Preliminary and Regional Reports

Evaluation of Growth, Flowering, and Cold Hardiness of *Ceanothus* in Western Oregon

Neil C. Bell¹

ADDITIONAL INDEX WORDS. drought, landscape, shrubs, wild lilac, California lilac

SUMMARY. Thirty-eight species, cultivars, and hybrid selections of *ceanothus* (*Ceanothus* spp.) were evaluated for growth, flowering, and cold hardiness in a landscape trial in Silverton, OR, from 2001 to 2005. Plants were only irrigated for establishment in Summer 2001 and were not pruned or fertilized throughout the trial. Several cultivars showed dieback and leaf damage after 22 °F cold events in late October and early Nov. 2002 and 2003, the most severely affected of which were *Ceanothus thyrsiflorus* var. *griseus*, *C. thyrsiflorus* var. *griseus* 'Yankee Point', *Ceanothus hearstiorum*, and *C. thyrsiflorus* 'Snowflurry'. Among the cultivars evaluated, those recommended for early bloom are 'Ray Hartman' and 'Blue Jeans'. Several cultivars are effective drought-tolerant groundcovers, including 'Wheeler Canyon', 'Joyce Coulter', and 'Joan Mirov'. Among the smaller-growing plants, *Ceanothus cuneatus* var. *rigidus* 'Snowball' and *Ceanothus gloriosus* 'Heart's Desire' made effective groundcovers only 0.6 and 0.2 m tall, respectively.

The genus *Ceanothus*, also known as wild lilac or simply ceanothus, comprises ≈55 species of woody shrubs native to North America (Hardig et al., 2000). The distribution of species is concentrated in western North America, particularly in California, where they are an important component of semiarid forest, oak woodland, and chaparral. The majority of the species are evergreen

shrubs, which range in habit from prostrate to sprawling or erect large shrubs, although some may be found as small trees (Schmidt, 2003). The climate in the California floristic province in which many of the species of *ceanothus* originated is Mediterranean, with mild, rainy winters and warm to hot, dry summers. As a result, *ceanothus* is adapted to growing in hot, dry situations, often in relatively poor soils.

Few *ceanothus* cultivars are grown or used extensively in landscapes in western Oregon or

Washington. The most commonly grown are *Ceanothus gloriosus* and 'Skylark' (synonym 'Victoria'), which are a groundcover and large shrub, respectively. The genus is perceived as short-lived and tender. This reputation may partly be a result of the limited selections cultivated, but may also be attributed to plants being grown in landscapes that are watered regularly in summer—a common practice in arid regions of the western United States. Another challenge for landscape management is the large size to which 'Skylark' typically grows. An individual shrub may be more than 6 ft tall and wide after only 5 to 7 years, particularly when irrigated; this size is impractical for some landscapes and gardens.

Little specific information on the cold hardiness of species of *ceanothus* cultivars is available. An estimation of winter hardiness can be inferred from the native range of species or individual clones. Fross and Wilken (2006) provide anecdotal information on a number of cultivars based on experiences in California and the United Kingdom. A field trial of 40 cultivars in Holland, which included evergreen and hybrid cultivars, found all hardy to at least U.S. Department of Agriculture (USDA) zone 8b (Hop, 2006). Boorse et al. (1998) studied the hardiness of four chaparral shrubs, including *Ceanothus megacarpus*, a species found in southern California and the Channel Islands, and *Ceanothus spinosus*, a widespread species found from Eldorado County in the Sierra Nevada foothills south into Baja California. Their research concluded that adult plants of each species showed greater resistance to cold than seedlings. Langan et al. (1997) examined the relationship between cold hardiness and drought stress in *C. megacarpus* and concluded that both factors needed to be considered as limiting survival and distribution of the species. In studies of potted 'Autumnal Blue' *ceanothus*, plant survival was diminished by

Oregon State University Extension Service, Marion County, Salem, OR 97301

I would like to acknowledge financial support from the Washington State Department of Agriculture, donation of plants by California Flora Nursery (Fulton, CA), Suncrest Nursery (Watsonville, CA), Native Sons Nursery (San Luis Obispo, CA), and Monrovia Nursery (Dayton, OR), technical assistance from the Oregon Garden, Silverton, OR, assistance with plot maintenance and data collection by Oregon State University Marion County Master Gardeners, and assistance with statistical analysis provided by Bernadine Strik, Professor of Horticulture, Oregon State University.

¹Corresponding author. E-mail: neil.bell@oregonstate.edu.

Units

To convert U.S. to SI, multiply by	U.S. unit	SI unit	To convert SI to U.S., multiply by
0.4047	acre(s)	ha	2.4711
0.3048	ft	m	3.2808
3.7854	gal	L	0.2642
2.54	inch(es)	cm	0.3937
1	ppm	mg·kg ⁻¹	1
(°F - 32) ÷ 1.8	°F	°C	(1.8 × °C) + 32

increased duration of freezing and smaller container size (Cameron and Dixon, 1997). The objectives of this trial were to evaluate ceanothus cultivars under field conditions for cold hardiness, growth, and flowering in western Oregon.

Materials and methods

Species and cultivars of ceanothus were obtained from nurseries in California and Oregon in Oct. 2000 and May 2001 (Table 1). The plants were growing in 2.5-inch tree bands or 1-gal pots. The trial was located at the Oregon Garden, Silverton, OR (lat. 44°59'N, long. 122°47'W, 440 ft elevation). The evaluation site was $\approx 1/4$ acre, sloping slightly westward. The soil was coarse construction fill remaining from the building of nearby wetlands. Before planting, the site was bladed off using a bulldozer and the top 1 ft was ripped and roughly graded. Three soil samples, consisting of three subsamples to a 6-inch depth each, were collected from the east, center, and west side of the site in June 2007. The soil was classified as clay with a pH of 5.6 (Table 2).

The trial was divided into five unequal length rows, spaced 10 ft apart, orientated east to west. Individual plants were randomly assigned to rows and were planted 5 ft apart within rows. Cultivars were planted in a completely randomized design with three replicates of each cultivar.

After planting on 25 May 2001, plants were mulched with medium grade douglas fir (*Pseudotsuga menziesii*) bark to a depth of 3 inches, and were watered individually, by hand, through Sept. 2001. Plants received no supplemental irrigation from Sept. 2001 to Oct. 2005. No fertilizer was applied after planting for the duration of the trial. Plants were not pruned. Weed management included hand weeding and spot use of glyphosate, when needed.

Data collected included plant height, flowering season, and cold hardiness evaluation. Plant height (ground level to tallest shoot) and width (mean of the widest diameter and width perpendicular to the widest diameter) were measured twice per year, in Apr. and Oct. 2001 through 2004 and again in Apr. 2005. Flowering season was evaluated by recording the date of 5%, 50%, and 100% total

bloom. These data were used to calculate length of flowering season (days from 5% to 100% bloom) from 2003 through 2005. Flowering evaluation generally commenced in March for the early cultivars and continued through July for late-blooming cultivars. Cold hardiness evaluations were done in early Spring after mild weather allowed for full symptom development from any prior cold injury. Data were collected only in Spring 2003 and 2004, as there was no apparent damage following the winters of 2001–02 and 2004–05. Winter cold damage was rated on a 0 to 5 scale, adapted from Lonard and Judd (1991) with 0 = no damage, 1 = minor leaf damage (browning), 2 = leaf and stem damage restricted to the exterior 30% of the plant, 3 = leaf and stem damage to the exterior 60% of the plant, 4 = plant was killed to the ground and was resprouting, 5 = plant was killed. Regional weather data were obtained from the Bureau of Reclamation Agrimet weather station in Aurora, OR (U.S. Bureau of Reclamation, 2008), 25 miles north of the research site.

Growth data were analyzed using repeated measures PROC GLM. Plant size was significantly affected by year in all cultivars, thus data were analyzed by year with mean comparisons using protected least significant difference (LSD) to describe differences between cultivars (version 9.1; SAS Institute, Cary, NC). The dates of 5%, 50%, and 100% bloom and duration of bloom were analyzed using PROC GLM with mean comparisons using protected LSD. Data for size and flowering are presented in tables and figures as means and standard errors. Growth data, height, and average width, are presented for the last measurement date, 14 Apr. 2005 when plants were mature. Flowering data are presented for 2005. Cold hardiness data are presented as means with standard deviations.

Results and discussion

Ceanothus cultivars became established, grew, and filled in the rows by 2005. A small part of the trial area at the west end was subject to periodic flooding because of runoff from a nearby road after rainfall, resulting in death of several cultivars. Three cultivars were damaged to varying degrees by deer that grazed

heavily, reducing the data available ('Marie Simon' and 'Henri Desfosse') or requiring elimination from the trial ('Cliff Schmidt'). No other ceanothus cultivars suffered any noticeable feeding damage. No serious insect pest problems were noted during the trial, and disease problems were infrequent. 'Autumnal Blue' grew well early in the trial, but severe defoliation was observed starting in 2003. This resulted in the loss of all but the current season's leaves, leaving this cultivar sparsely foliated and unacceptable for landscape use. The pathogen *Cercospora* sp. (possibly *C. ceanothi*) was isolated from the affected leaves (Oregon State University Plant Diagnostic Clinic, Corvallis, OR) and was assumed to be the cause.

Individual plants were lost during the trial for undetermined causes, including two of the three *Ceanothus velutinus* var. *velutinus*, although the third plant grew and flowered well. This is a montane species and though the origin of the clone was unknown, it may not be particularly well-adapted to clay soils and the climate at low elevation. Individual hybrids of *Ceanothus impressus*, 'Julia Phelps' and 'Dark Star', died during the study. Plants derived from this species are generally regarded as preferring well-drained soils (Fross and Wilken 2006) and possibly were unsuitable for the constructed clay soil on the evaluation site (Table 2).

PLANT GROWTH. In Spring 2005, many plants had filled their allocated space and some were beginning to grow into one another. Plant height data in Spring 2005 are presented in Fig. 1 and corresponding width data are presented in Fig. 2. There was a significant effect ($P < 0.0001$) of cultivar on height and width. The results show that ceanothus as a group have a wide range of vigor and growth habit and can be divided into four broad groups based on growth habit: 1) upright shrubs; 2) large, rounded shrubs; 3) mounding, wide spreading shrubs; and 4) low, spreading groundcovers.

Of the upright shrubs, 'Ray Hartman' is not commonly available in the Pacific northwestern United States, but blooms heavily and proved more cold hardy than its parentage (*Ceanothus arboreus* $\times$ *Ceanothus thyrsiflorus* var. *griseus*) would suggest (Table 3). 'Ray Hartman' was unaffected by wind

Table 1. Origin and description of ceanothus species and cultivars evaluated in a landscape trial in Silverton, OR, 2001–05.

Name	Description ^z
‘Autumnal Blue’	Possibly <i>Ceanothus</i> × <i>delilianus</i> × <i>Ceanothus thyrsiflorus</i> . Garden hybrid introduced early in 20th century by Burkwood and Skipwith Nursery, London.
‘Blue Jeans’	Seedling of hybrid origin found at Rancho Santa Ana Botanic Garden, Claremont, CA, in 1951. Named by John Dourley and introduced in 1979
‘Centennial’	Naturally occurring hybrid, <i>Ceanothus foliosus</i> × <i>C. thyrsiflorus</i> var. <i>griseus</i> , grown from seed collected at Salt Point on Sonoma County coast, CA, by Roger Raiche in 1985.
‘Concha’	Hybrid found by Charles Samms in San Dimas, CA, in 1946 and named in 1949. Thought to be <i>Ceanothus impressus</i> × <i>Ceanothus papillosus</i> var. <i>roweanus</i> .
<i>Ceanothus cuneatus</i>	One of most widespread species in California and also found into Oregon. This clone of unknown origin.
<i>C. cuneatus</i> (Nipomo Mesa)	Erect shrub, widespread in California and Oregon. This selection from Nipomo Mesa in southern San Luis Obispo County, CA.
<i>C. cuneatus</i> var. <i>ramulosus</i> ‘Rodeo Lagoon’	Cultivar of the species by Steven Edwards from a ridgeline north of Rodeo Lagoon in Marin County, CA. Selected for low, spreading habit.
<i>C. cuneatus</i> var. <i>rigidus</i> ‘Snowball’	Mounding, spreading form of the species with white blooms; one of earliest ceanothus to bloom.
‘Cynthia Postan’	Hybrid selected at University Botanic Garden, Cambridge, UK, from seed collected in 1965 at Regional Parks Botanic Garden. Believed to be <i>C. papillosus</i> var. <i>roweanus</i> × <i>C. thyrsiflorus</i> var. <i>griseus</i> .
‘Dark Star’	Selected from a seedling group by Ken Taylor in Aromas, CA, in 1968. Believed to be <i>C. impressus</i> × <i>C. papillosus</i> var. <i>roweanus</i> . One of most popular garden ceanothus in California.
<i>C. foliosus</i> ‘Berryhill’	Cultivar with tiny, glossy, pebbled leaves. Found in 1976 by Nevin Smith in 1976 on Hood Mountain in Sonoma County, CA.
<i>Ceanothus gloriosus</i> ‘Heart’s Desire’	A very prostrate cultivar found by Phil Van Soelen above Heart’s Desire Beach in the Point Reyes National Seashore in Marin County, CA.
<i>C. gloriosus</i> var. <i>gloriosus</i>	Evergreen shrubs with a prostrate habit found on coastal bluffs from Humboldt County, CA, south to Marin County, CA.
<i>Ceanothus hearstiorum</i>	Rare, narrow endemic from coastal hills surrounding Arroyo de la Cruz in northern San Luis Obispo County, CA.
<i>Ceanothus integerrimus</i>	Erect, deciduous shrub found in Cascade and Coast Ranges from Washington south through California to New Mexico.
‘Italian Skies’	Seedling selected from plants grown from open-pollinated seed of <i>C. foliosus</i> by Edward Anderson of Gloucestershire, UK, in the 1950s. Popular cultivar in Europe.
‘Joan Mirov’	Naturally occurring hybrid of <i>C. thyrsiflorus</i> var. <i>griseus</i> and <i>C. foliosus</i> . Collected by Roger Raiche on the Sonoma County coast near Salt Point, CA, and introduced in 1991.
‘Joyce Coulter’	Selected by John Coulter at his nursery in San Carlos, CA, in 1956 and named in honor of his wife. Believed to be <i>C. papillosus</i> × <i>C. thyrsiflorus</i> var. <i>griseus</i> .
‘Julia Phelps’	Hybrid introduced by Saratoga Horticultural Foundation in 1951, selected from open-pollinated seed of <i>C. papillosus</i> var. <i>roweanus</i> . One of most popular ceanothus in California.
<i>Ceanothus lemmonii</i>	Low, spreading shrub found in northern California from the inner Coast Ranges to the Sierra Nevada, growing from 590–4300 ft elevation.
<i>Ceanothus maritimus</i> ‘Point Sierra’	Species is endemic to area around Arroyo de la Cruz in northern San Luis Obispo County, CA. Selected in 1985 because of low-growing, compact habit.
<i>C. maritimus</i> ‘Popcorn’	Species is endemic to area around Arroyo de la Cruz in northern San Luis Obispo County, CA. This selection made for mounding habit and light olive-green leaves.

(Continued on next page)

Table 1. (Continued) Origin and description of ceanothus species and cultivars evaluated in a landscape trial in Silverton, OR, 2001–05.

Name	Description ^z
‘Puget Blue’	Selection made at University Of Washington Botanic Garden from open-pollinated seed of <i>C. papillosus</i> var. <i>roweanus</i> .
‘Ray Hartman’	Hybrid of <i>Ceanothus arboreus</i> and <i>C. thyrsiflorus</i> var. <i>griseus</i> , introduced by Saratoga Horticultural Foundation in 1954.
‘Remote Blue’	Hybrid from Las Pilitas Nursery, Santa Margarita, CA, introduced in 1991. Believed to be <i>Ceanothus oliganthus</i> × <i>C. thyrsiflorus</i> var. <i>griseus</i> .
<i>Ceanothus sanguineus</i>	Erect, deciduous shrub widely distributed in western North America from British Columbia south to northwestern California and west to Montana. This clone of unknown origin.
‘Skylark’	Introduced by Mitch Nursery, Aurora, OR, and named in the 1970s. Evergreen shrub growing to 8 × 8 ft. Name is considered synonymous with ‘Victoria’.
<i>C. thyrsiflorus</i> var. <i>griseus</i> (prostrate selection)	Evergreen shrub distributed from Santa Barbara County, CA, north to Coos County, OR. This clone is a prostrate selection of <i>C. thyrsiflorus</i> var. <i>griseus</i> of unknown origin.
<i>C. thyrsiflorus</i> var. <i>griseus</i> ‘Kurt Zadnik’	Selection by Roger Raiche from northern Sonoma coast, CA, in 1986 and introduced in 1991. Fast-growing and vigorous.
<i>C. thyrsiflorus</i> var. <i>griseus</i> ‘Louis Edmunds’	Selection made in 1942 by Louis Edmunds from a group of plants growing at the entrance to the Regional Parks Botanic Garden, Berkeley, CA.
<i>C. thyrsiflorus</i> var. <i>griseus</i> ‘Yankee Point’	Selection from Yankee Point in northern Monterey County, CA, made in 1954 by Maunsell Van Rensselaer. Selected for low-growing habit and rapid growth.
<i>C. thyrsiflorus</i> var. <i>thyrsiflorus</i> ‘Arroyo de la Cruz’	Selection made by Nevin Smith from Arroyo de la Cruz in northern San Luis Obispo County, CA, in 1981. Introduced by Wintergreen Nursery.
<i>C. thyrsiflorus</i> var. <i>thyrsiflorus</i> ‘El Dorado’	Variegated plant that originated as a branch sport on <i>C. thyrsiflorus</i> var. <i>thyrsiflorus</i> ‘Zanzibar’ at Yoder Toddington in Littlehampton, UK, in 1996.
<i>C. thyrsiflorus</i> var. <i>thyrsiflorus</i> ‘Snowflurry’	Selection from the Big Sur coast, CA, made by Joseph Solomone in 1975 and introduced in 1977. One of most commonly grown white-flowering ceanothus in California.
<i>Ceanothus velutinus</i>	Erect evergreen shrub widely distributed from southern British Columbia to central California and east to South Dakota. This clone of unknown origin.
‘Wheeler Canyon’	Selection made by Dara Emery in 1981 from a plant growing along a road in Wheeler Gorge, Ventura County, CA. Thought to be a hybrid involving <i>C. papillosus</i> var. <i>roweanus</i> .
<i>Ceanothus</i> × <i>delilianus</i> ‘Henri Desfosse’	One of many hybrids of <i>Ceanothus americanus</i> and <i>Ceanothus caeruleus</i> created by Lemoine Nursery in France in the 19th Century. This cultivar is particularly compact, to 3 ft tall.
<i>Ceanothus</i> × <i>pallidus</i> ‘Marie Simon’	Selected in 19th Century from hybrids of <i>Ceanothus herbaceus</i> × <i>Ceanothus</i> × <i>delilianus</i> . This cultivar has strong pink flowers and robust habit.

^z1 ft = 0.3048 m.

Table 2. Soil texture, pH, and nutrient content of the top 1 ft (0.3 m) constructed soil at the east, center, and west sections of the ceanothus evaluation site at Oregon Garden, Silverton, OR (lat. 44°59'N, long. 122°47'W).

Sample ^z	Texture	pH	Extractable nutrient concn (ppm) ^y					NO ₃
			P	K	Ca	Mg	Na	
East	Clay	5.5	15	285	1,160	357	29	3.5
Center	Clay loam	5.6	12	244	1,690	460	30	2.3
West	Clay	5.5	11	242	1,130	310	29	4.7

^zSamples consist of three subsamples from east, center, and west areas of the evaluation plot, which were combined before the analysis.^yP = phosphorus, K = potassium, Ca = calcium, Mg = magnesium, Na = sodium, NO₃ = nitrate; 1 ppm = 1 mg·kg⁻¹.

or snow and retained its form and foliage. ‘Blue Jeans’ was noticeably smaller than ‘Ray Hartman’ and was of distinctive appearance, with small

leaves on upright stems and very early blooming (Fig. 3).

Among the large, rounded shrubs the industry standard,

‘Skylark’ grew and flowered reliably. ‘Italian Skies’ is not as commonly grown as ‘Skylark’, but also grew well, although the foliage of this cultivar is

Fig. 1. Height of *ceanothus* after growing for 4 years in a landscape evaluation in Silverton, OR, in Spring 2005 [mean + SE (n = 3)]; 1 m = 3.3208 ft.

Fig. 2. Width of *ceanothus* after growing for 4 years in a landscape evaluation in Silverton, OR, in Spring 2005 [mean + SE (n = 3)]; 1 m = 3.3208 ft.

not as attractive as 'Skylark'. 'El Dorado' is a variegated cultivar that has a tendency to revert, resulting in variegated and green shoots, although it continues to grow, flower, and retain its form. The cultivars and hybrids of *C. impressus* are in this group and although some of them died during the trial, they are among the best foliage and flowering plants in the genus. *Ceanothus* 'Concha' also typically forms a large shrub, but in this evaluation, it lacked vigor.

The third group, mounding, spreading shrubs, contains several

well-known cultivars used as groundcovers in California, including 'Joyce Coulter' and 'Joan Mirov'. All of these are distinctive in appearance and would make excellent tall and wide-spreading groundcovers on hot, dry banks in western Oregon. Other cultivars that would be similarly useful include *C. thyrsiflorus* var. *griseus* 'Kurt Zadnik' and 'Wheeler Canyon'. They are all very wide-spreading and likely of sufficient height and density to suppress most weeds.

The lower-growing groundcovers in the trial performed

inconsistently. Weed suppression with the lowest-growing cultivars, such as 'Centennial' and *Ceanothus hearstiorum*, was poor because of lack of height and loss of foliage due to cold injury (Table 3). Low-growing weeds such as dandelion (*Taraxacum officinale*) and quackgrass (*Elytrigia repens*) were able to take advantage of these openings and became difficult to eradicate. *C. gloriosus* 'Hearts Desire' was more cold hardy than 'Centennial' or *C. hearstiorum*, but was still very low-growing. These three cultivars might be most effectively used as small-scale groundcovers. Taller growing plants such as *C. gloriosus* and *Ceanothus cuneatus* var. *rigidus* 'Snowball' tend to be more effective groundcovers, particularly for weed control. Other low-growing shrubs that were hampered by cold injury included *C. thyrsiflorus* var. *griseus* and *Ceanothus foliosus* 'Berryhill' (Table 3).

COLD HARDINESS. The most serious damage occurred after temperatures in early Nov. 2002 dropped from average night temperature of 37 to 22 °F. This was an early freeze that occurred while many plants were still growing. A similar freeze occurred on 1 Nov. 2003, when the temperature again dropped quickly from mild lows of 37 to 25 °F. Again, because of the relatively severe temperature early in the winter, serious damage occurred on a wide range of plants.

The most commonly grown clones of *ceanothus*, 'Skylark' and *C. gloriosus*, showed relatively little or no cold damage in this trial (Table 3). Similarly unaffected were the semi-evergreen cultivars 'Marie Simon' and 'Henri Desfosse', probably because of hardiness inherited from their *Ceanothus americanus* lineage (Fross and Wilken, 2006). Several of the most desirable cultivars, such as 'Remote Blue', 'Blue Jeans', and 'Wheeler Canyon' showed relatively minor leaf and twig burn from the cold events described above and they quickly recovered.

With the exception of 'Kurt Zadnik', which is a vigorous shrub, most cultivars of *C. thyrsiflorus* var. *griseus*, popular as groundcovers in California, showed severe cold damage (Table 3). *C. hearstiorum* also had considerable tip dieback, although the plants recovered. *C. thyrsiflorus* var. *thyrsiflorus* 'Snowflurry' is a

Table 3. Mean cold-hardiness ratings (n = 3) of ceanothus evaluated in Silverton, OR, on 3 Apr. 2003 and 29 Apr. 2004 and an average over years with the SD.

Plant name	Mean cold hardiness rating (0–5 scale) ^a			
	2003	2004	Avg	SD
<i>Ceanothus × delilianus</i> ‘Henri Desfosse’	0.0	0.0	0.0	0.01
<i>Ceanothus gloriosus</i> ‘Hearts Desire’	0.0	0.0	0.0	0.87
<i>Ceanothus × pallidus</i> ‘Marie Simon’	0.0	0.0	0.0	0.01
<i>Ceanothus sanguineus</i>	0.0	0.0	0.0	0.01
<i>Ceanothus velutinus</i>	0.0	0.0	0.0	0.01
<i>Ceanothus integerrimus</i>	0.0	0.7	0.3	0.58
<i>Ceanothus cuneatus</i> (Nipomo Mesa)	0.0	1.0	0.5	0.71
<i>C. cuneatus</i>	0.3	0.0	0.2	0.29
‘Wheeler Canyon’	0.3	0.0	0.2	0.29
<i>Ceanothus lemmonii</i>	0.3	0.7	0.5	0.87
<i>C. gloriosus</i>	0.3	1.3	0.8	0.87
<i>Ceanothus thyrsiflorus</i> var. <i>thyrsiflorus</i> ‘El Dorado’	0.7	0.0	0.3	0.29
‘Skylark’	0.7	0.0	0.3	0.58
‘Italian Skies’	0.7	0.7	0.7	0.87
‘Cynthia Postan’	1.0	0.0	0.5	0.50
‘Dark Star’	1.0	1.0	1.0	1.41
‘Remote Blue’	1.0	1.3	1.2	0.96
‘Blue Jeans’	1.2	0.2	0.7	0.77
‘Autumnal Blue’	1.3	1.3	1.3	0.58
<i>Ceanothus maritimus</i> ‘Point Sierra’	1.3	1.3	1.3	0.87
<i>Ceanothus ramulosus</i> ‘Rodeo Lagoon’	1.5	0.0	0.8	0.35
‘Concha’	1.7	0.0	0.8	0.76
‘Julia Phelps’	1.7	0.0	1.0	0.76
‘Ray Hartman’	1.7	0.0	0.8	0.29
<i>C. thyrsiflorus</i> var. <i>griseus</i> ‘Kurt Zadnik’	1.7	1.3	1.5	0.87
‘Puget Blue’	2.0	1.0	1.7	0.01
<i>C. thyrsiflorus</i> var. <i>thyrsiflorus</i> ‘Arroyo de la Cruz’	2.0	2.3	2.2	0.29
‘Joyce Coulter’	2.3	0.0	1.4	0.76
<i>Ceanothus foliosus</i> ‘Berryhill’	2.3	2.0	2.2	0.29
<i>C. thyrsiflorus</i> var. <i>griseus</i> ‘Louis Edmunds’	2.5	1.5	2.0	1.41
‘Centennial’	2.7	1.3	2.0	0.87
‘Joan Mirov’	2.7	2.0	2.3	0.76
<i>C. cuneatus</i> var. <i>rigidus</i> ‘Snowball’	2.7	2.0	2.4	0.29
<i>C. maritimus</i> ‘Popcorn’	2.7	3.0	2.8	1.00
<i>C. thyrsiflorus</i> var. <i>thyrsiflorus</i> ‘Snow Flurry’	3.0	3.0	3.0	0.87
<i>Ceanothus hearstiorum</i>	3.5	1.0	2.3	1.06
<i>C. thyrsiflorus</i> var. <i>griseus</i> ‘Yankee Point’	4.0	N/A	4.0	0.01
<i>C. thyrsiflorus</i> var. <i>griseus</i> (prostrate selection)	4.0	N/A	4.0	0.00

^a0 = no visible damage, 1 = minor leaf damage, 2 = leaf and stem damage restricted to outer 30% of shrub, 3 = leaf and stem damage restricted to outer 60% of shrub, 4 = killed to ground with re-sprouting, 5 = killed and not recovering.

white-flowered cultivar from the mild Big Sur coast of California (Fross and Wilken, 2006) and was much more susceptible to cold damage than other cultivars of var. *thyrsiflorus*. Plants of this cultivar recovered poorly from successive cold spells in 2002 and 2003, and would thus be best suited for coastal areas. Another cultivar that showed serious cold damage in 2002 and 2003 was *Ceanothus maritimus* ‘Popcorn’, which had dieback, although plants eventually recovered. Another cultivar of this species, ‘Point Sierra’, had relatively little cold

damage in both years, and with its blue flowers and compact habit, would make a good small-scale groundcover.

FLOWERING. Most cultivars in the trial flowered well in 2002, but analysis of data on flowering was restricted to 2003–05, when the plants were more mature. There was a significant effect of year, cultivar, and a year by cultivar interaction on date of 5%, 50%, and 100% bloom. There was no significant effect of cultivar, year, or an interaction on duration of the flowering season.

Data on duration of flowering are presented for 2005, when plants were mature, in Fig. 3. The earliest-flowering cultivars were consistently *C. cuneatus*, *C. maritimus* selections (‘Point Sierra’ and ‘Popcorn’), and ‘Blue Jeans’. The specific order in which these began blooming varied from 2003 to 2005, accounting in part for the year by cultivar interaction. Interestingly, even though the date of 5% bloom would vary from year to year because of weather conditions (data not shown), the duration of flowering did not, remaining consistent for all cultivars for each year. The most commonly grown ceanothus in the northwestern United States, *C. gloriosus* and ‘Skylark’, are early- to midseason- and mid- to late season-flowering cultivars, respectively. The flowering season can be extended several weeks earlier and later by selecting other cultivars.

Among the better early-blooming cultivars was ‘Blue Jeans’, which typically began flowering in early March and continued through early to mid-April. *C. cuneatus* is a species widespread in California and Oregon, and the form in this trial, although of unknown origin, was a shapely, medium-sized gray-leaved shrub that produced white flowers also starting in early March. Although this species is rarely cultivated in the Northwest, it is a hardy, attractive shrub of distinctive appearance because of the gray leaves. Several cultivars or hybrids of *C. impressus*, ‘Julia Phelps’, ‘Dark Star’, and ‘Puget Blue’, were among the showiest of the trial, flowering from April through mid-May. *C. thyrsiflorus* var. *griseus* ‘Kurt Zadnik’ was one of the most distinctive in bloom, with deep blue flowers throughout May on a tall, wide-spreading groundcover.

Several cultivars flowered from late May well into July, including ‘Autumnal Blue’, ‘Marie Simon’, and ‘Henri Desfosse’. ‘Autumnal Blue’ had severe leaf spot (*Cercospora* sp.) that caused major defoliation, thus reducing its ornamental appeal and vigor. Although other cultivars in the evaluation may have been affected by this pathogen, no other plant was affected to the same extent. ‘Marie Simon’ and ‘Henri Desfosse’ grew and flowered well, but were grazed heavily by deer, along with ‘Cliff

Fig. 3. Average flowering time and duration of *ceanothus* grown in a landscape evaluation in Silverton, OR, in 2005 [mean + SE (n = 3)].

Schmidt', and like that cultivar, were eventually removed from the evaluation. If damage from deer is not likely to be an issue in a landscape, these and other cultivars of *Ceanothus* $\times$ *delilianus* and *Ceanothus* $\times$ *pallidus* are excellent ways to extend the flowering season of *ceanothus* into the summer months.

Literature cited

- Boorse, G.C., F.W. Ewers, and S.D. Davis. 1998. Response of chaparral shrubs to below-freezing temperatures: Acclimation, ecotypes, seedlings vs. adults. *Amer. J. Bot.* 85:1224–1230.
- Cameron, R.W.F. and G.R. Dixon. 1997. Air temperature, humidity and rooting

volume affecting freezing injury to *Rhododendron* and other perennials. *J. Hort. Sci.* 72:553–562.

Fross, D. and D. Wilken. 2006. *Ceanothus*. Timber Press, Portland, OR.

Hardig, T.M., P.S. Soltis, and D.E. Soltis. 2000. Diversification of the North American shrub genus *Ceanothus* (Rhamnaceae): Conflicting phylogenies from nuclear ribosomal DNA and chloroplast DNA. *Amer. J. Bot.* 87:108–123.

Hop, M.E.C.M. 2006. *Ceanothus*-sortimentsonderzoek en keuringsrapport. *Dendroflora* 43:80–123.

Langan, S.L., F.W. Ewers, and S.D. Davis. 1997. Xylem dysfunction caused by water stress and freezing in two species of co-occurring chaparral shrubs. *Plant Cell Environ.* 20:425–437.

Lonard, R.I. and F.W. Judd. 1991. Comparison of the effects of the severe freezes of 1983 and 1989 on native woody plants in the lower Rio Grande River valley, Texas. *Southwest. Nat.* 36:213–217.

Schmidt, C. 2003. Dr. Cliff Schmidt's treatment of the genus *Ceanothus*. 18 June 2008. <<http://oregonstate.edu/dept/botany/herbarium/projects/ceanothus/genus.html>>.

U.S. Bureau of Reclamation. 2008. Agri-met, The Pacific Northwest Cooperative Agriculture Weather Network. 9 Aug. 2007. <<http://www.usbr.gov/pn/agrimet/webarcread.html>>.