

## 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 the Associated Landscape Contractors of Colorado and Denver Water 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 rouging 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. The statistical methods used to analyze differences between means was a standard paired plot t-test.

## Results

Mean evaluation ratings of grass entries are shown in [tables 5-7](#) for mid, late, and post growing season periods for 1998, respectively. The grass entries were not evaluated during the early growing season period of 1998 because

that was the establishment period. Plants on replication plots of little bluestem, buffalo grass, Indiangrass, Canada wildrye, sweetgrass, and sand love grass died during the first year of the trial as a result of weakened condition caused by the plants being covered by wood chips for several days and not receiving additional attention to assist the plants recovery. These plants will need to be replaced in the spring of 1999. The mean values of the evaluation ratings of these six grass entries with dead replication plots were determined by two methods. The mean evaluation ratings were determined by including the ratings of the replications with dead plants, and means were determined by including the ratings from only the replications with live plants. Mean evaluation ratings for vigor and ornamental value, which were determined by two methods, are reported in [tables 5-7](#). The seedhead aesthetics ratings also 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 mid to late season periods or remained at high or medium ratings. Vigor and ornamental value decreased for most grass entries from late to post growing season periods ([Tables 5-7](#)). Several grass entries, little bluestem, big bluestem, prairie cordgrass, sweetgrass, feather reed grass, ribbon grass, blue lyme grass, sand love grass, giant silver banner grass, zebra grass, red switchgrass, autumn red, altai wildrye, and blue fescue, had medium to high vigor and ornamental value ratings during the post growing season period ([Table 7](#)). Most of the grass entries tended to have high seedhead aesthetics value ratings during the period from head emergence to seed development stages ([Tables 5-7](#)). A few grass entries, blue grama, prairie sandreed, switchgrass, prairie cordgrass, sand love grass, giant silver banner grass, autumn red, and pampas grass had medium or high attractiveness of seedheads after reaching full maturity and during the post growing season period ([Table 7](#)).

Most of the grass entries had distinctive attractive shades of green color during the early, mid, and late growing season periods ([Tables 5-6](#)). 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 6-7](#)).

The height categories for the grass entries ([Table 8](#)) were determined when the plants were mature and the seedheads had reached maximum height. Mature height of a plant is important when designing landscapes. The trial included three short grass, thirteen mid grass, and eight tall grass entries.

## Discussion

This is the first 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, sand bluestem, Canada wildrye, zebra grass, altai wildrye, and green needlegrass 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 to select ornamental perennial grass plants for use in their low water use landscaping.

## Acknowledgment

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Table 1. Experiment identification number, common name, and scientific name of grasses included in xeriscape ornamental perennial grass trial for low water use landscaping.
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1	Blue grama	'Bad River'	<i>Bouteloua gracilis</i>
2	Little bluestem	'Badlands'	<i>Schizachyrium scoparium</i>
3	Buffalo grass	'Bismarck'	<i>Buchloe 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 nutans</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>Hierochloa 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 46 53'N, longitude 102 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 lume 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 red grass	16 Sand love grass	2 Little bluestem	19 Red switchgrass	10 Prairie cordgrass	13 Feather reed grass
9 Switchgrass	10 Prairie cord grass	12 Sweetgrass	5 Big bluestem	8 Indiangrass	4 Sideoats 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



Table 5. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the mid growing season period, 24 July 1998.

	<b>Vigor</b>	<b>Ornamental Value</b>	<b>Seedhead aesthetics</b>	<b>Color</b>
1	3.7	3.0	2.3/3.5	Green
2	2.7/4.0	/2.5	0	Green
3	2.3	2.5	0.7/2.0	Bluegreen
4	3.7	3.7	2.7/4.0	Green
5	3.7	3.0	1.3/4.0	Green with red
6	2.7	1.7	0	Lt Blue green
7	3.7	2.7	0	Lt Green
8	2.3/3.5	/2.5	0	Green
9	3.7	3.0	1.3/4.0	Dk Green
10	4.0	3.3	0	Dk Green
11	2.7/4.0	/3.5	2.7/4.0	Lt Green
12	2.7	2.0	0	Dk Green
13	3.3	3.3	3.0	Green
14	3.0	3.3	1.0/3.0	Lt Green with whitestripe
15	3.3	3.0	0	Lt Blue green
16	2.0/3.0	/3.0	0	Dk Green
17	4.0	4.3	0	Dk Green with whiteline
18	2.3	2.7	0	Lt Green with yellow patches
19	3.3	3.0	2.0	Lt Green with red

20	3.3	3.0	0	Dk Green
21	2.3	2.3	0	Bluegreen
22	3.7	3.3	0	Lt Green
23	4.7	4.7	0	Dk Blue
24	2.3	2.0	1.7	Green

Split values: includes dead reps./only live reps.

Statistical significance

vigor:

Low 18, 21, 24

High 4, 7, 17, 22, 23

Ornamental value:

Low 6, 21, 24

High 4, 17, 23

Table 6. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the late growing season period, 16 September 1998.

	<b>Vigor</b>	<b>Ornamental Value</b>	<b>Seedhead aesthetics</b>	<b>Color</b>
1	4.0	3.0	3.0/4.5	Blue green
2	3.0/4.5	2.3/3.5	2.3/3.5	Green with purple
3	2.0/3.0	1.7/2.5	1.3/4.0	Green
4	3.3	3.0	3.0	Green
5	4.0	4.0	4.0	Green with purple
6	3.3	3.3	3.3	Lt Blue green
7	3.7	3.3	2.7/4.0	Green
8	3.0/4.5	2.0/3.0	0.3/1.0	Green with purple
9	4.3	3.7	2.7	Dk Green
10	4.3	4.0	3.3/5.0	Dk Green

11	1.0/3.0	1.0/3.0	1.3/4.0	Green
12	2.3/3.5	2.0/3.0	0	Dk Green
13	2.7	2.7	1.0/1.5	Green
14	4.3	3.7	0	Lt Green with white stripe
15	3.7	3.3	0	Lt Blue green
16	3.0/4.5	3.0/4.5	2.7/4.0	Lt Green
17	4.7	4.7	0	Dk Green with white line
18	3.0	3.0	0	Lt Green with yellow patches
19	4.3	4.3	3.7	Green with purple
20	4.3	4.0	1.3/4.0	Green with fine white line
21	3.0	2.7	0	Lt Blue
22	4.7	4.7	4.7	Green
23	4.3	4.3	0	Lt Blue
24	2.0	1.7	0	Green with drying

Split values: includes dead reps./only live reps.

Statistical significance

vigor:

Low 11, 24

High 17, 20, 22, 23

Ornamental value:

Low 24

High 17,22, 23

Table 7. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the post growing season period, 2 November 1998.

	<b>Vigor</b>	<b>Ornamental Value</b>	<b>Seedhead aesthetics</b>	<b>Color</b>
1	1.7	2.0	2.0/3.0	Tan
2	2.0/3.0	2.0/3.0	1.7/2.5	Lt Green base with purple
3	0.7/1.0	0.7/1.0	0.3/1.0	Tan
4	1.0	1.3	1.3	Tan with Lt Red
5	2.0	3.0	2.7	Lt Red with purple
6	1.7	2.3	2.7	Tan with Lt Red
7	1.7	2.0	2.0/3.0	Lt Green base, yellowgreen,
8	1.0/1.5	1.3/2.0	0.3/1.0	Lt Red
9	2.0	2.3	2.3/3.5	Lt Red and Tan
10	2.3	3.0	2.0/3.0	Green base, gold yellow
11	1.7/2.5	1.3/2.0	1.3/2.0	Dk Green with Tan
12	2.7/4.0	1.7/2.5	0	Lt Green, yellowgreen
13	3.3	2.3	0.7/1.0	Green with red tips
14	3.7	3.7	0	Lt Green with white stripe
15	3.3	2.3	0	Lt Blue green
16	2.3/3.5	2.7/4.0	3.0/4.5	Green with red tips
17	3.7	3.7	1.3/4.0	Dk Green, white line, red tips
18	3.0	3.0	0	Lt Green, yellow patches, Tan
19	2.7	3.3	2.7	Green base, yellowgreen, red
20	2.3	4.0	1.0/3.0	Lt Red

21	3.0	2.7	0	Lt Blue green
22	1.3	3.3	4.0	Lt Red
23	4.0	4.3	0	Dk Blue
24	1.3	1.0	0	Green base, Tan

Split values: includes dead reps./only live reps.

Statistical significance

vigor:

Low

High

Ornamental value:

Low

High

Table 8. Plant height category of grass entries in xeriscape ornamental perennial grass trial.		
Number	Code	Height Category
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.

Appendix 1. Plot number location for xeriscape ornamental perennial grass trial.					
Rep. #1 West		Rep. #2 Middle		Rep. #3 East	
1	13	1	13	1	13
2	14	2	14	2	14
3	15	3	15	3	15
4	16	4	16	4	16
5	17	5	17	5	17
6	18	6	18	6	18
7	19	7	19	7	19
8	20	8	20	8	20
9	21	9	21	9	21
10	22	10	22	10	22

11	23	11	23	11	23
12	24	12	24	12	24

Appendix 2. Plot location of xeriscape ornamental perennial grasses entries on three replications.					
		Rep. #1	Rep. #2	Rep. #3	
1.	Blue grama	1	22	9	
2.	Little bluestem	4	7	17	
3.	Buffalo grass	13	23	4	
4.	Sideoats grama	2	5	20	
5.	Big bluestem	5	20	16	
6.	Sand bluestem	17	24	3	
7.	Prairie sandreed	6	15	10	
8.	Indiangrass	18	13	8	
9.	Switchgrass	8	14	11	
10.	Prairie cordgrass	20	18	7	
11.	Canada wildrye	16	2	23	
12.	Sweetgrass	14	8	22	
13.	Feather reed grass	7	10	19	
14.	Ribbon grass	3	16	24	
15.	Blue lyme grass	15	9	21	
16.	Sand love grass	19	6	13	
17.	Giant silver banner grass	9	4	18	
18.	Zebra grass	21	11	1	
19.	Red switchgrass	10	19	5	
20.	Autumn red	22	12	14	

21.	Altai wildrye	11	21	2
22.	Pampas grass	12	17	6
23.	Blue fescue	23	1	15
24.	Green needlegrass	24	3	12

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