



THE UNIVERSITY OF GEORGIA

COOPERATIVE EXTENSION

Colleges of Agricultural and Environmental Sciences & Family and Consumer Sciences



Commercial Production of English Ivy

Hedera helix L

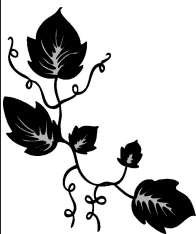
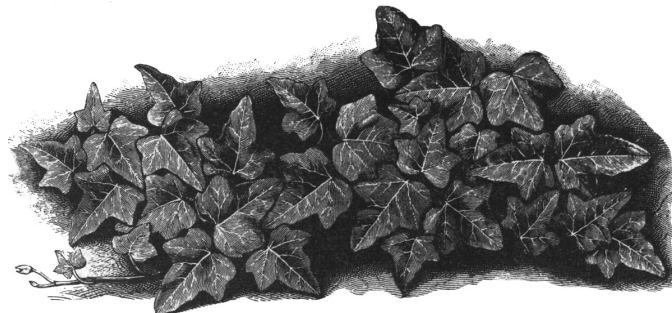


Table of Contents

Background	3
Propagation and Culture	3
Scheduling of <i>Hedera</i> Juvenile Forms	8
Registration of <i>Hedera</i> Cultivars	9
Economics of Commercial Production of <i>Hedera</i>	9
Physiological Problems, Disease and Pest Management	9

Disclaimer: The Georgia Exotic Pest Plant Council lists *Hedera helix*, English Ivy, as a Category I invasive plant. While it does not recommend English Ivy uses in the landscape, this publication provides information for its culture as a potted plant. Some cultivars of English Ivy may become invasive in certain environments if planted in the landscape. Should such a situation develop, and control and eradication of the plant is desired, refer to Georgia Cooperative Extension publication C 867-1, *Weed Wizard: Controlling Vines in Ornamentals*, for information.

<http://pubs.caes.uga.edu/caespubs/pubcd/C867-1.htm>



Commercial Production of English Ivy

(*Hedera helix* L.)

Bodie V. Pennisi, Department of Horticulture

Ronald D. Oetting, Department of Entomology

Forrest E. Stegelin, Department of Agricultural and Applied Economics

Paul A. Thomas, Department of Horticulture

Jean L. Woodward, Department of Plant Pathology



Background

The genus *Hedera* belongs to the family Araliaceae, which consists of temperate and tropical trees, shrubs or vines often having aromatic foliage, mostly palmately divided or lobed. Of the recognized *Hedera* species, *H. canariensis* (of the trade = *H. algeriensis*, Algerian ivy), *H. colchica* (Persian ivy), *H. helix* (English ivy), *H. nepalensis* (Nepal ivy) and *H. rhombea* (Japanese ivy), *H. pastuchovii* (Russian ivy), only *H. algeriensis* and *H. helix* (with largest number of cultivars) are widely grown commercially in the United States. *Hedera helix* cultivars are primarily evergreen, climbing, woody vines, which may become shrub-like or tree-like at maturity (Table 12, page 17.) The juvenile form has palmately-lobed leaves on flexible aerial root-bearing stems. The adult form has stiff stems with leaves having usually fewer lobes compared to the juvenile form. Small flowers in umbels develop only on the adult form.

The leaves and berries contain the glycoside hederagenin, which could cause a mild toxicosis if these parts are ingested (*Merck Veterinary Manual, 8th ed. Merck & Co, Inc. and Merial Limited.*) The American Ivy Society has developed a helpful classification system based on leaf shape and color (Table 10, page 12.) Most cultivars in the trade are the vine-like juvenile form with lobed leaves and no flowers. It is one of the most cold hardy garden plants with some cultivars (e.g., 'Baltica,' 'Wilson') surviving in -10 degree F temperatures in northern landscapes. Most variegated cultivated varieties are not as hardy.

Ivy foliage is evergreen and has been widely valued for its cascading and trailing look. Depending on the cultivar, ivies are used as indoor plants in hanging baskets, pots, topiaries, dish gardens; in interiorscape as ground, wall or tree trunk cover. The florist industry also uses ivy as cut vines in flower arrangements. Training ivy into various geometrical shapes, wreaths, trellises, and topiary figures is readily achieved and increasingly popular. More recently, variegated

cultivars have been used extensively as component plants in mixed combination hanging baskets and planters.



Propagation and Culture

Juvenile ivy can be easily propagated by tip cuttings or node cuttings, the latter yields more cuttings per stock plant and is most common. Single node cutting, also called leaf bud cutting, contains a leaf and a bud, or "eye," while double node cuttings contain two leaves and two buds (Fig.1.) The procedure is very simple. One- to four foot-long vines taken from stock plants are cut into small pieces each with one leaf (if one-leaf cuttings are used) or two to three leaves (if two-leaf or three-leaf cuttings are used,) making the cut immediately above the leaf and reducing the length of the stem below to about 1 inch. One popular method of combining the cutting and sticking processes is to hold the stock vine

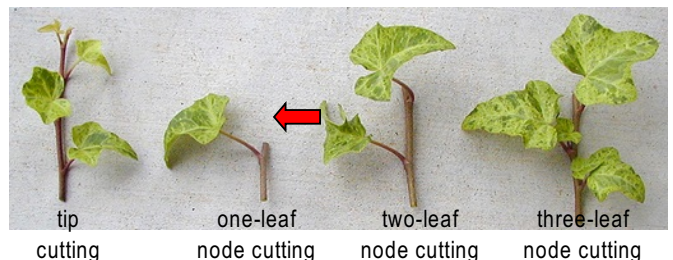


Figure 1. Ivy vine from the cultivar 'Gold Dust' and the various types of cuttings that can be obtained from it. Notice that there is a small piece of stem left above the node (a "handle," arrow).

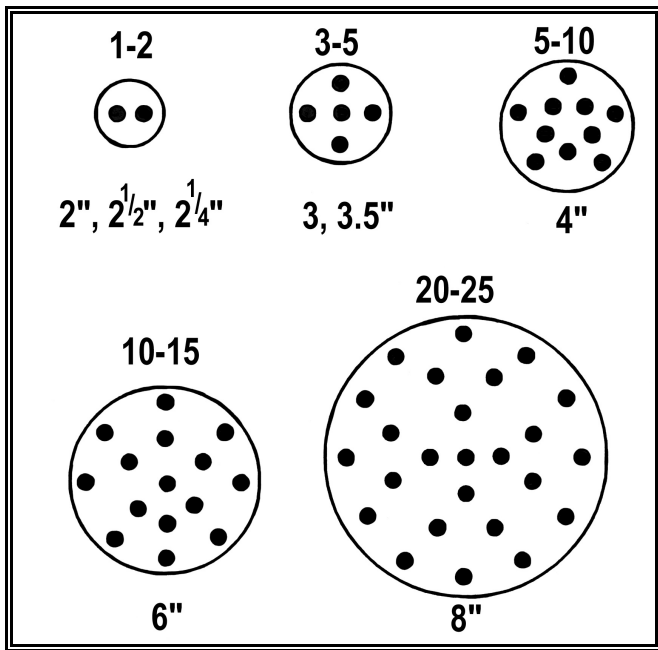


Figure 2. Variable number of cuttings and planting arrangements for various size pots and hanging baskets.

with one hand, push the bottom 1 inch of the stem into the propagating medium, make a cut just above the bottom leaf, move the vine into an adjacent position in the pot and repeat the process until only the tip of the vine is left. The very tip of the ivy vine is usually discarded. Two-leaf and three-leaf cuttings usually root and grow faster than one-leaf cuttings. Ivy is grown in various size pots: 2½", 2¼", 3", 3.5", 4"-pots, and 6" and 8" hanging baskets; 1 quart and 1 gal-lon containers are popular in the landscape industry.

Because juvenile ivy roots readily, rooting hormones are not needed. The grower can decide on the number of cuttings per pot, which can be as few as 5 and as many as 10 for a 4" pot (Fig.2.) Some growers use as many as 10 cuttings per 4" pot and 25 and 50 per 6" and 8" hanging basket, respectively. Number of cuttings used per pot may depend on the cultivar, *i.e.*, fewer for cultivars that branch more freely. Number of cuttings per pot will determine how full or "bushy" the finished plant product is. Naturally, a large number of cuttings per pot will yield a bushier plant. However, fewer than the maximum number of cuttings per pot also will yield an attractive plant. Growers usually stick one to three cuttings per 2¼" pot for plants that are used in the landscape industry. Cuttings can be stuck in trays of various cell sizes (for production of liners) or directly into the final container. Some growers maintain their own stock plants, while others purchase unrooted cutting material or rooted liners.

The unrooted material is usually shipped at 60 degrees F and can be stored for an extended time at lower temperatures (35-50 degrees F) without adverse effects on rooting. Some cultivars, however, do not tolerate cool storage well (*e.g.*, 'Ralf,' 'Ingrid'.) The grower should experiment with storage in his/her own environment. Vines for propagation also can be cut from ivy baskets one or two times before they are sold. When grown in small containers, plants do not need much room and can be pot-to-pot until ready for market. Some fast-growing or self-branching cultivars, however, benefit from spacing 2" apart.

Peatlite mixes with good aeration and water-holding capacities are commonly used for propagation and culture of ivy. Desirable pH of the medium is between 6.0 and 6.5. Medium containing some combination of peat, pine bark, perlite and vermiculite is appropriate. Examples of media are: 50 percent peat moss:50 percent pine bark; and 80 percent peat moss:20 percent perlite. The medium usually will require amendment with 4 to 10 lb of dolomite per cubic yard to adjust the pH to about 6.0 to 6.5 (Table 1.) Amount of dolomite will depend on the initial acidity of the medium and the alkalinity and pH of the irrigation water. If the irrigation source has high alkalinity, use less dolomite. Refer to Table 2 (page 5) for recommended alkalinity ranges. Perform a water quality test on a regular basis (2-4 times a year), as water quality may vary from season to season and from one irrigation source to another. Knowledge of water quality also is important during the growing cycle because irrigation water quality affects the pH of the medium, which in turn affects the availability of various micronutrients.

Table 1. Approximate amount of materials required to change pH of soilless potting mixes. (Adapted from Conover, R.T., and C.A. Poole. 1984. *Foliage Digest* (vii) 6:1-6.)

Beginning pH	50% Peat 50% Bark	100% Peat
7.5 ¹	2.0	3.4
7.0	1.5	2.5
6.5	1.0	2.0
5.0 ²	2.5	3.5
4.5	5.6	7.4

¹ Add sulfur or acidifying mixture to lower pH to 5.7.

² Add dolomitic lime or equivalent amount of calcium to raise pH to 5.7.

If desired, pre-plant slow-release fertilizer and a micronutrient charge could be added to the growing medium. To prevent root rot, two fungicide drenches should be applied, one after cuttings are stuck [*e.g.*,

Table 2. Recommended irrigation water alkalinity limits for different production systems. (Adapted from Bailey, D.A. 1996. Ch. 4. Alkalinity, pH and Acidification. *In: Water Media and Nutrition for Greenhouse Crops*. Ball Publishing.)

Container Size	Suggested minimum alkalinity ¹	Suggest maximum alkalinity ²
	me/l	me/l
Small pots and shallow flats	0.75	1.7
4- to 5-inch pots and deep flats	0.75	2.1
6-inch pots and long-term crops	0.75	2.6

¹ Consider adding potassium bicarbonate to the irrigation water to at least this level if media pH tends to decline during production.

² Consider acidifying the irrigation water if alkalinity is above this level and if media pH tends to rise during production.

ethazol-thiophanate-methyl (Banrot®)] and one after they have rooted [e.g., metalaxyl — Subdue®.] Place freshly-stuck cuttings under mist 10-15 seconds every 30 minutes from 0800 to 2000 hours in the summer for southern parts of United States, from 0900 to 1700 hours for northern parts of the United States, and from 0900 to 1700 hours in the winter in both southern or northern parts of the United States. Continue misting until rooting takes place (2-3 weeks; 4 weeks for complete root development.) During propagation, light levels should be 1200-1500 fc (13-16 klux) and temperatures 80-86 degrees F day/60-68 degrees F night. When temperatures rise above 90 degrees F, root development and growth is slow.

Ivy is easy to grow if cultural conditions are right. The light levels depend on the finished product and the intended market. For landscape use, ivy is commonly grown under 50 percent shade or higher (some nurseries use natural shade from trees.) Hanging baskets for indoor use can be grown under 3000-4000 fc (32-43 klux.) or approximately 70 percent shade. Recommendations for production of acclimatized foliage plants for interior use are light levels of 1500-2500 fc (16-27 klux.) These light levels are needed to help the plant adjust to the low light frequently encountered in interior environments. However, if the customer places an acclimatized ivy (produced under low light) in direct sun on a porch, foliage burn is likely to result. Therefore, growers should not only select the proper light levels for production of high quality ivies for the different markets, but they should also educate customers to provide the best conditions for plant growth.

Some variegated ivy cultivars loose intensity of color under low light levels, while others tend to increase their variegation. This variegation response depends on the cultivar of ivy, the light levels, and in some cases, the temperatures. Some cultivars that display either white- or yellow-margined leaves lose their variegation when grown under very low light levels. Cultivars that have variegated young growth, e.g., ‘Buttercup,’ need higher light to keep the bright yellow color. Experiments with *H. helix* ‘Gold Heart,’ which has yellow leaf centers, have shown that light levels below 1000 fc (11 klux) cause greening of the yellow variegation (*Pennisi and van Iersel, unpubl.*) Variegated cultivars are also more sensitive to high light and temperatures, compared to nonvariegated ones. Refer to Table 12 (page 17) for information on the changes in the coloration of variegated cultivars under different light conditions.

Ivy does not require high nutrient levels (Tables 3 and 4.) Ivy grows well with N-P-K ratios of 1:1:1, 2:1:2 and 3:1:2. The benefits of using the 3:1:2 ratio are reduced fertilizer costs per unit of nitrogen and lower total soluble salts. Liquid fertilizers can be applied with each irrigation, weekly, or every other week. Suggested N, P and K levels in ppm for continuous application are 150 ppm N, 50 ppm P, and 100 ppm K. Growers report good results using liquid feed with the formula 9-3-6, which also has micronutrients.

Table 3. Suggested nutrient application rates for slow-release fertilizer formulations and different pot sizes for English ivy. (Adapted from Conover, R.T., and C.A. Poole. 1984. *Foliage Digest (vii)* 8:1-6.)

gms ¹ 14-14-14/pot/3 months				
2½ "	4"	1-gal ²	6"	8"
1.0	2.5	6.5	5.0	10.0
gms ¹ 19-6-12/pot/3 months				
2½ "	4"	1-gal ²	6"	8"
0.7	1.8	4.8	4.2	7.1

¹ One level teaspoon=approximately 5 grams.

² 1-gal refers to Full 1 container in the nursery trade.

Soil temperatures below 60 degrees F and night temperatures below 65 degrees F will result in slower growth. During winter months, therefore, fertilizer levels can be reduced by half. During high temperature months (85-95 degrees F days and 75-85 degrees F nights) ivy grows rapidly and can use slightly higher

Table 4. Suggested micronutrient application rates for foliage plants. (Adapted from Conover, R.T., and C.A. Poole. 1984. *Foliage Digest* (vii) 8:1-6.)

Element	Rate of Application gm/1000 sq ft/mo
Boron (B)	0.43
Copper (Cu)	4.33
Iron (Fe)	17.33
Manganese (Mn)	8.67
Molybdenum (Mo)	0.02
Zinc (Zn)	4.33

fertilizer rates. A good rule that will accommodate cool and warm season ivy production is to reduce recommended fertilizer levels by 25 percent during December to February and raise them by 25 percent from the recommended fertilizer levels from June to September.

Slow-release fertilizers with 2 to 12 months release period also can be used. The release rate is usually calculated for a soil temperature near 70 degrees F. During cold months when potting media temperatures are lower, the release rate will be slower. Conversely, during warm months when potting media temperatures are higher, the release rate will be much faster. During propagation, especially toward the end, rooted cuttings benefit from foliar fertilization with a complete soluble fertilizer (100-150 ppm N), which can be delivered two or three times per week through the propagation misting system. Slight rinsing is recommended after foliar nutrient application to avoid possible foliage burn. A medium pH of near 6.0 should be maintained.

Ivy grown in baskets for cutting stock are usually grown for 12 to 14 months before being sold. Nitrogen and potassium have great effect on the vine length and quality. In general, N and K levels between 0.007 and 0.01 oz/6"-pot/mo (2.46 to 3.85 g/pot/yr) will produce the greatest number of cuttings per plant.

Regular testing of the growing medium throughout the crop cycle is recommended to obtain measurements of pH and EC (electrical conductivity) and if necessary, to make corrective steps to ensure that they are in the right ranges. Testing can be done in-house or a soil sample can be sent to a soil-testing lab. Most land-grant universities as well as several private labs offer soil testing for minimal charge. In-house testing can be done using the PourThru method, which involves pouring a known volume of water over the medium and collecting the leachate (for more on this technique, see www2.ncsu.edu:8010/unity/lockers/project/hortsublab/pourthru/).

The pH and EC of the leachate is then measured

using a pH/EC meter. Testing is recommended every week for plants in 4" or smaller pots; and every two weeks for larger size pots. For routine analysis a minimum of 5 pots should be analyzed. If the results vary widely, the sample size should be increased. The results should be recorded in pH and EC graphs (available <http://www.ces.ncsu.edu/floriculture/> or <http://www2.ncsu.edu/hortsublab/>), which should be included in the crop's history record.

In addition to pH and EC information, soil analysis performed by analytical labs also includes levels of individual nutrients in the growing medium. Some soil testing labs also provide recommended concentrations of the individual nutrients. This information can be used to adjust the fertilizer program. The PourThru method determines pH and EC of all the nutrients present in the growing medium, but does not give any information about individual nutrients. Therefore analytical labs may be able to detect potential problems that will not be detected with in-house tests. Soil testing labs generally use the 1:2 dilution method or the saturated medium extract (SME) method. Both methods involve dilution of the samples. Because of this, the EC results from a soil-testing lab are always lower than the EC measured in-house with the PourThru, and the results should be interpreted accordingly. (Table 5)

Table 5. Comparison of EC measured with different methods. There are large differences in the EC, depending on which method is used.

1:2	SME	PourThru	Indication
0 to 0.3	0 to 0.8	0 to 1.0	Very low
0.3 to 0.8	0.8 to 2.0	1.0 to 2.6	Low
0.8 to 1.3	2.0 to 3.5	2.6 to 4.6	Normal
1.3 to 1.8	3.5 to 5.0	4.6 to 6.5	High
1.8 to 2.3	5.0 to 6.0	6.5 to 7.8	Very high
> 2.3	> 6.0	> 7.8	Extreme

Tissue analysis should be performed if mineral deficiency or toxicity symptoms develop but also regularly throughout production to obtain information about the crop's nutritional status. When sampling, 30 (large-leaf cultivars) to 40 (small-leaf cultivars) mature leaves from new growth should be collected. Normal foliar analysis ranges are given in Table 6. When preparing soil samples for a soil-testing lab, remove the

upper 1/2" to 1" of the growing medium and then collect a core of the growing medium extending to the bottom of the pot.

Table 6. Normal foliar analysis ranges for English Ivy, *H. helix*. (Adapted from *Plant Analysis Handbook II*. 1996. MicroMacro Publishing.)

Macronutrients	
Element	ppm
N	2.50-4.50
P	0.25-0.90
K	1.50-4.50
Ca	1.00-2.00
Mg	0.25-0.70
S	0.25-0.50
Micronutrients	
Element	%
Fe	50-375
Mn	50-200
B	20-50
Cu	5-25
Zn	20-100
Mo	0.50-4.00
Nonessential Elements	
ppm	
Na	50-500
Al	10-200

grown successfully using subirrigation systems (*Pennisi and van Iersel, unpubl.*) Subirrigation systems decrease or virtually eliminate chemical runoff from greenhouses. As public awareness of environmental protection increases, growers may be pressured by strict laws and regulations to reduce or eliminate chemical runoff from their operations. In subirrigation systems, benches or whole greenhouse sections are flooded with a fertilizer solution pumped from a holding tank. The fertilizer solution is picked up by the potting medium through a wicking action. After approximately 15 to 20 minutes the fertilizer solution remaining on the bench or the flooded floor is drained back into the holding tank, where it is stored until the next fertigation (usually the next day). In addition to environmental benefits, zero runoff systems save labor, water, and fertilizer, and can produce more uniform crops than overhead or drip irrigation. Good quality ivy plants intended for interior use were produced using subirrigation with 100 ppm N, 50 ppm P, and 100 ppm K, and light levels of 1500 fc (*Pennisi and van Iersel, unpubl.*) Current research is underway to develop detailed guidelines including optimal light levels, fertilizer rates, growing media, and optimal ranges for the leachate EC and pH of the growing medium for production of ivy in subirrigation systems.

To produce an attractive, well-branched plant in a hanging basket, ivy should be pinched once or twice during production. The first pinch is usually done when plants are small and consists of removing the soft new growth as soon as cuttings have rooted and have shown one to two inches of growth. In this pinch, called a

Recent experiments have shown that ivy can be

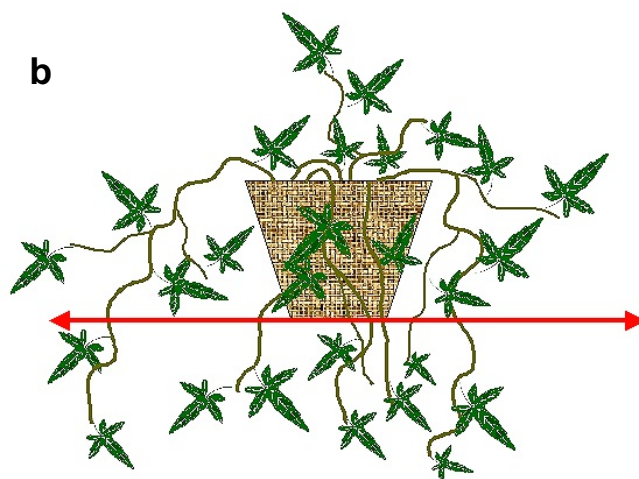
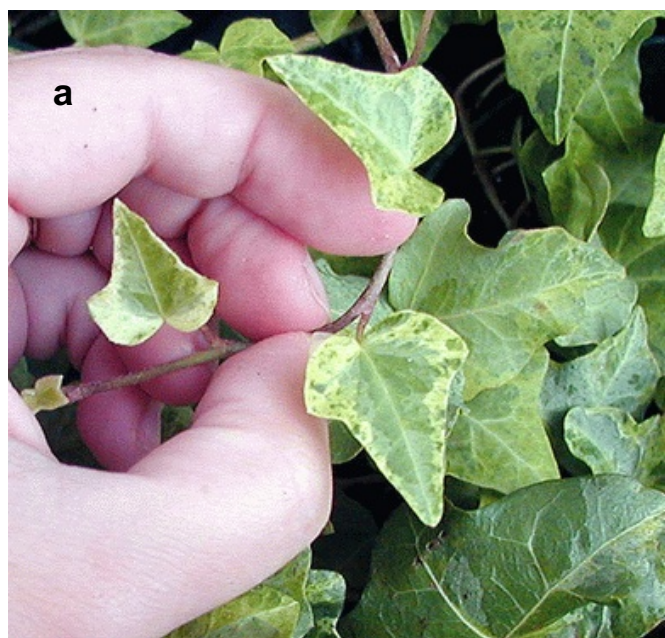


Figure 3. Pinching patterns for ivy in hanging baskets. Soft pinch (a) can be done by hand or it may require clippers. Later pinch (b) may be needed to keep vines from becoming too long.

Table 7. Summary of published literature on effects of plant growth retardants on *Hedera* juvenile forms. (Adapted from Henny, R. 1990. CFREC-Apopka Research Report RH-90-10.)

Growth Retardant	Method of Application	Amount Used	Degree of Response ¹
A-Rest	drench	0.25 to 1 milligram per 6-inch pot	none
A-Rest	spray	10 to 200 ppm	+
A-Rest	drench	0.5 to 5 ppm	+
B-Nine	spray	1,000 to 10,000 ppm	+
Bonzi	drench	0.5 milligram per 6-inch pot	slight
Cycocel	spray	500 to 3,000 ppm	none
Cycocel	drench	500 to 3,000 ppm	none

¹ Slight = 1 to 10% growth reduction. The “+” sign indicates that a positive response to the growth retardants was reported but no numerical data were presented in the original paper.

“soft pinch,” the tip of the vine and the first node with a recently expanded leaf are removed. (Fig.3a, page 7) For cultivars that branch well naturally, this one pinch may be sufficient to produce a full basket. A second pinch may be necessary for cultivars with less natural branching. At this stage of their growth, the vines may extend several inches from the rim of the hanging basket. The second pinch involves removing the shoot tip and two to three nodes below. Some growers may choose to start with the second pinch, after the baskets are hung, however, the softer the pinch, the less growth is wasted. When baskets need to be kept in the greenhouse longer, or the first pinch has not produced sufficient branching, another pinch may be necessary. This one is directed towards keeping the vine’s length to the height of the pot’s bottom. (Fig.3b, page 7) How full the basket look also depends on the number of cuttings that were originally stuck in it. Cultivar selection is important to help minimize manual labor; self-branching cultivars require less pinching while trailing cultivars may need more than three pinches to produce a well-branched plant. Cultivars with small leaves may require higher number of cuttings and/or more pinches to produce a full basket, while fewer cuttings may be needed of large-leaved cultivars.

Chemical growth control of ivy with various growth retardants has been used with a varying degree of success (Table 7.) The commercial use of growth retardants on ivy has not been extensive. However, a newer chemical Florel[®], has been shown to increase lateral branching and inhibit internode elongation on a wide range of floricultural crops. Recently accepted Florel[®] label includes ivy. Growth regulators should always be tested on a small group of plants first.

Lateral or basal branching and internode elongation (desirable in formation of topiary tree ‘trunks’) is enhanced with two foliar sprays of 300 ppm gibberellic acid (GA₃) applied on alternate weeks. Better results are achieved when the gibberellic acid is applied to previously pruned shoots. If the vines are used for propagation, they should be left to reach greater length before being cut.



Scheduling of *Hedera* Juvenile Forms

Finishing times for ivy in various size containers are provided in Table 8 on page 10. Direct stick takes longer time to finish but the input costs are lower. Shorter production time and rapid turnover can be achieved if liners or larger size pots are used. For mixed baskets and combination planters either liners or 2- to 4-inch pots can be used. Liners of self-branching ivy cultivars may be better suited for combination planters, because they produce a fuller look. Another way to achieve a fuller appearance is to use more plugs or a larger size pot (4-inch) with higher number of cuttings. When choosing cultivars for mixed plantings, growth habit and growth rate also should be considered. (Table 12, page 17) Best suited for combo planters are self-branching cultivars with moderate to fast growth rate.



Registration of *Hedera* Cultivars

The American Ivy Society (AIS) strongly encourages producers to register their ivy stock and to submit potential new cultivars. The purpose of registration is to ensure that each new ivy has only one name. By submitting potentially new cultivars to one central registration authority, confusion over names may be minimized.

The American Ivy Society (P.O. Box 2123, Naples, Florida, 34106; www.ivy.org) is the International Registration Authority for the true ivies, *Hedera*. Registration forms may be requested from the above address. Potential cultivars are then sent to the Registrar. New cultivars will be described and photographed in the American Ivy Society's *Ivy Journal*.



Physiological Problems, Disease and Pest Management

The most common cultural problems encountered in *Hedera* production are listed in Table 10 (page 11). Specific recommendations are given for each problem. To avoid possible phytotoxicity problems, growers should evaluate the effects of every pesticide or mixture of pesticides on a few plants under their own environmental conditions. To best control diseases on ivy, do not over-water or over-fertilize plants. Disease spread can be rapid within greenhouses. Remove diseased plants promptly and keep area clean. Practice good sanitation to reduce introduction of diseases into crop production.



Economics of Commercial Production of *Hedera*

Estimated direct and indirect costs of producing juvenile *Hedera* in 2¼" pots in trays is given in Table 9 (page 10). The budget typifies the cost of producing and marketing nearly 60,000 ivy in 2¼" containers, the equivalent production for a 30' wide by 100' long commercial greenhouse.

Table 8. Scheduling of *Hedera* juvenile forms. (Based on USDA zones 8 and 9.)

Starting Plant Material	Product	Finishing Times
Single node unrooted cutting	50 cell	10 weeks
	72 cell	10 weeks
	2" pot (2 ctngs/pot)	10-12 weeks
	3" pot (3 ctngs/pot)	10-12 weeks
	3.5-4" pot (4-5 ctngs/pot)	12-16 weeks
	6" hanging basket (7 ctngs/pot)	16-18 weeks
	8" hanging basket (10 ctngs/pot)	16-18 weeks
Bare root cutting	3.5-4" pot (4 ctngs/pot)	8-10 weeks
	6" hanging basket (7 ctngs/pot)	12-14 weeks
	8" hanging basket (10 ctngs/pot)	12-14 weeks
Plug (Liner)	6" hanging basket (4 plugs/pot)	10-12 weeks
	8" hanging basket (6 plugs/pot)	10-12 weeks
	1 gal container (4 plugs/pot)	10-12 weeks
2" - 4" pot	6" hanging basket (2 - 2"pots/pot, 1 - 4"/pot)	8-10 weeks
	8" hanging basket (3 - 2"pots/pot, 2 - 4"/pot)	8-10 weeks
	1 gal container (2 - 2" pots/pot, 1 - 4"/pot)	8-10 weeks

Table 9. Estimated direct and indirect costs of producing juvenile *Hedera* in Georgia, USDA Zone 8, 2001. (Sal-able crop of 57,182 plants in 2¼" pots on trays.) The following budget typifies the cost of producing and marketing nearly 60,000 ivy in 2¼" containers, the equivalent production for a 30' wide by 100' long commercial greenhouse.

Item	Description	Unit	Quantity	\$/Unit	\$/Crop
Direct Costs:					
Cuttings	<i>Hedera</i> (220 trays, delivered, 5% shrink leaving 60,192 to grow)	each	63,360	0.012	761
Containers	2¼" press fill pots (500/case, delivered)	case	121	39.50	4,780
Trays	24 count (50-24 count/case, delivered)	case	51	29.50	1,505
Rooting Media	3 cubic foot bags (delivered)	bag	66	14.00	924
Plant ID Stakes	300/bundle (color printed)	bundle	201	6.00	1,206
Fertilizer	9-3-6 (20 lb bags, delivered)	bag	8	8.50	68
Fungicides and Insecticides	Banrot®, Aliette®, Orthene® and Talstar® drench/spray in rotation	application	4		966
Total Direct Costs					\$10,210
Indirect Costs:					
Greenhouse (12 weeks - hvac, lighting, irrigation, overhead)					880
Pot Filler (overhead expenses for filling 60,000 pots)					120
Hired Labor (72 hours at \$8.10/hour, including taxes, fringes, etc.)					6,480
Management Fee					2,000
Subtotal of Direct and Indirect Costs					19,690
Interest on Operating Capital (0.33 at 10%)					650
Total Direct and Indirect Costs					\$20,340
Variable Cost per Salable Plant (assumes 5% production loss or 57,182 salable plants)					\$0.18
Fixed Costs per Salable Plant (covers debt repayment, repairs/maintenance and depreciation on greenhouse and equipment)					0.17
Total Cost per Salable Plant (excluding any profit)					\$0.35
<p>If the marketing goal is a 20 percent markup (profit above cost), the asking price should be at least 42¢ per 2¼" container of ivy [35¢ + 20%, or 7¢ markup]. If the pricing strategy is to receive a 20 percent margin (profit as a percentage of selling price), the desired selling price would be 44¢ per 2¼" container [44¢ selling price minus 20% of price or 9¢ = 35¢ cost] for the 57,182 salable plants.</p>					

Table 10. Common cultural problems of *Hedera* and recommendations. (Adapted from CFREC-Apopka Research Note, RH-91-15. 1991.

Physiological Problems	Conditions	Solution
Loss of variegation in young leaves	Insufficient light levels; most common in winter months.	Move plants to higher light location.
Loss of variegation in older leaves	Observed only in a few cultivars, particularly some of the yellow and green ones. Insufficient light levels accelerate this condition.	Choose cultivars with stable variegation pattern.
Permanent loss of variegation or significant change in leaf shape	One or more shoots on a plant will develop distinctly different leaves than the rest of the plant.	Trim out these shoots; for propagation, use only vines with typical cultivar leaves.
Oedema	Small, irregular, raised corky areas on leaf surface. Physiological disorder sometimes associated with warm nights followed by cool, humid nights; also with excess salts.	Avoid uneven moisture and excess salts in the growing medium.
Slow growth and rooting of cuttings	Typical in the summer months in the southern United States.	Keep air temperatures below 90 degrees F.
Bacterial Problems	Symptoms & Favorable Conditions	Disease Management
<i>Xanthomonas</i> leaf spot (<i>Xanthomonas campestris</i> pv. <i>hederae</i>)	Brown to black circular to irregular spots often with yellow to red halo and a water-soaked margin found first on older leaves; stem and petiole cankers may also develop. With heavy infection, the young leaves can be malformed. Common on juvenile ivies and on adult forms when overhead irrigation is used; predominant in summer months.	Reduce overhead irrigation; use drip irrigation to prevent spread of the pathogen through water splashes. Use only disease-free propagation material. Trim and dispose of infected plant material. Treat with copper hydroxide (Kocide [®] , Blue Shield [®] , Champ [®] , Champion [®]), copper sulfate pentahydrate (Phyton [®]), or fosetyl aluminum (Aliette [®]) to reduce disease spread.
Botrytis blight (<i>Botrytis cinerea</i>)	Brown to tan lesions on leaves, stems, petioles. Occurs during high humidity and wet conditions. Cankers forming near soil line can kill plants.	Increase air movement to reduce relative humidity; keep foliage dry. Remove heavily damaged plants to reduce spread of the pathogen. Treat with Vinclozolin (Ornalin [®] 50 WP), copper hydroxide (Kocide [®]) or iprodione (Chipco [®] 26019WP).

Bacterial Problems (cont.)

<p><i>Colletotrichum</i> leaf spot (<i>Colletotrichum trichellum</i>) – also called anthracnose</p>	<p>Brown, sunken lesions on leaves, sometimes with tiny black specks in the centers. Appears very similar to <i>Xanthomonas</i> leaf spot. Common on juvenile forms when overhead irrigation is used; predominant in summer.</p>	<p>Reduce overhead irrigation; use drip irrigation to prevent spread of the pathogen through water splash. Use only disease-free propagation materials. Trim and dispose of infected plant material. Increase air movement to reduce relative humidity. Treat with copper hydroxide (Kocide®), manzate (Dithane®, Fore®), iprodione (Chipco® 26019WP) or azoxystrobin (Heritage®) to reduce disease spread.</p>
<p><i>Phytophthora</i> root rot (<i>Phytophthora</i> spp.)</p>	<p>Leaf chlorosis, wilting, root die-back, basal leaves turn brown and curl downward.</p>	<p>Use pathogen-free potting media, pots and plant material. Do not over-water or over-fertilize plants. Remove infected plants to reduce spread of the pathogen. Treat with etridiazole (Truban®, Terrazole®), etridiazole + thiophanate-methyl (Banrot®) or mefenoxam (Subdue Maxx®).</p>
<p>Powdery mildew (<i>Oidium</i> spp.)</p>	<p>White, powdery growth on leaves, petioles and stems. High humidity, poor air circulation and warm days followed by cool nights favor infection.</p>	<p>Remove severely infected plants. Improve air circulation. Treat with propiconazole (Banner Maxx®), triadimefon (Strike®) or copper sulfate pentahydrate (Phyton 27®).</p>

Fungal Problems	Symptoms & Favorable Conditions	Disease Management
<p>Rhizoctonia root rot and aerial blight (<i>Rhizoctonia solani</i>)</p>	<p>Brown, irregular lesions develop on the entire plant. Plant may wilt. Blighted leaves may mat together. Entire plants can be blighted and killed. Tan to light brown hyphae (thread-like fungal growth) can be seen between the soil and blighted foliage. Common on juvenile ivies and on adult forms when overhead irrigation is used; predominant during hot, humid weather. Disease development is rapid.</p>	<p>Use pathogen-free potting media, pots and plant material. Do not over-water or over-fertilize plants. Remove infected plants to reduce spread of the pathogen. Treat with PCNB (Terrachlor®), etridiazole + thiophanate-methyl (Banrot®) or iprodione (Chipco 26019®).</p>

Insect and Related Problems	Symptoms	Insect, Related Pests Management
Aphids	Distortion of new growth. Infestation may not be noticed until cast skins, honeydew or sooty mold is observed.	Use pest-free plant material. Use yellow sticky traps to monitor early invasion. Treat with imadacloprid (Marathon [®]), pymetrozine (Endeavor [®]), cyfluthrin (Decathlon [®]), acephate (Orthene [®]), bifenthrin (Talstar [®]), azadirachtin (Azatin [®]), fenoxycarb (Precision [®]), soap, oil and neem oil (Triact [®]).
Mites (broad mite and false spider mite)	Foliar necrosis of the new growth; initially new leaves are cupped downward, puckered and have serrated margins; severe leaf drop may occur.	For all mite pests: Use pest-free plant material. Treat with abamectin (Avid [®]), fenpropathrin (Tame [®]), clofetezine (Ovation [®]), bifenazate (Floramite [®]), bifenthrin (Talstar [®]), pyridaben (Sanmite 75WP [®]), chlorfenapyr (Pylon [®]), endosulfan (Thiodan [®]), soap, oil and neem oil (Triact [®]).
Mites (two-spotted spider mite)	Infected plants become yellow or speckled due to the feed-ing damage; webs become visible when infestations are severe. Infected plants develop 'rat tail' symptom;	
Mites (cyclamen mite)	verification must be made by entomologist with microscope.	
Scales	Weakened or stunted plants; scales are readily distinguished from the plant material they are feeding on.	Use pest-free plant material. Treat with bifenthrin (Talstar [®]), chlorpyrifos (Dursban [®]), imadacloprid (Marathon [®]), acephate (Orthene [®]), kinoprene (Enstar [®]), pyriproxifen (Distance [®]), bendiocarb (Closure [®]) and fenoxycarb (Precision [®]).
Mealybugs	Stunted growth; honeydew and sooty mold often are present.	Use pest-free plant material. Treat with acephate (Orthene [®]), imadacloprid (Marathon [®]), bifenthrin (Talstar [®]), chlorpyrifos (Dursban [®]), cyfluthrin (Decathlon [®]), kinoprene (Enstar [®]), soap, oil and neem oil (Triact [®]).
Whiteflies	Infested leaves often have small, yellow spots where feeding occurred; with high infestations, leaves become yellowed and leaf undersides are covered with sooty mold.	Use pest-free plant material. Use yellow sticky traps to monitor early invasion. Treat with pyrethrum (Xclude [®]), acephate (Orthene [®]), fenoxycarb (Precision [®]), azadirachtin (Azatin [®]) and bendiocarb (Closure [®]), imadacloprid (Marathon [®]), bifenthrin (Talstar [®]), chlorpyrifos (Dursban [®]), cyfluthrin (Decathlon [®]), pyriproxifen (Distance [®]), <i>Beauveria basiana</i> (Naturalis [®]), soap, oil and neem oil (Triact [®]).

Insect and Related Problems (cont.)

Fungus gnats	Larvae feed on the roots and stems near the soil line; adults do not cause direct damage but can spread plant disease and are cause for complaints by consumers.	Reduce water application where possible. Use yellow sticky traps to monitor early invasion. Avoid algae growth on walkways, benches and cooling pads. Treat with azadirachtin (Azatin [®]), chlorpyrifos (Dursban [®]), kinoprene (Enstar [®]), cyromazine (Citation [®]), fenoxycarb (Precision [®]), diflubenzuron (Adept [®]), pyriproxifen (Distance [®]) and <i>Steinernema</i> (Skanmask [®]).
Thrips (Western flower thrips and banded greenhouse thrips)	Infested leaves become curled or distorted with silver-gray scars or calloused areas where feeding occurred; thrips can transmit the impatiens necrotic spot virus (INSV).	Use yellow sticky traps to monitor early invasion. Treat with pyrethrum (Xclude [®]), azadirachtin (Azatin [®]), chlorpyrifos (Dursban [®]) and bendiocarb (Closure [®]), abamectin (Avid [®]), spinosad (Conserve [®]), acephate (Orthene [®]) and methiocarb (MesuroI [®]).
Caterpillars	Holes in the center or along the leaf edge; easy to detect.	Treat with azadirachtin (Azatin [®]), chlorpyrifos (Dursban [®]), spinosad (Conserve [®]), acephate (Orthene [®]), cyfluthrin (Decathlon [®]), bendiocarb (Closure [®]) and <i>Bacillus thuringiensis</i> (Dipel [®]).
Slugs	Damage similar to caterpillars'; these pests are nocturnal and can be found feeding at night.	Treat with methiocarb (MesuroI [®]) and metaldehyde (Deadline [®]).
Shore Flies	Larvae and adults do not cause direct damage but they may spread plant pathogens and their fecal matter decreases plant value.	Reduce water application to control algae growth. Avoid algae growth on walkways, benches and cooling pads. Treat with diflubenzuron (Adept [®]), pyriproxifen (Distance [®]), fenoxycarb (Precision [®]) and <i>Steinernema</i> (Skanmask [®]).

Table 11. Classification system for *Hedera*. For descriptions of leaf parts, refer to Figure 4. (Adapted from Sulgrove, S.M. Index to Ivy Journal Photographs and Concise Descriptions 1980-1984 and 1985-1999. Registrar, American Ivy Society.)

Class	Examples of Cultivars (all are <i>H. helix</i> unless otherwise noted)
A = Adults: Plants that have lost their vining juvenile habit and have stiff, upright stems (or nearly so) and unlobed leaves; plants capable of flowering.	Few in commercial production; 'Treetop,' 'Garnet,' 'Iceberg,' <i>H. colchica</i> 'My Heart'
BF = Bird's foot: Leaves with narrow lobes resembling a bird's track in the snow; including willow-like unlobed leaves, three-lobed and five-lobed, star-like forms with narrow lobes.	'Brokamp,' 'Green Feather,' 'Irish Lace' 'Needlepoint,' 'Perfection'
C = Curlies: Leaves with ruffles, ripples or pleats involving the entire leaf or merely a significant rippling of the margin.	'Ivalace,' 'Manda Crested,' 'Telecurl'
F = Fans: Leaves very broad, fan-shaped with lobes of equal length – or the lobes of unequal length but forward-pointing and the veins prominently raised above the leaf surface.	'California Fan,' 'Fan,' 'Triton'
H = Heart-shaped: Leaves heart-shaped or valentine-like or shield-shaped including triangular, three-lobed leaves with small, sharp or rounded basal lobes.	<i>H. colchica</i> 'My Heart,' 'Deltoidea,' 'Garland'
I = Ivy, ivies: Typical ivy leaves, almost flat, palmately lobed, with five lobes – a pronounced terminal, lateral and recognizable basal lobes; evergreen and vining plants.	'Pittsburgh,' 'Denticulata'
M = Miniatures: Leaves 1 inch or less in length, of any shape; the plants have a delicate appearance.	'Merion Beauty,' 'Christian'
O = Oddities: Plants of unusual form such as upright or non-vining; or plants with fasciated, asymmetrical or distorted leaves or flattened, compacted stems.	Few in commercial production; 'Congesta' 'Conglomerata'
V = Variegateds: Multicolored leaves of shades of green or gray with white, yellow or light-green markings; or single colors other than green.	'Glacier,' 'Gold Dust,' 'Gold Heart,' 'Jubilee,' 'Chester,' 'Kolibri'

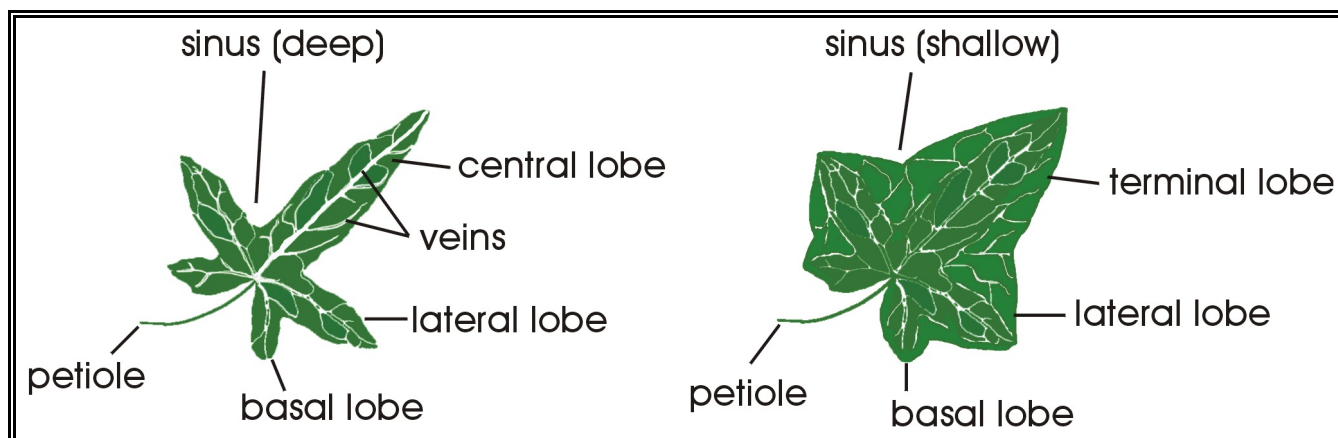


Figure 4. Descriptions of *Hedera* leaf parts.

Table 12. Commercially popular *Hedera* cultivars¹ (for cultivar purposes, refer to Table 10 on page 12) with descriptions of leaf size, shape, color, plant habit and suggested use (B = Basket, ST = Stuffed Topiary, TT = Trained Up Topiary, ALL = B or ST or TT).²

Cultivar Name	Description
'Amber Waves'	(V, I) Medium-sized leaves with three to five lobes. Younger leaves are chartreuse to yellow, maturing to all-green. Retains yellow color better in shade than other yellow-leaved ivies. Self-branching. Suitable for B and ST.
'Anita'	(M, BF) Small dark-green 'Ritterkreuz'-like leaves. Strongly self-branching, compact habit and slow growth. Suitable for B and ST.
'Anna Marie'	(V, C) Apple green, chartreuse and green or gray leaves with wide cream margins. Suitable for B and ST.
'Asterisk'	(BF) Five to seven long, narrow lobes; leaves resemble an asterisk symbol. Suitable for ALL.
'Baltica'	(I) Medium-sized, dark green, heart-shaped to three-lobed leaves, slightly longer than wide. Suitable for ALL.
'Bill Archer' also known as 'Archer's Lace'	(M, BF) A miniature ivy with long, unlobed, linear leaves that are 10 or more times as long as wide; the leaf margins are rolled under. Often reverts to coarse, widely-spaced three-lobed leaves of 'Green Spear'/'Spear Point.' Suitable for B and ST.
'Boskoop'	(C) Small, dark-green, shiny, one- to three-lobed, diamond-shaped leaves with tightly frilled lobes or margins. Suitable for B.
'Brimstone'	(V, C) Gently curly leaf with 'Gold Dust' coloring. Leaves yellow to gold with green and gray specks and blotches. Extremely self-branching. Suitable for B.
'Brokamp' also known as 'Imp'	(BF) Stout stems and long, tapering, unlobed, narrow leaves three to four times as long as wide. Suitable for ALL.
'Buttercup'	(V, I) Typical ivy-shaped leaf with bright yellow new growth when grown in high light. Older growth turning green. Suitable for TT.
'Calico'	(V, C) Gently curly leaves with a striking green and white variegation of bright green splotches scattered on a white background and fused to form an irregular green border. Suitable for B.
'California'	(C) Curly ivy with medium-sized leaves with five broad lobes and heart-shaped leaf base. Strongly self-branching. Suitable for ALL.
'California Fan'	(F, C) Leaves with five to seven forward-pointing, shallow but broad lobes of similar size with a curl in sinus between the lobes. Leaf bases strongly wedge-shaped. Conspicuous veins. Suitable for B.
'California Gold'	(V, C) Gently curly leaf with compact habit of 'California' and coloring of 'Gold Dust.' Leaves with yellow and gray speckles and blotches on a green background. Bright light intensifies the color. Suitable for B.
'Cascade'	(M, I, C) Small, uniform leaves with a curl in each sinus; new growth on the same plane rather than upright; self-branching and compact habit. Suitable for B and ST.
'Chester' also known as 'Citronella'	(V, H) Triangular with three-pointed lobes; wide, creamy-yellow or yellow-green margin and green center, which becomes darker with age. Suitable for TT.

Cultivar Name	Description
'Christian'	(M, H) Small leaves with three rounded lobes. Suitable for B and ST.
'Cockle Shell'	(F) Circular leaves with broad, shallow, forward-pointing lobes that cup upward in new growth and downward in older leaves. Suitable for B.
'Congesta'	(O) Upright plant with stout stems and sharply triangular leaves that are folded upward. New growth has flattened stems.
'Conglomerata'	(O) Triangular, rounded-lobed, curly, dark green leaves on upright stems that become contorted with age.
'Crème de Menthe'	(V, A) Adult form of <i>H. rhombea</i> 'Variegata' with creamy-white variegated leaves. Flowering starts in July. Yellow-orange buds followed by blue-black fruit. Slow growing plant with a slightly upright habit to 3' tall.
'Curly Locks'	(C) Leaves large, nearly round with five broad lobes with minutely crimped and fluted margins. Petioles as long as the blade, often upright. Vigorous plant with widely-spaced leaves. Suitable for B.
'Curvaceous'	(V, C) A variegated sport of 'Manda Crested.' Curly, broadly three- to five-lobed leaves like 'Manda Crested' but with wide, creamy-white margins and gray on gray-green splashed centers. Margins gently fluted. Suitable for B.
'Cyrano de Bergerac'	(BF) Leaves medium to large, asymmetrical, long-petioled, dark green and leathery, with three blunt-tipped lobes – or unlobed. Every leaf is different, but terminal lobe abruptly tapers to long "nose," hence the name. Veins light-green and conspicuous. Suitable for B.
'Deep Freeze'	(A, H) Adult ivy with dark green leaves. The earliest and most prolific blooming adult ivy; chartreuse flowers begin in June followed by blue-black fruits in fall. Grows 3-4' tall and 4-5' wide.
'Deltoidea'	(H) <i>H. hibernica</i> 'Deltoidea' with medium sized, dark green, heart-shaped leaves, unlobed or with three rounded lobes. Florist's "Sweetheart Ivy." Suitable for TT.
'Denticulata'	(I) Large, flat, dark green leaves with parallel sides. Suitable for TT.
'Dragon Claw'	(C) Large leaves with broad lobes and tightly fluted margins. Leaf surface often puckered. Suitable for B.
'Eclipse'	(V, C) Leaves small, crinkly, variegated with splashes of gray or grayish-white with pale veins and irregular touches of white along the unevenly crimped margins. Self-branching. Suitable for ALL.
'Egret'	(BF, V) Leaves with usually three or sometimes five long, narrow lobes that curve downward, claw-like. The terminal lobe often bends on the same plane to one side, lateral lobes are at right angles; basal lobes, when present, point backward. Variegation is marginal, of white to light cream, and the center with patches of light, medium and dark gray-green. Suitable for ALL.
'Fan'	(F) Broad leaves with shallow, forward-pointing lobes that are broad, often rounded, slightly downward-cupped. Suitable for B.
'Fanfare'	(M, C, F) The only miniature ruffled Fan ivy. Small, wider-than-long leaves with three to seven irregular lobes and prominent, raised, light-green veins. Slow growth and extremely self-branching. Suitable for B and ST.

Cultivar Name	Description
'Fantasia'	(V) Older leaves green except for white main veins. White and green speckled new leaves with conspicuous white main veins. Suitable for B and TT.
'Filigran'	(C) Deeply cut, seven to nine linear, forward-pointing lobes that are tightly fluted and curled downward. Suitable for B.
'Fluffy Ruffles'	(C) Leaves nearly circular, unlobed with tightly fluted margins. Many veins raised above the leaf surface. Suitable for B.
'Galaxy'	(BF) A hardy cultivar of 'Star.' Leaves star-shaped with an elongated terminal lobe that is twice as long as wide; narrow lateral lobes; small, backward-pointing basal lobes. Suitable for B.
'Garland'	(H) Large, unlobed, broadly heart-shaped, shiny, dark green leaves with pinch at base of blade. Conspicuous veins. Suitable for B.
'Garnet'	(H, A) Adult ivy with glossy green, unlobed leaves that become a burgundy shade in winter, hence the name 'Garnet.' Flowers in late summer followed by blue-black fruits that persist well into the winter. Grows 3-5' tall and 4-6' wide.
'Gertrud Stauss'	(C, V) A curly, three- to barely five-lobed, variegated ivy with square sides. A presumed sport of 'Harald,' with which it shares its variegation of gray-splashed center with a wide, white border – or mottled green on cream or nearly all green. Coloration depends on environment. Suitable for ALL.
'Glacier'	(V, I) White-edged variegated ivy with thin, pointed, medium to large leaves with silver-gray patches in the center. Suitable for B and TT.
'Gold Child'	(V, I) Medium to large ivy-shaped leaves; variegation under cool conditions a bright greenish-gold border with a center splashed with shades of gray. In hot weather, border becomes creamy-white. Suitable for B and TT.
'Gold Craft'	(V) Typical ivy with gold edges and green center. Requires high light for bright variegation. Suitable for B.
'Gold Dust'	(V, I) Typical ivy-shaped leaves that are green speckled with gold and gray blotches. Requires high light for bright variegation. Suitable for ALL.
'Gold Heart'	(V, I) Leaves small, widely spaced on pink to maroon stems with bright yellow blotched center and wide green border. The size and intensity of the yellow center varies with light levels. Suitable for TT.
'Golden Ingot' also known as 'Golden Inge'	(V, I) Medium-large more or less flat leaves with central blotch of greens and grays on a golden-yellow background bordered by irregular, coalesced green flecks at the margin. Suitable for B and TT.
'Goldstern'	(V, BF) Star-like leaves with yellow-green margins with irregular dark green center. New growth may be all yellow, while older leaves are all green. Suitable for B.
'Green Feather' also known as 'Meagheri'	(M, BF) Small, dark green leaves with three to five long, tapering, narrow lobes that are cupped upward and folded along the midrib. Compact, extremely self-branching habit. Suitable for ALL.
'Green Ripple'	(F) Three to five long, forward-pointing lobes; prominent raised veins on medium-green leaves. Suitable for ALL.

Cultivar Name	Description
'Green Spice'	(H, A) <i>H. colchica</i> with leathery leaves that give off a spicy scent when crushed. Flowering starts in July. Grows 3-4' tall and wide with an upright, rounded form.
'Harrison'	(I) Medium sized, triangular, dark green leaves with whitish veins and narrow terminal lobe.
'Henriette'	(M, V) Small, oblong white leaves with dark green to gray flecks and blotches. Suitable for B and ST.
'Harald'	(V, H) Triangular leaves, mostly three-lobed, gray, with narrow, irregular white or cream margin.
'Ingrid'	(V, I) Small leaves with creamy white margins and gray-splashed centers; older leaves may turn all green. Suitable for ALL.
'Innuendo'	(V, BF) Dark green leaves usually with three long, narrow, forward-pointing, asymmetrical lobes – or barely five-lobed. Leaf margins rolled under. Suitable for ALL.
'Irish Lace'	(BF) Dark green, star-like leaves with very narrow linear lobes and elongated terminal lobe. Leaves are flat while the margins are rolled under. Slight "brushed-on" variegation along the veins near margin. Suitable for ALL.
'Ivalace'	(M, C) Very lustrous, small dark green leaves with margins curled upward. Suitable for B and TT.
'Jersey Doris'	(V, I) Typical 'Pittsburgh' ivy-shaped leaves with new growth that is creamy-yellow to white with a few deep green blotches and green speckles. Leaves become all green with age or under low light levels. Suitable for TT.
'Jubilee'	(V, M) Densely arranged leaves or irregular shape with white edge and gray-splashed center. Flattened branch system. Suitable for ST.
'Kaleidoscope'	(V, C, F) Leaf shape similar to 'Boskoop.' Elongated leaves with three to seven ruffled lobes with striking green-and-white variegation along the veins. Stems maroon-colored. Suitable for B.
'Kobold'	(BF, M) Smaller leaf sport of 'Wichtel.' Small, medium-green, mostly lobed leaves with rounded-tipped, elongated terminal lobe or slightly three-lobed with asymmetrical basal protrusions. Suitable for B and ST.
'Kolibri'	(M, V, BF) Small, very white leaves; three forward-pointing lobes and bright to dark green flecks. Some leaves with extensive gray background patches. Suitable for ST. What is called 'Kolibri' in the trade is actually 'Schaefer Three.'
'Lady Frances'	(M, V, BF) Miniature gray and white variegated Bird's Foot ivy. Leaves small, asymmetrical, sharply pointed, predominantly three-lobed with lateral lobes pointing outward, or leaves barely five-lobed. Strongly self-branching. Suitable for ALL.
'Lalla Rookh'	(C) Large, very curly-leafed ivy with deeply cut broad leaves and large, asymmetrical, blunt teeth on each lobe. Suitable for B and TT.
'Manda Crested'	(C) Curly ivy with shiny new leaves. Five broad, star-like lobes that curl strongly downward, while the margin of each lobe undulates up and down one or two times. Suitable for B.

Cultivar Name	Description
'Maple Queen'	(I) One of the oldest American pot plant varieties, reported to be a sport of 'Pittsburgh.' Leaves flat, dark green and somewhat shiny, leathery and about as long as wide; three-lobed, square-sided; veins prominent. Suitable for B and TT.
'Merion Beauty'	(I, M) Small, typical ivy-shaped or triangular three-lobed leaves on dense, bushy plants. Suitable for ST.
'Midget'	(M, BF) Miniature star-like, narrow-lobed leaves usually three-lobed or slightly five-lobed. A smaller version of 'Needlepoint.' Suitable for ALL.
'Milky Way'	(V, BF) Leaves three-lobed except when little variegation present, then five-lobed. Variegation is milky-white streaks along the main vein but can vary from leaf to leaf to none. Self-branching. Suitable for B and ST.
'Minor Marmorata' also known as 'Discolor'	(V, I) Small leathery-leafed, sparsely clad ivy with cream, green and gray flecks on a dark green leaf. Mature leaves nearly all green. Suitable for TT.
'Misty' also known as 'Silver Lace'	(M, V, BF) Compact self-branching miniature ivy with five-lobed leaves with a center of various shades of gray, white veins and a very narrow white margin. Suitable for ST.
'Needlepoint'	(BF) Star-like leaves with three narrow lobes or barely five-lobed with basal protrusions. Suitable for ST and B.
'Paper Doll'	(V) Leaves asymmetrical with irregular shape and gray-green splashed center with irregular, narrow, white margin. Suitable for TT and B.
'Parasol'	(C) Large, very shiny, dark green, curly, five-lobed leaves with lobes that curl slightly downward and have a wide upward curl between the lobes. Leaf stalks nearly twice as long as the blade. Sport of 'Ivalace.' Suitable for B.
'Perfection'	(BF) A medium- to large-leaved ivy with narrow lobes; strongly vining habit. A larger version of 'Needlepoint.' Suitable for ALL.
'Perle'	(M, V, O) Miniature self-branching, variegated ivy with small, asymmetrical, round, puckered leaves with conspicuously crimped or rolled-under, irregular margins. Center of leaf splashed with shades of gray or green with white or cream margin. A fasciated sport of 'Harald.' Suitable for B.
'Pittsburgh'	(H) The first of the self-branching ivies with five-lobed, medium-sized, lighter-green leaves with brighter veins. Leaves held at an angle parallel to the stem, giving a stem cut from the plant an elegant look, suitable for flower arrangements. Very variable group. Most plants no longer self-branching. Suitable for B.
'Pittsburgh Variegated'	(V, I) Speckled green on white new growth or white on green older leaves; leaves slightly wavy. Suitable for B.
'Ralf'	(H) Light green-yellow, heart-shaped – or with three rounded lobes; puckered new leaves with thread-like veins extending close to margins. Older leaves slightly five-lobed with less prominent veins. Suitable for ALL.
'Ritterkreuz'	(BF) Leaf shape similar to Maltese Cross; lobes broadest above middle, terminal lobe diamond-shaped. Suitable for ALL.
'Rona'	(V, I) <i>H. hibernica</i> 'Rona' with typical Hibernica-shaped leaves, wider than long, with broad terminal lobe. Variegation patches of bright yellow with small green speckles. Leaves often half-green, some half-variegated. Suitable for TT.

Cultivar Name	Description
'Rumania'	(I) Leaves flat, dull, dark green, almost blackish basically three-lobed to broadly heart-shaped, about as long as wide to slightly longer than wide. Terminal lobe very broad with lateral lobes short and swept backward. Veins very white. Suitable for ALL.
'Sagittaeifolia'	See 'Star.'
'Sagittaeifolia Variegata'	(V, BF) Star-shaped leaves with elongated terminal lobes. Mottled green on cream to gray-green mottled central variegation. Suitable for ALL.
'Schaefer Three'	(V) Leaves with three irregular lobes and an irregular green margin banded by white to the inside and a gray-splashed center. An extremely variable cultivar: some leaves like 'Calico' without a gray center, others green with white blotches and streaks, and others all green. Often mistakenly known as 'Kolibri' in the trade. Suitable for ALL.
'Shamrock'	(M, BF) Ideally, a very self-branching Miniature ivy with three (rarely five) ovate, round-tipped, lobed leaves. Leaves may be split into separate leaflets that over-lap the terminal lobe. Suitable for ALL.
'Spear Point' also known as 'Green Spear'	(BF) Diamond-shaped leaves with three forward-pointing lobes; the terminal lobe the longest. Veins prominent, raised above leaf surface. Suitable for ALL.
'Spetchley' also known as 'Gnome'	(M, BF) One of the smallest ivies. Leaves leathery, dark green, three-lobed with an elongated, rounded terminal lobe. Stems of new growth maroon. Suitable for ST.
'Star'	(BF) Leaves with five narrow lobes with the center lobe twice as long as lateral lobes. Basal lobes backward-pointing. This is the cultivar known as 'Sagittaeifolia' in the trade. Suitable for ALL.
'Tanja'	(H) Distinctive barely three-lobed, long, triangular, dark green leaves twice as long as wide with slightly wavy leaf margins. Veins white with distinctive vein loops. Suitable for ALL.
'Teardrop'	(H) Leaves teardrop shaped with a elongated point. Vins raised above the surface and radiating out from the base of the leaf. Suitable for ALL.
'Telecurl'	(C) Leaves medium green; new growth very curly with deep pinch at base of blade; the three or five lobes twisted and curved downward. Suitable for ALL.
'Teneriffe'	(V, I) Leaves slightly wider than long, mostly five-lobed or three-lobed with shallow sinuses. Variegation combines three shades of green blotches, speckles and dots on a yellow to cream leaf. Suitable for TT.
'Thorndale'	(I) Leaves large, dark green, slightly wider than long, five-lobed with broad terminal lobe, broad lateral lobes and shallow, nearly inconspicuous basal lobes that form a heart-shaped leaf base. Veins white. Suitable for ALL.
'Tobler'	(BF, O) Leaf very unlike any ivy leaf, with three to five linear, stalked segments. When growth is fast, segments may fuse and become star-like. Suitable for TT.
'Tomboy'	(H) Ivy with shiny, leathery, unlobed, pointed, ovate leaves. Grows flat and flowers easily when growing on a wall. Suitable for ALL.
'Touch of Class'	(I) Shiny, dark green leaves with broad, pointed terminal and lateral lobes, and small basal lobes. Leaf margins rolled under and irregularly, slightly crimped or crested. Suitable for B and TT.

Cultivar Name	Description
'Treetop'	(A, H) Adult ivy with bright green, glossy, ovate leaves that mature to dark green. Flowers in summer followed by black fruits. Grows 4-6' tall with rounded form but can be pruned to maintain desired height and shape.
'Très Coupé'	(BF, M) Leaves fine-textured, very small, almost linear, unlobed or with two short basal lobes at right angles. Compact and strongly self-branching. Suitable for ST.
'Triton'	(F, BF) Leaves dark green, shiny, deeply cut, long and tapering with twisted lobes; tapering leaf base. Conspicuous, parallel and prominently raised veins. Suitable for B and TT.
'Troll'	(M, F) Like a miniature 'Treetop,' leaves small, three-lobed, with elongated terminal lobe. Very self-branching.
'Tusie Mussie'	(V, BF) A green and white speckled variegated form (presumably of 'Shamrock'). Compact plant with extremely variable leaves, usually three-lobed but sometimes unlobed or with two small, additional basal lobes. Speckled variegation along margins or veins and spreading outward. Veins white. Variegation most pronounced on new growth. Suitable for ALL.
'Walthamensis'	(I) Dark green leaves similar to miniature 'Hibernica' leaves but with rounded lobes. Leaves as wide as long with broad terminal lobe. Suitable for TT.
'Wichtel'	(M, BF) Narrow three-lobed leaves with broad, elongated terminal lobe and small, rounded basal protrusions. Suitable for ST and B.
'Wilson'	(I) Leaves dark green, satiny, three-lobed or heart-shaped, often wider than long with concave terminal lobe. Stems stout, bright green; new growth variable in shape. Veins light green. Suitable for ST and B.
'Zebra'	(V, F) A variegated fan-shaped ivy with three to five forward-pointing lobes – or the leaves often orbicular or somewhat heart-shaped. In bright light, shades of gray radiate out from the petiole, resembling zebra stripes. Veins white. Under low light, leaves nearly all green. Suitable for B and TT.

¹ Sources: Sulgrove, S.W. Index to Ivy Journal Photographs and Concise Descriptions 1980-1984, 1985-1999. Registrar, American Ivy Society.

² Davis, R. The Ivy Farm, Locustville, VA.

³ Hammer, P.R. Samia Rose Topiary, Encinitas, CA.

The authors thank Patricia R. Hammer of Samia Rose Topiary; Dr. Sabina M. Sulgrove, Director of Research, American Ivy Society; Dr. Franklin A. Pokorny, University of Georgia; Mr. Warren Davenport of TimberCrest Farm, Georgia; and Mr. Richard Davis of The Ivy Farm, Virginia, for reviewing this bulletin and for their helpful suggestions.

Mention of a commercial or proprietary product in this publication does not constitute a recommendation by the authors nor does it imply registration under FIFRA as amended.

Learning *for* Life

The University of Georgia and Ft. Valley State University, the U.S. Department of Agriculture and counties of the state cooperating. Cooperative Extension, the University of Georgia College of Agricultural and Environmental Sciences, offers educational programs, assistance and materials to all people without regard to race, color, national origin, age, gender or disability.

An Equal Opportunity Employer/Affirmative Action Organization Committed to a Diverse Work Force