

Xeriscape Ornamental Perennial Grass Trial for Low Water Use Landscaping

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Western North America has an increasing problem of providing adequate quantities of clean water for domestic use. A large portion of western municipalities' water supply is used for watering lawns, gardens, and landscape plants. Traditional landscaping frequently selects Kentucky bluegrass lawns and ornamental plants that require large amounts of water to remain beautiful. Several agencies and institutions joined Denver Water and the Associated Landscape Contractors of Colorado in 1981 to develop the concept of "Xeriscape" gardening. Alternatives to the traditional techniques are being examined to develop landscapes that are harmonious with the local environmental conditions and use less water. Homeowners in western North Dakota have experienced the high costs of using domestic water for traditional landscape plants and have become aware of the need for alternative landscaping plants. Grass species in this trial are being tested and examined for use as plant material in low water use landscaping.

The purpose of Xeriscape gardening, or low water use landscaping, is to conserve expensive, precious domestic water by following seven simple commonsense principles.

- Use plants native to the region or plants adapted from areas with very similar environments and arrange the plants in zones with similar water, sun, and soil needs.
- Design the plants in arrangements that match family needs and lifestyle and select plants that provide color, texture, shade, and wind protection for all four seasons.
- Consider limitations of soil's water-holding characteristics and organic content and make improvements by amending the soil with composted plant material or aged manure.
- Limit turf grass lawns to areas actually used as "outdoor carpets" and select low water use grasses like blue grama, buffalo grass, crested wheatgrass, or tall fescue.
- Mulch with organic matter like wood or bark chips between plants to reduce evaporation and erosion and resist the use of plastic beneath decorator rock.
- Install water-wise irrigation systems and adjust them for maximum water savings with seasonal changes.

- Minimize maintenance to proper seasonal pruning and weed pulling and reduce fertilizer and pesticide applications.

Low water use landscaping achieves the desired goal of conserving water, money, leisure time, and precious resources while providing healthy, beautiful landscapes that add value to property. Xeriscape gardening combines landscaping with conservation.

Methods

This multi-year trial was designed to test and evaluate native grasses and adopted horticultural grasses as low water use ornamental landscape plants in western North Dakota. Thirteen native grasses and eleven horticultural domesticated grasses ([Table 1](#)) were included in this study. The research plots are located at the Dickinson Research Extension Center. These plots are managed with minimum maintenance, little supplemental irrigation water, no fertilizer, no herbicides after plot establishment, and hand roguing of weeds when necessary. The study consisted of three replications ([Table 2](#)). The grass plants were evaluated for vigor, ornamental value, seedhead aesthetics, color, and height. Vigor, ornamental value, and seedhead aesthetics were rated on a scale of 0-5 ([Table 3](#)). Color was recorded as one of twelve colors ([Table 3](#)). Total plant height was recorded as one of three height categories ([Table 3](#)). The twenty-four grass entries were randomly placed in plots in three replications ([Table 4](#)). Two evaluators rated each grass replication during early, mid, late, and post growing-season periods.

Results

Mean evaluation ratings of grass entries are shown in [tables 5-9](#) for initiation, early, mid, late, and post growing-season periods for 1999, respectively. Plants on replication plots of little bluestem, buffalo grass, Indiangrass, Canada wildrye, and sweetgrass died during the first year of the trial as a result of weakened condition caused by the plants ²⁹/₃₁ being covered by wood chips for several days and not receiving additional attention to assist the plants ²⁹/₃₁ recovery. These plants were replaced in the spring of 1999. The mean values of the evaluation ratings were determined. The seedhead aesthetics ratings report two mean values. The first value includes data from replications not having seedheads, and the second value includes data from only the replications with seedheads present.

Most of the grass entries increased in vigor and ornamental value from initiation of growing-season, through mid-, and to late-season periods ([Table 5-8](#)). A few grass entries, sweetgrass, feather reed grass, ribbon grass, and blue fescue, had medium to high vigor and ornamental value ratings during the initiation of growing period, with two entries with seedheads present in mid May, sweetgrass and blue fescue ([Table 5](#)). Vigor and ornamental value decreased for most grass entries from late to post growing-season periods (Tables 8-9). Several grass entries, blue grama, little bluestem, big bluestem, switchgrass, prairie cordgrass, feather reed grass, ribbon grass, blue lyme grass, red switchgrass, autumn red, altai wildrye, pampas grass, and blue fescue, had medium to high vigor and ornamental value ratings during the post growing- season period ([Table 9](#)). Most of the grass entries tended to have high seedhead-aesthetics value ratings during the period from head-emergence to seed- development stages ([Table 5-9](#)). Several grass entries, little bluestem, big bluestem, sand bluestem, prairie sandreed, indiangrass, switchgrass, prairie cordgrass, feather reed grass, red switchgrass, autumn red, altai wildrye, and pampas grass had medium or high attractiveness of seedheads after reaching full maturity and during the post growing- season period ([Table 8-9](#)).

Grass entries, sideoats grama, sand love grass, giant silver banner grass, zebra grass, and green needlegrass had three or more sample periods with low vigor ratings and low ornamental values ([Table 5-9](#)). Several grass entries, big bluestem, sand bluestem, switchgrass, prairie cordgrass, feather reed grass, ribbon grass, blue lyme grass, autumn red, altai wildrye, pampas grass, and blue fescue, had three or more sample periods with high vigor ratings and high ornamental values ([Table 5-9](#)).

Most of the grass entries had distinctive attractive shades of green during the early, mid, and late growing-season periods ([Tables 5-8](#)). Many of the grass entries completed senescence during the late and post growing-season periods, displaying attractive shades of red, purple, or yellow before turning tan ([Table 6-9](#)).

The height categories for the grass entries ([Table 10](#)) were determined when the plants were mature and the seedheads had reached maximum height. Some of the grass entries grew relatively tall during the growing-season of 1999. The grasses with seed heads taller than 6 feet were sand bluestem, prairie sandreed, prairie cordgrass, and pampas grass. Mature height of a plant is important in landscape design. The trial included three short-grass, thirteen mid-grass, and eight tall-grass entries.

Discussion

This is the second year of a multi-year trial designed to test and evaluate grass entries for use as ornamental plants for low water use landscaping. Most of the grass entries show positive potential for use as low water use landscaping plants. A few grass entries had one or more sample periods with low ratings, but these grass entries should not be dismissed as landscape plants yet because one year of data is not an adequate basis for this determination, and these plants may improve. Some of the other grass entries may not maintain their moderate or high value ratings for the long run under these low maintenance and low supplemental water conditions.

Low water use landscaping, which uses native and/or adopted horticultural plants, is an important alternative to traditional landscaping, which uses plants that require large amounts of domestic water to remain beautiful. The results of this trial will assist homeowners in selecting ornamental perennial grass plants for use in their low water use landscaping.

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Report Tables

[Table 1.](#) Experiment identification number, common name, and scientific name of grasses included in xeriscape ornamental perennial grass trial for low water use landscaping.

[Table 2.](#) Experimental plot description for xeriscape ornamental perennial grass trial for low water use landscaping.

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[Table 8](#). Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the late growing-season period, 17 September 1999.

[Table 9](#). Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the post growing-season period, 17 November 1999.

[Table 10](#). Plant height category of grass entries in xeriscape ornamental perennial grass trial.



Table 1. Experiment identification number, common name, and scientific name of grasses included in xeriscape ornamental perennial grass trial for low water use landscaping.

1	Blue grama	'Bad River'	<i>Bouteloua gracilis</i>
2	Little bluestem	'Badlands'	<i>Schizachyrium scoparium</i>
3	Buffalo grass	'Bismarck'	<i>Buchole dactyloides</i>
4	Sideoats grama	'Pierre'	<i>Bouteloua curtipendula</i>
5	Big bluestem	'Bison'	<i>Andropogon gerardi</i>
6	Sand bluestem	'Garden'	<i>Andropogon hallii</i>
7	Prairie sandreed	'Gosher'	<i>Calamovilfa longifolia</i>
8	Indiangrass	'Holt'	<i>Sorghastrum natans</i>
9	Switchgrass	'Dacotah'	<i>Panicum virgatum</i>
10	Prairie cordgrass	'Red River'	<i>Spartina pectinata</i>
11	Canada wildrye	'Mandan'	<i>Elymus canadensis</i>
12	Sweetgrass		<i>Hierochloe odorata</i>
13	Feather reed grass	'Karl Foerster'	<i>Calamagrostis acutiflora</i>
14	Ribbon grass	'Feeseey'	<i>Phalaris arundinacea</i>
15	Blue lyme grass		<i>Elymus arenarius</i>
16	Sand love grass		<i>Eragrostis trichodes</i>
17	Giant silver banner grass	'Robustus'	<i>Miscanthus sacchariflorus</i>

18	Zebra grass	'Zebrinus'	<i>Miscanthus sinensis</i>
19	Red switchgrass	'Rehbraum'	<i>Panicum virgatum</i>
20	Autumn red	'Purpurascens'	<i>Miscanthus sinensis</i>
21	Altai wildrye		<i>Elymus angustus</i>
22	Pampas grass		<i>Miscanthus sacchariflorus</i>
23	Blue fescue		<i>Festuca cinerea</i>
24	Green needlegrass		<i>Stipa viridula</i>

Table 2. Experimental plot description for xeriscape ornamental perennial grass trial for low water use landscaping.

Location:	Dickinson Research Extension Center, Dickinson, ND latitude 46E 53'N, longitude 102E 49'W, elevation 2,500ft.
Replications:	Three; Rep #1 West, Rep #2 Middle, Rep #3 East Randomized Block Design
Study size:	18' x 36'
Plot size:	3' x 3'
Perimeter border:	3'
Plot arrangement:	2 columns with numbers 1-12 on west side and numbers 13-24 on east side of each replication.
Grass samples:	24 types x 3 reps. = 72 plants
Plug planting date:	5 May 1998 holes 12" diameter, 8" deep, planted as plugs.
Soil:	Morton silt loam
Mulch:	Wood chips applied at 4" to 6" thickness between plants.
Herbicide treatment:	Roundup applied to previously existing grass cover 30 April 1998. No other herbicides applied.
Fertilizer treatment:	No fertilizer applied.
Soil amendments:	No soil amendments applied.

Water:	1.0 to 1.5 gallons water applied to each plot within 3.0 hours of planting. Minimum amount of irrigation water applied during growing season.
Weed control:	Wood chips used between plants to help prevent weed growth. Weeds will be hand rogued when necessary.
Pruning:	Previous year senescent growth trimmed in early spring prior to rapid growth. Fall leaves of cool season grasses not trimmed.

Table 3. Ratings scales used in the evaluation methods of this trial.

Plant Vigor Ratings Scale					
5	4	3	2	1	0
robust vigor		medium vigor		low vigor	dead
Ornamental Value Ratings Scale					
5	4	3	2	1	0
high value		medium value		low value	zero value
Seedhead Aesthetic Ratings Scale					
5	4	3	2	1	0
high attractiveness		medium attractiveness		low attractiveness	not present
Color Ratings					
1. Drying		5. Bluegreen		9. Yellow Green	
2. Dark Green		6. Light Blue		10. Light Red	
3. Green		7. Dark Blue		11. Purple	

4. Light Green

8. Gold yellow

12. Tan

Height Ratings Categories	
Short grass	0.5 to 2.0 feet
Mid grass	2.0 to 3.0 feet
Tall grass	3.0 to 7.0 feet

Table 4. Location of grass entries in xeriscape ornamental perennial grass trial for low water use landscaping.

Rep. #1 West		Rep. #2 Middle		Rep. #3 East	
1 Blue grama	3 Buffalo grass	23 Blue fescue	8 Indiangrass	18 Zebra grass	16 Sand love grass
4 Sideoats grama	12 Sweetgrass	11 Canada wildrye	9 Switchgrass	21 Altai wildrye	20 Autumn red
14 Ribbon grass	15 Blue lyme grass	24 Green needlegrass	7 Prairie sandreed	6 Sand bluestem	23 Blue fescue
2 Little bluestem	11 Canada wildrye	17 Giant silver banner grass	14 Ribbon grass	3 Buffalo grass	5 Big bluestem
5 Big bluestem	6 Sand bluestem	4 Sideoats grama	22 Pampas grass	19 Red switchgrass	2 Little bluestem
7 Prairie sandreed	8 Indiangrass	16 Sand love grass	10 Prairie cordgrass	22 Pampas grass	17 Giant silver banner grass
13 Feather reed grass	16 Sand love grass	2 Little bluestem	19 Red switchgrass	10 Prairie cordgrass	13 Feather reed grass
9	10 Prairie	12	5 Big	8	4 Sideoats

Switchgrass	Flame cordgrass	Sweetgrass	Big bluestem	Indiangrass	Stuebals grama
17 Giant silver banner grass	18 Zebra grass	15 Blue lyme grass	21 Altai wildrye	1 Blue grama	15 Blue lyme grass
19 Red switchgrass	20 Autumn red	13 Feather reed grass	1 Blue grama	7 Prairie sandreed	12 Sweetgrass
21 Altai wildrye	23 Blue fescue	18 Zebra grass	3 Buffalo grass	9 Switchgrass	11 Canada wildrye
22 Pampas grass	24 Green needlegrass	20 Autumn red	6 Sand bluestem	24 Green needlegrass	14 Ribbon grass

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Table 5. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the initiation growing-season period, 13 May 1999.

	Vigor	Ornamental Value	Seedhead aesthetics	Color
1	2.00	1.00	0	
2	1.00	1.00	0	
3	2.00	1.00	0	
4	1.00	1.00	0	
5	2.00	1.00	0	
6	1.00	1.00	0	
7	2.00	1.00	0	
8	2.00	1.00	0	
9	2.00	1.00	0	
10	3.00	2.70	0	
11	2.00	4.00	0	
12	5.00	4.50	5.00	
13	4.00	3.30	0	
14	4.00	4.70	0	

15	3.00	2.30	0	
16	0	0	0	
17	1.00	1.00	0	
18	0	0	0	
19	1.00	1.00	0	
20	3.00	1.30	0	
21	4.00	2.70	0	
22	4.00	1.70	0	
23	4.00	4.00	3.00	
24	1.00	1.00	0	

Evaluation

Vigor:	Low High	2, 4, 6, 16, 17, 18, 19, 24 12, 13, 14, 21, 22, 23
Ornamental value:	Low High	1, 2, 3, 4, 5, 6, 7, 8, 9, 16, 17, 18, 19, 24 11, 12, 14, 23

Table 6. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the early growing-season period, 16 June 1999.

	Vigor	Ornamental Value	Seedhead aesthetics	Color
1	3.67	2.67	0	Green
2	3.67	2.67	0	Lt Green
3	3.67	2.33	2.00	Green
4	2.00	0.67	0	Green
5	4.33	4.00	0	Green with purple
6	3.33	2.67	0	Lt Green
7	3.33	2.33	0	Dk Green
8	3.33	2.67	0	Lt Green
9	4.33	3.67	0	Dk Green
10	4.67	4.33	0	Dk Green
11	3.67	3.33	0	Green
12	4.33	3.33	1.33	Green
13	4.33	3.67	1.00	Green
14	5.00	5.00	5.00	Lt Green with white lines

15	3.33	3.00	1.33	Lt Blue
16	0.33	0	0	Yellow Green
17	1.33	1.00	0	Green
18	0.67	0.33	0	Lt Green
19	3.33	3.00	0	Lt Green with purple
20	3.33	4.00	0	Green with purple
21	4.33	4.33	4.33	Bluegreen
22	5.00	4.33	0	Green
23	5.00	4.33	4.33	Lt Blue
24	2.33	1.33	1.33	Green

Evaluation

Vigor:	Low	4, 16, 17, 18, 24
	High	1, 2, 3, 5, 9, 10, 11, 12, 13, 14, 21, 22, 23
Ornamental value:	Low	4, 16, 17, 18, 24
	High	5, 9, 10, 13, 14, 20, 21, 22, 23

Table 7. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the mid growing-season period, 16 July 1999.

	Vigor	Ornamental Value	Seedhead aesthetics	Color
1	4.00	3.00	2.67	Lt Green
2	3.33	2.67	0	Green
3	3.33	2.33	2.67	Lt Green
4	2.33	1.67	0.67	Green
5	4.67	4.00	3.67	Green with purple
6	3.67	3.33	0	Lt Green
7	4.00	3.67	1.00	Dk Green
8	4.00	3.33	0	Green
9	4.67	4.67	4.67	Green
10	4.67	4.67	3.00	Dk Green
11	3.67	3.67	4.67	Bluegreen
12	5.00	3.67	2.00	Lt Green
13	4.67	4.67	5.00	Dk Green
14	5.00	5.00	5.00	Lt Green with white lines
15	3.67	3.00	1.67	Blue

16	0.67	0.67	0	Green
17	1.00	1.00	0	Green with white stripe
18	0.33	0.33	0	Green
19	4.00	3.67	0	Yellow Green with purple
20	3.67	3.67	0	Green
21	4.67	4.33	4.67	Bluegreen
22	5.00	4.67	0	Lt Green
23	4.00	4.00	4.33	Blue
24	2.00	2.00	1.67	Green

Evaluation

Vigor:	Low	4, 16, 17, 18, 24
	High	1, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 19, 20, 21, 22, 23
Ornamental value:	Low	4, 16, 17, 18, 24
	High	5, 7, 9, 10, 11, 13, 14, 19, 20, 21, 22, 23

Table 8. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the late growing-season period, 17 September 1999.

	Vigor	Ornamental Value	Seedhead aesthetics	Color
1	3.67	3.33	3.33	Lt Green
2	3.33	4.00	4.00	Lt Green with purple
3	4.00	3.00	1.00/3.00	Lt Gray Green
4	2.67	3.33	4.00	Lt Green with purple
5	3.33	3.67	2.67	Lt Green, orange with purple & tan
6	4.00	3.67	3.67	Bluegreen with red & tan
7	3.67	4.00	3.33	Yellow Green
8	4.33	4.33	3.67	Lt Green with yellow
9	3.67	3.33	3.67	Yellow Green
10	4.33	4.33	4.00	Yellow Green
11	2.67	2.67	2.67	Lt Green with tan
12	4.67	3.00	0	Green
13	4.33	4.67	4.33	Dk Green
14	4.67	4.33	0.33/1.00	Lt Green with white

15	4.33	3.67	0.67/2.00	Bluegreen
16	1.00	0.67	0.67/2.00	Green
17	2.33	1.33	0	Dk Green with white line
18	0.67	1.00	0	Lt Green with yellow patches
19	4.33	4.33	4.33	Lt Green
20	5.00	4.33	5.00	Green with red
21	4.67	3.33	3.00	Bluegreen
22	4.33	4.67	5.00	Yellow Green with yellow
23	4.33	4.67	2.33	Blue
24	1.67	1.67	1.33/4.00	Lt Green

Evaluation

Vigor:	Low High	16, 18, 24 1, 2, 3, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 19, 20, 21, 22, 23
Ornamental value:	Low High	16, 17, 18, 24 1, 2, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 19, 20, 21, 22, 23

Table 9. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the post growing-season period, 17 November 1999.

	Vigor	Ornamental Value	Seedhead aesthetics	Color
1	3.33	3.00	1.33	Tan
2	3.00	3.67	4.00	Lt Red
3	3.00	2.33	0	Tan
4	2.33	1.67	0.67	Very Lt Red
5	3.33	4.00	3.67	Lt Red
6	2.67	3.67	4.00	Very Lt Red
7	2.67	3.00	3.67	Tan
8	2.67	3.33	3.00	Lt Red
9	3.00	3.33	4.00	Very Lt Red
10	3.67	3.00	3.67	Tan
11	2.33	3.00	2.67	Tan
12	2.67	3.00	0.33	Tan
13	4.67	4.00	4.00	Dk Green-Red
14	4.00	4.00	0	Lt Green-Lt Tan
15	4.33	3.67	1.00	Bluegreen-Tan

16	0.33	0.33	0.33	Tan
17	2.00	2.00	0	Tan
18	0.33	0.33	0	Tan
19	3.00	3.33	3.67	Very Lt Red-Tan
20	3.67	4.00	4.00	Lt Red
21	4.33	4.00	3.33	Green-Tan
22	3.67	4.00	4.00	Lt Red
23	4.67	4.67	2.67	Blue
24	1.67	1.00	1.00	Tan

Evaluation

Vigor:	Low	16, 17, 18, 24
	High	10, 12, 13, 14, 15, 20, 21, 22, 23
Ornamental value:	Low	4, 16, 17, 18, 24
	High	2, 5, 6, 13, 14, 15, 20, 21, 22, 23

Table 10. Plant height category of grass entries in xeriscape ornamental perennial grass trial.

Height Category	Code	
1	S	Short grass 0.5-2.0 ft.
2	M	Mid grass 2.0-3.0 ft.
3	S	Short grass 0.5-2.0 ft.
4	M	Mid grass 2.0-3.0 ft.
5	T	Tall grass 3.0-7.0 ft.
6	T	Tall grass 3.0-7.0 ft.
7	T	Tall grass 3.0-7.0 ft.
8	T	Tall grass 3.0-7.0 ft.
9	T	Tall grass 3.0-7.0 ft.
10	T	Tall grass 3.0-7.0 ft.
11	M	Mid grass 2.0-3.0 ft.
12	M	Mid grass 2.0-3.0 ft.
13	M	Mid grass 2.0-3.0 ft.
14	M	Mid grass 2.0-3.0 ft.

15	M	Mid grass 2.0-3.0 ft.
16	M	Mid grass 2.0-3.0 ft.
17	T	Tall grass 3.0-7.0 ft.
18	M	Mid grass 2.0-3.0 ft.
19	M	Mid grass 2.0-3.0 ft.
20	M	Mid grass 2.0-3.0 ft.
21	M	Mid grass 2.0-3.0 ft.
22	T	Tall grass 3.0-7.0 ft.
23	S	Short grass 0.5-2.0 ft.
24	M	Mid grass 2.0-3.0 ft.