

Xeriscape Ornamental Perennial Grass Trial for Low Water Use Landscaping

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Western North America has increasing difficulty in 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 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; 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 initiation, early, mid-1, mid-2, late, and post growing-season periods.

Results

Mean evaluation ratings of grass entries are shown in Tables 5-10 for initiation, early, mid-1, mid-2, late, and post growing-season periods for 2000, 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' being covered by wood chips for several days and not receiving additional attention to assist the plants' recovery. These plants were replaced in the spring of 1999. Plants that expired from environmental conditions or natural causes were not replaced. The mean values of the evaluation ratings were determined for each growing-season period. Some ratings are reported with two mean values. The first value includes data from all three replications, and the second value includes data from only the active replications.

Most of the grass entries increased in vigor and ornamental value from initiation of growing-season, through mid-, and to late-season periods (Table 5-9). Several grass entries had medium to high vigor and ornamental value ratings during the initiation of growing-season period, and two entries had 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 9-10). Several grass entries, blue grama, little bluestem, big bluestem, switchgrass, prairie cordgrass, feather reed grass, 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 10). Most of the grass entries tended to have high seedhead aesthetics value ratings during the period from head-emergence to seed-development stages (Table 5-10). 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 9-10).

Grass entries, sand love grass, giant silver banner grass, and zebra grass, had three or more sample periods with low vigor ratings and low ornamental values (Table 5-10). Several grass entries, blue grama, buffalo grass, big bluestem, sand bluestem, prairie sandreed, Indiangrass, switchgrass, prairie cordgrass, sweetgrass, 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 5-10).

Most of the grass entries had distinctive attractive shades of green during the early, mid, and late growing-season periods (Tables 5-9). 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 9-10).

The height categories for the grass entries (Table 11) 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 2000. The grasses with seed heads taller than 6 feet were big bluestem, 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 third 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 grasses should not be dismissed as landscape plants yet because the 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 supplemental 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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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>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	'Feesey'	<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	3	23	8	18	16
Blue grama	Buffalo grass	Blue fescue	Indiangrass	Zebra grass	Sand love grass
4	12	11	9	21	20
Sideoats grama	Sweetgrass	Canada wildrye	Switchgrass	Altai wildrye	Autumn red
14	15	24	7	6	23
Ribbon grass	Blue lyme grass	Green needlegrass	Prairie sandreed	Sand bluestem	Blue fescue
2	11	17	14	3	5
Little bluestem	Canada wildrye	Giant silver banner grass	Ribbon grass	Buffalo grass	Big bluestem
5	6	4	22	19	2
Big bluestem	Sand bluestem	Sideoats grama	Pampas grass	Red switchgrass	Little bluestem
7	8	16	10	22	17
Prairie sandreed	Indiangrass	Sand love grass	Prairie cordgrass	Pampas grass	Giant silver banner grass
13	16	2	19	10	13
Feather reed grass	Sand love grass	Little bluestem	Red switchgrass	Prairie cordgrass	Feather reed grass
9	10	12	5	8	4
Switchgrass	Prairie cordgrass	Sweetgrass	Big bluestem	Indiangrass	Sideoats grama
17	18	15	21	1	15

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

Table 5. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the initiation growing-season period, mid May 2000.

	Vigor	Ornamental Value	Seedhead aesthetics	Color
1	4.0		0	
2	2.7		0	Leaf tip, frost damage
3	4.3		0	
4	2.7		0	
5	4.0		0	Leaf tip, frost damage
6	2.7		0	Leaf tip, frost damage
7	4.0		0	Leaf tip, frost damage
8	2.7		0	Leaf tip, frost damage
9	3.3		0	Leaf tip, frost damage

10	4.3	4.0	0	
11	3.0		0	
12	5.0		5.0	
13	5.0	4.0	0	
14	5.0	5.0	0	
15	4.3		0	
16	0		0	
17	0.3/1.0		0	
18	0		0	
19	1.7		0	Leaf tip, frost damage
20	3.3		0	Leaf tip, frost damage
21	4.7	3.7	0	
22	3.0		0	Leaf tip, frost damage
23	5.0	4.0	5.0	
24	2.0/4.0		0	

split values: includes 3 reps./only active reps.

Evaluation

vigor: Low 16, 17, 18, 19, 24

High 1, 3, 5, 7, 9, 10, 12, 13, 14, 15, 21, 23

Ornamental value: Low N/A

High 10, 13, 14, 21, 23

Table 6. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the early growing-season period, mid June 2000.

	Vigor	Ornamental Value	Seedhead aesthetics	Color
1	4.3	3.0	0	Lt Green

2	1.7	1.7	0	Green
3	3.7	3.0	2.7/4.0	Green
4	2.0	2.0	0	Green
5	4.3	4.7	0	Green
6	3.3	3.3	0	Blue Green
7	3.3	3.7	0	Dk Green
8	3.0	3.0	0	Lt Green
9	3.3	3.7	0	Yellow Green
10	4.3	4.7	0	Dk Green
11	2.0	2.0	0	Blue Green
12	4.7	4.0	2.0/3.0	Lt Green
13	5.0	5.0	5.0	Dk Green
14	5.0	5.0	5.0	Lt Green with Cream
15	4.7	4.0	2.7/4.0	Bluegreen
16	0	0	0	
17	0.3/1.0	0.3/1.0	0	Dk Green with white lines
18	0	0	0	
19	2.3	2.3	0	Yellow Green
20	3.3	3.0	0	Lt Yellow Green
21	5.0	5.0	5.0	Bluegreen
22	5.0	4.3	0	Lt Green
23	5.0	5.0	5.0	Blue
24	1.7/5.0	1.7/5.0	1.7/5.0	Green

Split values: includes 3 reps./only active reps.

Evaluation

vigor: Low 2, 16, 17, 18, 19, 24

High 1, 3, 5, 6, 7, 9, 10, 12, 13, 14, 15, 20, 21, 22, 23

Ornamental value: Low 2, 16, 17, 18, 24

High 5, 6, 7, 9, 10, 12, 13, 14, 15, 21, 22, 23

Table 7. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the mid-1 growing-season period, mid July 2000.

	Vigor	Ornamental Value	Seedhead aesthetics	Color
1	3.7	3.3	4.0	Lt Green
2	2.7	2.7	0	Green
3	4.0	3.7	4.0	Green
4	2.3/2.7	1.8/2.8	2.5/3.8	Green
5	4.0	4.3	1.5/4.5	Green with purple
6	3.7	3.8	0	Lt Green
7	3.7	3.7	0	Dk Green
8	3.2	3.4	0	Green
9	3.8	4.0	4.3	Green
10	4.2	4.3	0	Dk Green
11	2.6	2.8	3.0/4.5	Bluegreen
12	4.3	4.0	1.3/4.0	Lt Green
13	5.0	5.0	5.0	Dk Green
14	5.0	5.0	5.0	Lt Green with Cream
15	4.2	3.3	4.0	Bluegreen
16	0	0	0	
17	0.5/1.5	0.5/1.5	0	Dk Green with white line
18	0	0	0	
19	2.8	2.8	0	Green with purple
20	4.0	3.8	0	Green
21	4.5	4.3	4.8	Bluegreen
22	4.8	4.2	0	Lt Green
23	4.2	4.3	4.3	Blue
24	1.5/4.5	1.3/4.0	1.7/5.0	Green

Split values: includes 3 reps./only active reps.

Evaluation

vigor: Low 16, 17, 18, 24

High 1, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 20, 21, 22, 23

Ornamental value: Low 4, 16, 17, 18, 24

High 1, 3, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 20, 21, 22, 23

Table 8. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the mid-2 growing-season period, mid August 2000.

	Vigor	Ornamental Value	Seedhead aesthetics	Color
1	3.7	3.3	3.3	Lt Green
2	2.3/3.5	2.3/3.5	2.3/3.5	Bluegreen
3	3.7	3.0	1.7/2.5	Lt Green
4	2.3/3.5	2.3/2.5	2.7/4.0	Lt Green
5	4.0	4.7	4.7	Green
6	4.7	4.7	5.0	Bluegreen
7	4.3	4.0	4.3	Green
8	3.3	3.3	2.3/3.5	Green
9	4.7	4.7	5.0	Green
10	4.7	4.7	4.7	Dk Green
11	2.3	2.3	2.0/3.0	Green
12	4.3	3.7	1.0/3.0	Green
13	4.0	4.3	4.7	Dk Green
14	4.0	4.3	3.0	Lt Green with Cream
15	3.3	3.3	2.0/3.0	Blue
16	0	0	0	
17	0.7/2.0	1.0/3.0	0	Green with white line
18	0	0	0	
19	3.0	3.7	3.3	Green
20	4.0	4.0	0	Green

21	4.3	3.7	3.3	Blue
22	4.7	4.3	0	Lt Green
23	3.3	3.3	2.7	Blue
24	1.3/4.0	1.3/4.0	1.3/4.0	Green

Split values: includes 3 reps./only active reps.

Evaluation

vigor: Low 16, 17, 18, 24

High 1, 3, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 20, 21, 22, 23

Ornamental value: Low 16, 17, 18, 24

High 1, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 19, 20, 21, 22, 23

Table 9. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the late growing-season period, mid September 2000.

	Vigor	Ornamental Value	Seedhead aesthetics	Color
1	3.0	3.3	3.0	Lt Green & Tan
2	2.0/3.0	2.2/3.3	1.8/3.0	Lt Green with purple
3	3.3	3.0	1.7/2.5	Lt Green & Tan
4	1.8/3.0	2.0/3.3	2.0/3.0	Lt Green & Tan
5	4.2	4.4	3.8	Lt Green, Lt. Red with purple & Tan
6	3.7	3.7	4.0	Bluegreen with red & Tan
7	3.8	3.5	3.8	Yellow Green & Tan
8	3.3	3.4	3.8	Lt Green with yellow & Tan
9	4.3	4.5	3.8	Yellow Green & Tan
10	3.8	4.2	3.8	Yellow Green & Tan
11	2.0	2.2	2.0/3.0	Lt Green & Tan
12	3.8	3.7	0.8/2.5	Yellow Green
13	4.5	4.7	4.5	Green & Tan
14	4.5	4.7	3.0	Yellow Green with white & Tan
15	3.3	3.2	3.8	Lt Bluegreen & Tan

16	0	0	0	
17	0.7/2.0	0.7/2.0	0	Yellow Green with white line
18	0	0	0	
19	3.2	3.7	3.3	Lt Green & Lt Red
20	4.2	4.3	2.7	Lt Green with Lt Red
21	3.8	3.5	3.3	Lt Bluegreen & Tan
22	4.2	4.3	3.3	Yellow Green with yellow & Tan
23	4.0	4.0	2.8	Lt Blue & Tan
24	1.2/3.5	1.2/3.5	1.2/3.5	Lt Green & Tan

Split values: includes 3 reps./only active reps.

Evaluation

vigor: Low 4, 16, 17, 18, 24

High 3, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 19, 20, 21, 22, 23

Ornamental value: Low 16, 17, 18, 24

High 1, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 19, 20, 21, 22, 23

Table 10. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the post growing-season period, November 2000.

	Vigor	Ornamental Value	Seedhead aesthetics	Color
1	(A)	(B)	0.0	Tan
2	(A)	1.7/2.5	1.7/2.5	Lt Red
3	(A)	(B)	0.0	Tan
4	(A)	(B)	0.7/1.0	Tan
5	(A)	3.3	2.3/3.5	Tan and Lt Red
6	(A)	3.7	3.3	Tan and Lt Red
7	(A)	1.3/1.5	2.0/3.0	Tan
8	(A)	3.0	2.3	Tan and Lt Red
9	(A)	3.0	3.7	Tan and Lt Red
10	(A)	2.7	3.3	Tan

11	(A)	1.7/2.0	1.7/2.5	Tan
12	(A)	(B)	0.0	Tan
13	(A)	3.7	4.0	Tan
14	(A)	1.7	0.0	Lt Tan
15	(A)	1.7/2.0	2.3	Tan and Green
16	0	0	0	-
17	(A)	0.3/1.0	0.0	Tan
18	0	0	0	-
19	(A)	1.7	3.0	Tan and Lt Red
20	(A)	2.7	2.3	Tan and Lt Red
21	3.0	2.3	3.0	Lt Green and Tan
22	(A)	3.0	2.3/3.5	Lt Red
23	(A)	(B)	1.0/1.5	Tan
24	(A)	0.7/2.0	0.3/1.0	Tan

(A)=senescent

(B)=covered by snow

Split values: Includes 3 reps./only active reps.

Evaluation

vigor: Low 16, 17, 18

High 21

Ornamental value: Low 16, 17, 18

High 5, 6, 13

Table 11. 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.

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