Production & Marketing Reports

Rhododendron Performance Evaluation in Maine

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Summary. For nearly 30 years, the Univ. of Maine has been conducting woody ornamental plant performance evaluations. While there are a number of focus collections under evaluation, the *Rhododendron* collection is one of the central features of the program. This report offers performance data for more than 100 specimens grown at the Lyle E. Littlefield Ornamentals Trial Garden on the campus of the Univ. of Maine. Winter survival, folk disease rating, fall foliage color and effectiveness, and flowering dates are included.

Members of the genus *Rhododendron* are among the most popular woody ornamental landscape plants used in the eastern United States. They offer tre-

mendous variety in flower characteristics, including color, season and length of effectiveness, and fragrance. In addition, there is great diversity within the genus in terms of foliage characteristics, growth habit, pest susceptibility, and cold hardiness. It is the lack of comprehensive cold hardiness ratings that has limited use of many species and varieties in cold climates. For this reason, a plant performance evaluation program was begun in the early 1960s at the Univ. of Maine. The goal of the program has been to provide reliable plant performance ratings for use by industry professionals as well as amateur gardeners.

There have been several reports published on laboratory cold hardiness tests of *Rhododendron* species and cultivars. Graham and Mullin (1976a, 1976b) reported on investigations into the relationships among cold-hardiness and low-temperature exotherms offreezing tissue. Others have reported on investigations into the supercooling ability of flower primordia (George et al. 1974; Kaku et al. 1982). Pellett and Holt (1981) reported on laboratory cold-hardiness limits of several evergreen rhododendron cultivars. Pellett et al. (1991) surveyed several

native populations of *R. calendulaceum*, *R. prinophyllum*, and *R. viscosum* for cold hardiness. Flowering characteristics and fall foliage coloration of these same populations also were reported (Pellett and Alpert 1988, 1989). In the most comprehensive laboratory study to date, Sakai et al. (1986) reported on the laboratory-determined low-temperature tolerance limit of 101 *Rhododendron* genotypes.

Aside from the above work, there has been little reported on performance of many of the rhododendron varieties currently available in landscape situations. As a result, there are a great many misconceptions regarding appropriate siting and cold-hardiness zone ratings assigned to *Rhododendron* species and varieties.

Table 1 lists the low-temperature limit offered for several species in four plant material references. The fact that there are discrepancies is not surprising because there are many factors that affect winter survival. Exposure to sun and wind and snow cover among other factors can alter plant performance drastically. However, excessive variation in plant hardiness ratings still exists. For example, Table 1 indicates minimum survival temperature for *R. impeditum* to range from -15 to -29°C. While some variation might be expected, the magnitude of this temperature spread indicates a lack of reliable performance information.

Since 1962, the Univ. of Maine has been conducting an ongoing woody landscape plant evaluation program at the Lyle E. Littlefield Ornamentals Trial Garden. This facility, located on the Orono campus, has served as the site for testing of winter hardiness. The site is located in USDA hardiness zone 4a (USDA 1990), the average minimum temperature for the last 6 years being about -32°C. The

Table 1. Minimum winter survival ratings (°C) for five *Rhododendron* species from four publications.

Rhododendron species	Reference source			
	Rehder ^a	Hortus III ^b	Krussmann ^c	Dirr ^w
<i>R. atlanticum</i>	-20	-23	-23	-26
<i>R. brachycarpum</i>	-26	-23	-23	---
<i>R. impeditum</i>	-15	-23	-29	-26
<i>R. luteum</i>	-20	-29	-29	-26
<i>R. yakusimanum</i>	---	-23	-23	-26

^aRehder, 1940.

^bLiberty Hyde Bailey Hortorium, 1976.

^cKrussmann, 1986.

^wDirr, 1990.

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4.8-ha site is located on an exposed hilltop that experiences considerably windy conditions throughout the winter. The soil is primarily a Dixfield, sandy loam. Average annual precipitation is 960 cm. Snowfall averages $\approx$ 200 cm per year and is distributed relatively evenly from late December through early April.

In 1988, a major expansion of the Rhododendron collection was initiated and a more in-depth evaluation program begun. From 1989-1993, all the specimens in the collection were rated for winter survival offoliage and flower buds, fall foliage coloration, and incidence of foliar diseases. In addition to the above ratings, flowering date was recorded for each specimen as the date the plant was estimated to be at peak "showiness." Plantings of all cultivars consisted of a minimum of two specimens. Any cultivars that died as a result of winter injury were replanted once. Seed-produced taxa were not replanted.

Table 2 lists the results of the *Rhododendron* evaluations. More than 100 specimens are listed and rated for hardiness, foliar disease, fall color, fall color effectiveness, and flowering date. All data in Table 2 represent an average of at least three seasons evaluations. All plants were established for 1 full year prior to evaluation. A uniform 3-inch layer of mixed-species conifer bark mulch was maintained throughout the evaluation period and plants received supplemental irrigation only during two extended dry periods in Summer 1992. The hardiness rating (1 = no damage, 5 = complete winter kill) represents a minimum of three winters of evaluation. The minimum winter temperatures for 1989-90, 1990-91, 1991-92, and 1992-93 were -35, -30, -33, and -35C, respectively. The ratings were rounded to the nearest whole-number rating.

The disease rating was a subjective assessment of the aesthetic effect of the foliage as affected by foliar diseases, primarily powdery mildew and leaf spot. A rating of 1 was given only to plants that exhibited no disease signs during the evaluation period. Ratings of 2 to 5 indicated <25%, 25-50%, 50-75%, and >75% of the foliage surface affected by disease symptoms. No attempt was made to identify particular causal organisms; rather, ratings were based on the effect of one or more organisms on the visual quality of the foliage.

Table 2. *Rhododendron* performance evaluation.

Species	Variety/ cultivar	Hardiness ^a	Disease rating ^b	Fall color ^c	Fall color rating ^d	Flowering date
<i>R. aberconwayi</i>		5	---	---	---	---
<i>R. arborescens</i>		1	1	R	2	20 June
<i>R. atlanticum</i>		2	2	R,O	2	12 June
<i>R. atlanticum</i>		1	2	O	3	12 June
<i>R. Bakeri</i>		1	2	DR,O	2	15 June
<i>R. Bakeri</i>		1	1	R	1	15 June
<i>R. barbatum</i>		5	1	R,O	2	---
<i>R. brachycarpum</i>	<i>Tigerstedtii</i>	1	1	G	---	10 June
<i>R. calendulaceum</i>		1	1	DR	1	2 June
<i>R. calendulaceum</i>		2	2	R,O	2	2 June
<i>R. calenculaceum</i>		1	1	R,O	1	2 June
<i>R. calenculaceum</i>		1	1	DR	2	2 June
<i>R. campanulatum</i>		5	---	---	---	---
<i>R. canadense</i>		1	2	Y,O,G	3	29 May
<i>R. canadense</i>		1	2	Y,O,G	3	29 May
<i>R. canadense</i>	<i>albiflorum</i>	1	2	Y,G	3	29 May
<i>R. carolinianum</i>	<i>album</i>	2	1	---	---	1 June
<i>R. catawbiense</i>	<i>album</i>	1	1	---	---	2 June
<i>R. catawbiense</i>	Lee's Dark Purple	2	1	---	---	8 June
<i>R. catawbiense</i>	Nova Zembla	1	1	---	---	9 June
<i>R. catawbiense</i>	Roseum Elegans	1	1	---	---	9 June
<i>R. dauricum</i>		1	1	Y,O	2	8 May
<i>R. dauricum</i>	<i>album</i>	1	1	Y	2	6 May
<i>R. dauricum</i>	Madison Snow	1	1	Y	2	6 May
<i>R. hyb</i>	Aglo	1	1	R,G	2	22 May
<i>R. hyb</i>	Alexander	1	1	DR	2	22 May
<i>R. hyb</i>	Anna's Cheer	2	2	R,O	3	18 June
<i>R. hyb</i>	Anna's Dream	2	2	Y,O	3	18 June
<i>R. hyb</i>	Apricot Surprise	1	3	Y	4	2 June
<i>R. hyb</i>	April Snow	1	1	Y	3	14 May
<i>R. hyb</i>	Big Deal	1	1	---	---	21 May
<i>R. hyb</i>	Bixby	4	1	---	---	1 June
<i>R. hyb</i>	Black Satin	1	2	DM	3	22 May
<i>R. hyb</i>	Boule de Neige	1	1	---	---	2 June
<i>R. hyb</i>	Cunningham's White	2	1	---	---	5 June
<i>R. hyb</i>	Desmit	1	1	Y,O	3	---
<i>R. hyb</i>	Frank Abbott	1	1	M,R,O	2	8 June
<i>R. hyb</i>	Gallant Warrior	1	1	---	---	10 June
<i>R. hyb</i>	Gibraltar	1	4	B,O	4	28 May
<i>R. hyb</i>	Golden Gala	1	1	---	---	9 June
<i>R. hyb</i>	Golden Lights	1	3	Y,O	2	1 June
<i>R. hyb</i>	Golden Showers	1	2	DM	3	14 July
<i>R. hyb</i>	Hidden Treasure	1	3	B,O	4	23 June
<i>R. hyb</i>	Homebush	1	1	Y,R	2	27 May
<i>R. hyb</i>	Iridescent	1	2	DM	3	22 June
<i>R. hyb</i>	Jane Abbott Peach	1	1	DR	2	1 June
<i>R. hyb</i>	Jane Abbott Pink	1	2	Y,O	3	3 June
<i>R. hyb</i>	Jolie Madame	1	3	B,O	4	10 June
<i>R. hyb</i>	Keowee Sunset	1	2	B,Y	4	4 June
<i>R. hyb</i>	Klondyke	1	1	DR,O	3	1 June
<i>R. hyb</i>	Lemon Drop	1	1	DM	2	12 July
<i>R. hyb</i>	Lollipop	1	1	DM	3	22 June
<i>R. hyb</i>	Low Red Frilled	1	1	---	---	8 June
<i>R. hyb</i>	Majesty	4	1	DR	3	4 June
<i>R. hyb</i>	Marie Hoffman	1	2	R,O	2	2 June
<i>R. hyb</i>	Mary Kittel	1	1	---	---	2 June
<i>R. hyb</i>	Merley Cream	2	1	---	---	---
<i>R. hyb</i>	Milestone	1	1	R,BZ	3	15 May

continued

Table 2 Continued.

Species	Variety/ Cultivar	Hardiness ^z	Disease rating ^y	Fall color ^x	Fall color rating ^w	Flowering date
<i>R. hyb</i>	Molly Fordham	1	1	Y,G	3	22 May
<i>R. hyb</i>	Mrs. J.A. Withington III	1	2	---	---	19 May
<i>R. hyb</i>	Narcissiflora	1	1	DR,Y	2	6 June
<i>R. hyb</i>	New Patriot	2	1	R	2	15 May
<i>R. hyb</i>	Northern Lights	1	4	Y	5	1 June
<i>R. hyb</i>	Olga Mezzitt	1	1	Y,G	3	22 May
<i>R. hyb</i>	Orchid Lights	1	4	Y	4	30 May
<i>R. hyb</i>	Parade	1	2	R,Y	3	3 July
<i>R. hyb</i>	Pink & Sweet	1	2	DR	2	30 June
<i>R. hyb</i>	Pink Discovery	3	1	DR	3	20 May
<i>R. hyb</i>	PJM	1	1	R,DM	2	10 May
<i>R. hyb</i>	PJM Victor	1	1	DR,DM	2	18 May
<i>R. hyb</i>	Primrose	1	4	Y,G,O	4	3 June
<i>R. hyb</i>	Purple Gem	2	1	---	---	3 June
<i>R. hyb</i>	Purple Pajamas	1	1	R,O	2	18 May
<i>R. hyb</i>	Rio	1	1	---	---	11 June
<i>R. hyb</i>	Rosy Lights	1	3	Y,O	4	1 June
<i>R. hyb</i>	Spicy Lights	1	4	DM	4	1 June
<i>R. hyb</i>	Thunder	1	1	DR,DM	2	18 May
<i>R. hyb</i>	Toucan	1	2	BZ	3	4 June
<i>R. hyb</i>	Victoria's Consort	1	1	---	---	19 May
<i>R. hyb</i>	Viscosepala	2	4	DR	3	15 June
<i>R. hyb</i>	Wally	1	1	---	---	24 May
<i>R. hyb</i>	Weston's Pink Diamond	1	1	R	3	14 May
<i>R. hyb</i>	Weston's Innocence	1	1	DM	2	22 June
<i>R. hyb</i>	White Lights	1	2	DR	2	1 June
<i>R. hyb</i>	Windbeam	1	1	---	---	29 May
<i>R. impeditum</i>		1	1	---	---	29 May
<i>R. keiskei</i>		5	---	---	---	---
<i>R. kiusianum</i>		1	1	Y	3	2 June
<i>R. lepidotum</i>		5	---	---	---	---
<i>R. luteum</i>		1	1	Y,O	2	28 May
<i>R. luteum</i>		1	1	O,R	4	6 June
<i>R. maximum</i>	<i>roseum</i>	1	1	---	---	20 June
<i>R. Metternichii</i>		5	---	---	---	---
<i>R. molle</i>		5	---	---	---	---
<i>R. mucronulatum</i>	Cornell Pink	1	1	DR	1	13 May
<i>R. mucronulatum</i>	<i>nana</i>	1	1	DR	1	18 May
<i>R. prinophyllum</i>		1	1	R,O,G	2	23 June
<i>R. prinophyllum</i>		1	1	R	2	17 June
<i>R. rupicola</i>		1	1	---	---	2 June
<i>R. schlippenbachii</i>		1	1	Y,O,R,M	2	16 May
<i>R. schlippenbachii</i>	<i>alba</i>	1	1	Y,O	2	16 May
<i>R. serphyllifolium</i>		5	---	---	---	---
<i>R. tschonskii</i>		5	---	---	---	---
<i>R. vaseyi</i>		1	1	DR	1	18 May
<i>R. vaseyi</i>	White Find	1	1	R,O	1	22 May
<i>R. viscosum</i>		1	2	DM	2	12 July
<i>R. viscosum</i>	Pink hyb	1	1	Y,R	2	18 July
<i>R. weyrichii</i>		5	---	---	---	---
<i>R. yakusimanum</i>	Mist Maiden	1	1	---	---	8 June

^zHardiness ratings defined as follows: 1) little or no winter damage; 2) occasional tip die-back or flower bud kill; 3) plant consistently experiences tip die-back, occasional severe winter damage; 4) plant consistently experiences severe winter damage; 5) plant killed.

^yDisease ratings represent evaluations of presence of mildew or leaf spot; ratings defined as 1 (no sign of disease) to 5 (>75% leaf covered with mildew or early leaf drop due to mildew).

^xFall color abbreviations: R = red, O = orange, Y = yellow, G = green, M = maroon, DM = deep maroon, DR = deep red, BZ = bronze, B = brown.

^wFall color rated from 1 (clear consistent color, effective from some distance) to 5 (no color or leaves drop brown, green, or mildew-covered).

Table 2 reveals that $\approx 80\%$ of the taxa evaluated proved to be reliably cold hardy (hardiness rating of 1) in USDA hardiness zone 4a. More than 70 taxa remain after individuals that exhibited high foliage disease problems (foliage disease ratings of 3 to 5) are removed from the list. Add to this list those with potential for successful use if given minimal protection (those given a hardiness rating of 2), and there >80 taxa that can be used successfully in northern landscapes. This certainly represents a much higher number than the number of taxa commonly offered for sale in the northeastern United States.

Of the taxa evaluated, 11 also were tested for cold hardiness by Sakai et al. (1986). Ten of those 11 taxa successfully withstood temperatures as low as -35C in our tests; however, all 10 were given higher lowest-survival-temperature (LST) ratings by Sakai. Their LST ratings ranged from 5 to 12C higher than the -35C that all 10 withstood in our study. Because nine of those 10 taxa were seed-produced species, some variation would be expected. In addition, most of their test material was collected from plants growing in Sapporo, Japan, while ours were collected from plants growing in central Maine. The differences in collection date and ambient environment likely contributed to the differences.

Finally, of the five species listed in Table 1, all show a minimum rating of USDA cold hardiness zone 5 (-23 to -29C). Our evaluations, however, indicate that of the five species listed, all but *R. atlanticum* perform well in zone 4, and thus should reflect that in their rating. In fact, from our laboratory observations, *R. luteum* and *R. brachycarpum* var. *tigerstedtii* both will perform acceptably in zone 3.

This work has demonstrated zone 4 performance of many taxa considered too tender to be used successfully in that climate. Work is continuing on additional rhododendron species and cultivars as well as a wide array of other landscape plants. It is intended that this report, and others to follow, will lead to more widespread use of these superior plants throughout northern landscapes.

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