in excessive dripping on bench crops below hanging baskets are undesirable and may result in diseases which require free water to spread, such as *Botrytis*. Automated systems should be designed to deliver an equal amount of water to all pots on a watering station, then each station should be timed carefully to prevent dripping. Various programmable timing devices are available to set the required timing for each station and then cycle through the stations in a section or house. Automated Station cycling also places less demand on labor and the water supply. In fact, with the addition of a 24 hour clock, the system may be activated to run early in the morning before employees arrive for work.

Low light and cool temperature conditions during the winter can be a problem for young, recently potted plants. The grower should watch weather conditions and learn to anticipate watering requirements. Avoid watering on dark, overcast days unless the medium is clearly dry, but be prepared to water when the sun comes out. Try to water early in the morning at a time when the temperature is increasing.

### Fertilizer

Liquid fertilization with a fertilizer injector is the most common method of fertilizer application in the production of Boston Ferns. Newly potted plugs should not be fertilized until the roots reach the container margins. Afterward, fertilize with a low ammonium

fertilizer such as 15-16-17 peat-lite special, 15-0-15, or a calcium and potassium nitrate tank mix during darker, cooler times of the year. These can be applied at 150 to 175 ppm nitrogen on a constant liquid feed basis (CLF) depending on the stage of growth. One clear watering per week in a CLF program will help prevent soluble salts buildup. During warmer, brighter periods, a 20-10-20 fertilizer may be used at 175 to 200 ppm nitrogen. Where CLF is not possible, 250-300 ppm nitrogen once per week works well. Rinse the foliage with clear water after applying strong fertilizer to prevent foliar burn. Some sources recommend a fertilizer ratio of 3-1-2 or 2-1-2.

Like watering, the grower should consider the stage of growth and watch weather conditions to learn how to adjust fertilization frequency. CLF works fine when plants are established and during warm, bright weather, but may provide too much fertilizer when plants are young or during dark, cool weather. Try alternating fertilizer and clear water.

Many growers supplement the liquid fertilizer program by top-dressing with a slow release fertilizer such as Osmocote® or Nutricote® at the rate recommended for a particular pot size. Use the lower CLF fertilizer rate indicated above. Slow release fertilizer may also be incorporated at the time of soil mixing at a rate recommended by the product manufacturer. However, uniform mixing with the medium can be a problem.

Media testing and tissue analysis are important components in maintaining adequate fertility for growing Boston ferns. Testing should be performed every two to four weeks during production by sending samples from each planting to the Soil Testing Laboratory, Auburn University, Alabama or a commercial laboratory. Specific recommendations for tissue analysis nutrient levels are indicated in Table 2. If one or more nutrients fall outside of these ranges, corrective steps should be taken promptly or growth rate may be adversely affected.

### Light

The best quality Boston ferns are produced at between 2500 and 3500 foot-candles. The higher intensity can be used during the late fall, winter, and early spring when temperatures are more controllable and the days are short. The lower intensity may be necessary at other times, especially during the summer, to control high temperature. Light intensity reductions in the greenhouse can be

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achieved by applying a 30% to 60% shade fabric or a liquid shading compound to the greenhouse glazing. Light intensity that is too low results in long, weak, pendulous fronds that are dark green in color, but few in number. Too much light causes fronds to be light green in color.

**Table 2. Boston Fern Tissue Analysis Ranges**

	<u>Low</u>	<u>OK</u>	<u>High</u>
<u>%</u>			
N	2.00-2.49	2.50-3.0	>3.0
P	0.15-0.24	0.25-0.7	>0.7
K	1.00-1.59	1.60-3.8	>3.8
Ca	0.50-0.79	0.80-2.5	>2.5
Mg	0.20-0.24	0.25-1.0	>1.0
S	0.15-0.19	0.20-0.5	>0.5
<u>ppm</u>			
B	15-19	20-70	>70
Cu	4-5	6-50	>50
Fe	40-49	50-300	>300
Mn	30-39	40-200	>200
Zn	15-19	20-200	>200

### Temperature

Generally, Boston ferns grow well with a night temperature (NT) of 65 F and a warmer day temperature (DT) that does not exceed 95 F. Night temperatures of 68 F may be used to speed development of young plants, while a temperature of 62 F can be used to hold mature plants. Recent research has shown that maximum frond length, frond unfolding rate, and shoot dry weight was achieved with an average daily temperature of 77 F (DT+NT/2). Be aware that greenhouse temperatures may stratify vertically with warmer temperatures occurring up high where hanging baskets are located. Temperatures at hanging basket level may be 10 F or more warmer than at bench level.

### Scheduling

Many growers produce Boston ferns for the spring market and production timing depends on the size of the initial liner, the final container size, and the growing conditions. Accurate scheduling and keeping detailed records of previous crops is important to meet

shipping dates. The grower must develop standard cultural practices for each crop date depending on the geographic location and time of year so that schedules can be workable and adhered to. Those in charge of acquisition of liners, baskets, media and other materials must work with suppliers to see that these items arrive on time. Management must make sure that production steps are accomplished according to schedule. Table 3 outlines total production times for transplanting from several common pre-finish containers to several common finish containers.

### Diseases

**Pythium or Phytophthora:** Symptoms include stunting, wilting, and graying or yellowing of the foliage. Roots may be stunted, brown in color, and outer portions of the root slide away from the inner core. They are more likely to occur in cool, dark weather and cool, wet media.

**Rhizoctonia:** Aerial blight that occurs mostly in the summer. Symptoms include brown irregular lesions commonly in the crown or inner canopy of the plant. The lesions can spread rapidly and cover the entire plant with brown web-like mycelia. Check plants frequently in the summer and take corrective measures immediately if found.

### Insects

The most common insect pests are caterpillars, fungus gnats, mealybugs, mites, scale, and thrips.

### Marketing

Boston Fern hanging basket are frequently the first choice of a crop to grow for those who are new to the greenhouse business. They are relative easy to grow and market appeal and demand are often strong. However, the beginner should develop a market plan before the first liner is planted. Ask yourself; who will buy my product when it is ready for market and how many will they require? Without proper planning, you may produce too many, too few, or of the wrong cultivar. Begin by considering the specific market area you are capable of servicing. You may grow for an entire region or just those within a five mile area. Then survey potential retail buyers to determine the amount of product they need, when they need them, and what cultivars and containers sizes their customers are interested in purchasing. This information can then be used to develop a marketing strategy that will benefit the grower, retailer, and customer.

**Table 3. Boston Fern Scheduling**

<u>from/to -</u>	<u>72 cell</u>	<u>40 cell</u>	<u>4" pot</u>	<u>6" pot</u>	<u>8" HB</u>	<u>10" HB</u>
273 cell	6-8 wks	8-10 wks	10-12 wks	16 wks	-	-
72 cell	-	-	6-8 wks	10-12 wks	16-20 wks	20-24 wks
40 cell	-	-	-	8-10 wks	14-16 wks	18-22 wks
4" pot	-	-	-	6 wks	12 wks	16 wks
6" pot	-	-	-	-	8 wks	12 wks