

Ornamental Plant Trials from Georgia to Maine - A Case Study of *Chamaecyparis thyoides* Accessions

Donglin Zhang¹ and Michael A. Dirr²

¹Department of Plant, Soil and Environmental Sciences,
University of Maine, Orono, ME 04469-5722

²Department of Horticulture
University of Georgia, Athens, GA 30602

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Significance to the Industry: Ornamental plant trials provide extremely important growth and cold-hardiness data for growers to produce and market their plants. From the Georgia and Maine Trials of *Chamaecyparis thyoides*, growers can successfully sell their Atlantic White Cedar plants to the right place and extend their market arena.

The Lyle E. Littlefield Ornamentals Trial Garden is the northern-most ornamental garden along the eastern US coast and has brought nation-wide attention by its cold hardiness trials for woody and herbaceous perennial ornamental plants (1, 2). The Landscape Horticulture Program at the University of Maine is dedicated to cold hardiness work and this *Chamaecyparis thyoides* study is a great example. We look forward to the further collaboration with researchers and members of Southern Nursery Association and producing more useful data for our nursery industry.

Nature of Work: Atlantic White Cedar (*Chamaecyparis thyoides* (L.) B.S.P.) is a native needle evergreen plant, ranges from Maine to Georgia (along the Atlantic Coast) and from Florida to Mississippi (Gulf Coast) (3, 4, 6). Naturally, the plant occurs in wet spots or nearby swamp areas and reaches 12-15 meters tall and 3-6 meters wide. In the everyday garden situation, this species performs well on drier soil and the habit and height are extremely variable (4). The diversity in morphological and growth features and artificial selection has resulted in more than 50 accessions in the commercial trade (3, 4). Thanks to plant-lovers and horticultural professionals, the wide selection of this insect- and disease-free plant has gained popularity in our landscape (4, 6).

For both growers and gardeners, the key questions in producing or buying a plant are its cold hardiness zones and growth rate. With so many taxa of Atlantic White Cedar available in the trade, the cold hardiness and growth rate have to be addressed with trials in different locations. Six plants (three for each location) of each *Chamaecyparis thyoides* accession was randomly planted in the Horticultural Farm and Trial Beds at the University of Georgia (under Dr. Michael Dirr's Ornamental Plant Improvement Program) and the Lyle E. Littlefield Ornamentals Trial Gardens at the University of Maine (under Dr. Donglin Zhang's Maine Plants Program). The winter damage and plant growth were recorded yearly.

Results and Discussion: As variable as its morphological features, *Chamaecyparis thyoides* taxa have broad-adaptability to the cold. Based on the Maine field trial and reference from other inputs (small trials from Vermont and Portland, ME) and literature (2, 3, 4, 6), growers can sell the following taxa to the USDA cold hardiness zone 4 (Table 1): all "Arnold Arboretum" clones; 'Aurea'; 'Blue Sport'; 'Compact Glauca'; 'Glauca'; 'Heatherbun'; 'Maine Form'; "Planting Field Arboretum" clones; 'Shiva'; 'Twombly Blue'; and, 'Variegata'. In our observations, plants with blue and yellow scaled-foliage are much more cold hardy than these with green foliage. At least, the cold damage on the green foliage (small branches) were significant. In zone 5 'Ericoides', 'Little Jamie', 'MethDwarf', 'Raulston Form', 'Red Star', 'Taylor County' and '#23WL' could be added to the list. All tested Atlantic White Cedar accessions should do well in USDA hardiness zone 6 or above.

'Andelyensis' and 'Shiva' are doing well in the cold climate. However, they could not survive in the Georgia field trial. 'Top Point' died in 2002 in both Georgia and Maine. Besides the cold tolerance, some other factors, such as heat-resistance, should be considered for better growing these plants for the landscape along US Atlantic and Gulf coasts.

The growth rate of Atlantic White Cedar is clone-dependable. Some taxa grow about 10 cm per year, while others about 100 cm. Climate zones also have significant effects on the plant growth. The field trial in Georgia produced much taller plants than the trial in Maine. For the same cultivar, especially the fast growing ones (5), the growth rate per year and total growth for the last five years usually doubled in Georgia. Only slow growing cultivar, 'Heatherbun', is the outlier of this trend (Table 2 and Figure 1). Obviously, the production of *Chamaecyparis thyoides* takes much longer in the north. Growers in the south should take the advantage of the climate and market their cold hardy taxa to the northern landscape.

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Table 1: Cold hardiness and suggested USDA cold hardiness zones for the taxa of *Chamaecyparis thyoides* based on Georgia and Maine field trials.

Taxa	Trials 1998-2003		USDA Zones			
	Georgia	Maine	4	5	6	7
Arnold Arboretum#1022-84	N/A	No damage	√	√	√	√
Arnold Arboretum#129681	N/A	No damage	√	√	√	√
Arnold Arboretum#13047	No damage	No damage	√	√	√	√
Andelyensis (Appalachian)	Died in 2002	10% damage	√	√	√	
Andelyensis (Arnold Arb.)	N/A	10% damage	√	√	√	√
Aurea (Dilworth)	N/A	10% damage	√	√	√	√
Baldwin County	No damage	Died in 2004		?	√	√
Blue Sport	N/A	No damage	√	√	√	√
Compact Glauca	N/A	No damage	√	√	√	√
Compact Glauca (Smotherman)	N/A	No damage	√	√	√	√
Dirr #1	N/A	Died in 2000			√	√
Dirr #2	No damage	Died in 2000			√	√
Dodd Form	No damage	Died in 2000			√	√
Ericoides	N/A	70% damage		√	√	√
Georgia Form (Ruter)	No damage	Died in 2004		?	√	√
Glauca (Schumacher)	N/A	No damage	√	√	√	√
Heatherbun	No damage	No damage	√	√	√	√
var. <i>henryae</i>	N/A	Died in 2004		√	√	√
Little Jamie (Smotherman)	No damage	40% damage		√	√	√
Maine Form	N/A	No damage	√	√	√	√
Meth Dwarf	N/A	40% damage		√	√	√
Mobile Bay (Dooley)	N/A	Died in 2000		?	√	√
Okefenokee Compact	No damage	Died in 2000			√	√
Planting Field Arboretum #1	N/A	No damage	√	√	√	√
Planting Field Arboretum #2	N/A	10% damage	√	√	√	√
Raulston Form	No damage	20% damage		√	√	√
Red Star	No damage	Died in 2004		√	√	√
Select Tree (Narrow)	No damage	Died in 2001		?	√	√
Select Tree (Open)	N/A	Died in 2000			√	√
Shiva	Died in 1999	No damage	√	√	?	
Taylor County (ABG)	No damage	80% damage		√	√	√
Taylor County (BWWC)	N/A	Died in 2003		√	√	√
Top Point (Greer)	Died in 2003	Died in 2001		?	√	
Twombly Blue	N/A	5% damage	√	√	√	√
Variegata (Australia)	No damage	10% damage	√	√	√	√
Webb#1 (Emily)	No damage	Died in 2000			√	√
Webb#2 (Rachel)	No damage	Died in 2001			√	√
Webb Gold	No damage	Died in 2003		?	√	√
#23 WL	N/A	Died in 2004		√	√	√
#23 WL Witch's Broom	N/A	30% damage		√	√	√

Table 2: Growth rate of *Chamaecyparis thyoides* taxa based on Georgia and Maine field trials from 1998-1999.

Taxa	Growth rate (cm)	
	Georgia*	Maine
Arnold Arboretum#1022-84	69	33.5 ab**
Arnold Arboretum#129681	66	28.8 bc
Arnold Arboretum#13047	62	27.0 bcd
Andelyensis (Appalachian)	31	15.5 de
Andelyensis (Arnold Arb.)	24	15.7 de
Aurea (Dilworth)	58	28.5 bc
Blue Sport	93	42.5 a
Compact Glauca	31	27.2 bcd
Compact Glauca (Smotherman)	36	26.8 bcd
Glauca (Schumacher)	36	26.1 bcd
Heatherbun	13	10.3 e
Planting Field Arboretum #1	67	24.7 bcd
Planting Field Arboretum #2	92	33.5 ab
Raulston Form	93	41.8 a
Twombly Blue	82	17.3 cde
Variegata (Australia)	66	31.0 ab

*Data from Sandrock, 2000 (5).

**Mean growth rate within the column followed by the same letter are not significantly different based on Duncan's new multiple range test at $P \leq 0.05$.

Figure 1: Growth of four *Chamaecyparis thyoides* taxa based on Georgia and Maine field trials after planting for 5 years (1998-2003).

