

# Xeriscape Ornamental Perennial Grass Trial for Low Water Use Landscaping

Llewellyn L. Manske and Jerry C. Larson  
Range Scientist, NDSU, Dickinson Research Extension Center  
Extension Agent, NDSU, Extension Service, Stark-Billings County

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 the 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 initiation, early, mid-1, mid-2, late, and post growing-season periods.

## Results

Mean evaluation ratings of grass entries are shown in Tables 5-8 for early, mid-1, mid-2, and late growing-season periods for 2002, 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 5-8). Several grass entries had medium to high vigor and ornamental value ratings during the initiation of growing-season period, and one entry--sweetgrass--had seedheads present in mid May. Vigor and ornamental value decreased for most grass entries after the late growing-season period (Tables 8). Several grass entries--blue grama, little bluestem, buffalo grass, sideoats grama, big bluestem, sand bluestem, prairie sandreed, Indiangrass, switchgrass, prairie cordgrass, Canada wildrye, sweetgrass, feather reed grass, ribbon grass, blue lyme grass, red switchgrass, autumn red, Altai wildrye, and pampas grass--had medium to high vigor and ornamental value ratings during the late growing-season period (Table 8). Most of the grass entries tended to have high seedhead aesthetics value ratings during the period from head-emergence to seed-development stages (Table 5-8). Several grass entries--blue grama, little bluestem, buffalo grass, sideoats grama, big bluestem, sand bluestem, prairie sandreed, Indiangrass, switchgrass, prairie cordgrass, Canada wildrye, feather reed grass, blue lyme grass, red switchgrass, autumn red, Altai wildrye, and pampas grass--had medium or high attractiveness of seedheads after reaching full maturity and during the late growing-season period (Table 8).

A few 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 5-8). Several grass entries--blue grama, little bluestem, buffalo grass, sideoats grama, big bluestem, sand bluestem, prairie sandreed, Indiangrass, switchgrass, prairie cordgrass, sweetgrass, feather reed grass, ribbon grass, autumn red, Altai wildrye, and pampas grass--had three or more sample periods with high vigor ratings and high ornamental values (Table 5-8).

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 8).

The height categories for the grass entries (Table 9) 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 2002. 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 fifth 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.

The ornamental grass research plot at the Dickinson Research Extension Center has attracted lots of public interest. It is evident that the use of ornamental grasses in southwest North Dakota is steadily increasing. Local greenhouses and nurseries document this interest through increased sales of ornamental grasses. This acceptance is also evident through a windshield survey driving through Dickinson and surrounding areas.

## Acknowledgment

The authors thank Ron Smith, NDSU Extension Horticulturist, Fargo, for providing plugs of horticultural adopted grass species plant material #13 to 20, for assisting with plot establishment, and for providing consultation during the development of this research project. We thank Craig Armstrong for providing plugs of horticultural adopted grass species plant material #22 and 23 and for providing advice on plot management. We thank USDA Plant Materials Center, Bismarck, for providing plugs of native species plant material #1 to 12. We thank Mike Knutson, USDA Plant Materials Center, Bismarck, for selection, collection, and delivery of native species plant material plugs and for assistance with plot establishment. We thank Jon Stika, NRCS, Area Agronomist, Dickinson, for making arrangements for native species plant material and for assistance with plot establishment. We

thank James Nelson, DREC Animal Scientist, Dickinson, for preliminary preparation of plot area and for providing and spreading wood chips. We are grateful to Sheri Schneider for assistance in production of this manuscript. We are grateful to Amy M. Kraus and Naomi J. Thorson for assistance in preparation of this manuscript.

**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	‘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 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 Switchgrass	10 Prairie cordgrass	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 early growing-season period, mid June 2002.**

	<b>Vigor</b>	<b>Ornamental Value</b>	<b>Seedhead aesthetics</b>	<b>Color</b>
1	2.7	2.7	0	Green
2	3.5	3.5	0	Green
3	4.3	5.0	5.0	Gray Green
4	4.0	4.0	0	Green
5	4.7	4.7	0	Lt Green
6	4.0	4.0	0	Green
7	3.7	3.7	0	Dk Green
8	4.0	4.0	0	Green
9	4.7	4.7	0	Green
10	4.0	4.0	0	Dk Green
11	4.0	4.0	3.0	Green
12	5.0	5.0	5.0	Yellow Green
13	5.0	5.0	0	Dk Green
14	5.0	5.0	0	Lt Green with Cream
15	2.7	2.7	4.0	Blue
16	0	0	0	
17	0	0	0	
18	0	0	0	
19	2.3	2.3	0	Green
20	4.7	4.7	0	Green
21	4.7	4.3	4.5	Blue
22	5.0	5.0	0	Lt Green
23	2.0	2.0	2.3	Blue
24	5.0	5.0	4.0	Green

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

Evaluation

vigor: Low 16, 17, 18, 23

High 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 20, 21, 22

Ornamental value: Low 16, 17, 18, 23

High 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 20, 21, 22



**Table 6. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the mid-1 growing-season period, mid July 2002.**

	<b>Vigor</b>	<b>Ornamental Value</b>	<b>Seedhead aesthetics</b>	<b>Color</b>
1	3.0	3.0	0	Green
2	4.0	4.0	4.0	Green
3	4.3	4.7	4.0	Gray Green
4	4.0	4.0	4.0	Lt Green
5	5.0	5.0	5.0	Green
6	5.0	5.0	5.0	Bluegreen
7	4.3	4.0	4.3	Bluegreen
8	4.0	4.3	0	Green
9	5.0	5.0	5.0	Green
10	5.0	5.0	0	Dk Green
11	3.3	3.3	4.7	Green
12	5.0	5.0	3.0	Yellow Green
13	5.0	5.0	5.0	Dk Green
14	4.7	5.0	4.0	Lt Green with Cream
15	3.7	3.3	1.3	Blue
16	0	0	0	
17	0	0	0	
18	0	0	0	
19	3.3	3.3	1.3	Green
20	5.0	5.0	0	Green
21	5.0	5.0	5.0	Blue
22	5.0	5.0	0	Lt Green
23	1.3	1.3	1.3	Blue
24	5.0	5.0	5.0	Green

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

Evaluation

vigor: Low 16, 17, 18, 23

High 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 19, 20, 21, 22

Ornamental value: Low 16, 17, 18, 23

High 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 19, 20, 21, 22

**Table 7. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the mid-2 growing-season period, mid August 2002.**

	<b>Vigor</b>	<b>Ornamental Value</b>	<b>Seedhead aesthetics</b>	<b>Color</b>
1	2.7	3.0	4.0	Green with Tan
2	4.0	4.0	5.0	Green and Red
3	4.3	4.0	3.5	Gray Green with Tan
4	3.5	3.5	2.5	Lt Green
5	5.0	5.0	5.0	Green and Red
6	4.7	5.0	5.0	Bluegreen
7	4.3	4.3	5.0	Green
8	4.3	4.7	5.0	Green
9	5.0	5.0	5.0	Green and Yellow
10	5.0	5.0	5.0	Dk Green
11	3.0	3.0	3.0	Green
12	5.0	5.0	3.0	Yellow Green
13	5.0	5.0	5.0	Dk Green
14	5.0	5.0	0	Lt Green with Cream and Pink
15	3.3	3.0	3.5	Blue
16	0	0	0	
17	0	0	0	
18	0	0	0	
19	3.3	3.3	4.7	Green and Red
20	5.0	5.0	0	Green and Red
21	4.7	4.7	4.0	Bluegreen
22	5.0	5.0	0	Lt Green
23	1.0	1.0	0	Blue
24	5.0	5.0	4.0	Green

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

Evaluation

vigor: Low 16, 17, 18, 23

High 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 19, 20, 21, 22

Ornamental value: Low 16, 17, 18, 23

High 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 19, 20, 21, 22

**Table 8. Mean evaluation ratings of grass entries in xeriscape ornamental perennial grass trial during the late growing-season period, mid September 2002.**

	<b>Vigor</b>	<b>Ornamental Value</b>	<b>Seedhead aesthetics</b>	<b>Color</b>
1	3.0	3.0	4.0	Lt Green and Tan
2	4.0	4.0	4.5	Purple and Lt Green
3	4.3	4.0	4.0	Gray Green and Tan
4	3.5	3.5	4.0	Lt Green and Tan
5	5.0	5.0	4.7	Red, Orange, and Lt Green
6	5.0	5.0	5.0	Yellow Bluegreen
7	4.7	4.3	5.0	Yellow Green
8	4.7	5.0	5.0	Yellow Green
9	5.0	5.0	5.0	Yellow
10	5.0	5.0	5.0	Yellow Green
11	3.3	3.3	4.0	Green
12	4.7	4.7	1.0	Yellow Green
13	5.0	5.0	5.0	Green
14	5.0	5.0	2.0	Lt Green with Cream
15	3.5	2.3	3.0	Blue
16	0	0	0	
17	0	0	0	
18	0	0	0	
19	3.7	3.7	4.3	Lt Green and Red
20	5.0	5.0	5.0	Lt Green and Orange
21	5.0	5.0	3.3	Blue
22	5.0	5.0	5.0	Yellow, Orange, and Lt Green
23	2.0	2.0	0	Blue
24	5.0	5.0	4.0	Green

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

Evaluation

vigor: Low 16, 17, 18, 23

High 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 19, 20, 21, 22

Ornamental value: Low 16, 17, 18, 23

High 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 19, 20, 21, 22

**Table 9. Plant height category of grass entries in xeriscape ornamental perennial grass trial.**

<b>Height Category</b>	<b>Code</b>	
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.

## Reference Literature

- Barondeau, D., R. Smith, J. Larson, C. Miller, J. Dohrmann, T. Becker, R. Gaebe, B. Schmidt, J. Buckley, and L. Manske. 1997.** Xeriscape plant selection. NDSU Extension Service, Fargo, ND. 22 min. Video tape.
- Denver Botanic Gardens. No date.** Water-smart gardening. Brochure. Denver Parks and Recreation Department, Denver, CO.
- Denver Water. 1996.** Xeriscape plant guide. American Water Works Association. Fulcrum Publishing, Denver, CO.
- Denver Water. No date.** Discover xeriscape. Pamphlet. Xeriscape Colorado Inc., Denver, CO.
- Denver Water. No date.** Efficient irrigation systems at work. Pamphlet. Office of Water Conservation, Denver, CO.
- Hill, L., and N. Hill. 1995.** Lawns, grasses and ground covers. Rodale Press, Emmaus, PA.
- Plant Materials Center. 1997.** Native grasses for prairie landscaping in the Northern Great Plains. Brochure. USDA Natural Resources Conservation Service, Bismarck, ND.