Evaluation of Grass Cultivars as Ornamental Xeriscape Plants

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Clean water is a critical resource in the semiarid and arid regions of the North American continent and adequate quantities of water for domestic use are increasingly difficult for city governments to provide. This adversity is exacerbated by the utilization of a large portion of western municipalities' water supply for irrigation of lawns and ornamental plants. The primary reason that landscape plants have been consuming great quantities of water has been that traditionally trained landscapers have selected or recommended high water use Kentucky bluegrass lawns and nonlocal ornamental plants for placement in western residential landscapes.

With the intent of reducing the proportion of domestic water used for landscape plants, Denver Water and the Associated Landscape Contractors of Colorado developed the concept of "Xeriscape" gardening in 1981. Xeriscape gardening incorporated alternative solutions to traditional high water use plants and originated the development of landscapes that included plants that were harmonious with the local environmental conditions and used less supplemental water.

According to Denver Water, the purpose of xeriscape gardening, or low water use landscaping, is to conserve 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 waterholding 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, buffalograss, or crested wheatgrass.

*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 rates for maximum water savings with seasonal changes.

* Minimize maintenance to proper seasonal pruning, foliage cut back, and weed pulling, along with reduced 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 (Denver Water).

Homeowners in the Northern Plains have experienced the high costs of using domestic water for irrigation of traditional nonlocal, high water demand lawns and landscape plants and have become aware of the need for alternative low water use lawn plants and ornamental landscape plants.

This research project examined fourteen agricultural grass cultivars and ten horticultural grass cultivars and evaluated these cultivars for use as ornamental xeriscape grasses in low water use residential landscapes in the Northern Plains (Manske and Larson 1999, 2000, 2001, 2002, 2003). The agricultural grass cultivars were developed from regional and adapted plant material for use in prairie restoration and/or as pasture forage grasses; these cultivars were not originally intended to be ornamental landscape plants. The horticultural grass cultivars were developed from nonlocal or foreign plant material and initially selected as ornamental plants for use outside of the Northern Plains.

Grass Growth Habit

Ornamental value and aesthetic appeal of grass plants used in residential landscapes is greatly affected by the variations in growth habit that result from differences in how grasses grow and from the various combinations in type of crown or rhizome tillering, type of vegetative long or short shoots, type of seed head, and height of reproductive tiller.

The primary structural unit of a grass plant is the individual tiller. Grass tillers consist of a shoot and roots. The shoot is the stem and leaves, and comprised of repeated components called phytomers (Beard 1973, Dahl 1995). A phytomer consists of a leaf, with a blade and a sheath separated by a collar; a node, the location of leaf attachment to the stem; an internode, the stem between two nodes; and an axillary bud, meristematic tissue capable of developing into a new tiller (Hyder 1974, Dahl and Hyder 1977). Each tiller shoot generally produces 6 to 8 phytomers per growing season (Langer 1972, Dahl 1995).

Phytomers develop from leaf primordia that form on alternating sides of the apical meristem (Evans and Grover 1940, Langer 1972, Beard 1973, Dahl 1995). The oldest cells of a leaf are at the tip, and the youngest cells are at the base (Langer 1972, Dahl 1995). The oldest leaf is outermost, while younger leaves grow up through existing leaf sheaths (Rechenthin 1956, Beard 1973). Growth of the leaf results through cell enlargement and elongation (Esau 1960, Dahl 1995). Cell expansion occurs in the region protected by the sheaths of older leaves. Once a leaf blade is fully expanded, no further growth of that blade is possible (Dahl 1995).

Perennial grasses perpetuate vitality through vegetative reproduction of secondary tillers from the axillary buds. All secondary tillers are dependant on the lead tillers for carbohydrates until they have developed their own root system and mature leaves (Dahl 1995). After young tillers become independent, they remain in vascular connection with other tillers of the grass plant (Moser 1977, Dahl and Hyder 1977, Dahl 1995). There are two types of vegetative tillering: crown tillers and rhizome tillers. Crown tillers grow vertically close to the lead tiller and within the enveloping leaf sheath, and tend to have a tufted or bunch-type growth habit (Dahl and Hyder 1977, Dahl 1995). Rhizome tillers penetrate the enveloping leaf sheath and grow horizontally below the soil surface away from the lead tiller for a distance before beginning vertical growth. Rhizome growth may be either continuous, producing tillers at progressive intervals, or terminal, producing one tiller when the apex turns up and emerges from the soil (Dahl 1995). Tillers with short rhizomes result in large open clumps. The long rhizome type of tillers results in the spreading or creeping growth habit of sod-forming plants (Dahl and Hyder 1977, Dahl 1995). If the horizontal growth occurs aboveground, it is a stolon (Dahl 1995). Stolons have continuous growth and form tillers at progressive nodes (Dahl 1995). Grass plants can produce both crown tillers and rhizome tillers. Generally, one tiller growth type is produced by a grass species more than the other tiller type, resulting in a typical growth form for a species. However, the expressivity of tiller type can be influenced by several growth factors and environmental conditions, and can be manipulated by defoliation management changing a bunch growth habit into a spreading growth habit and changing a creeping growth habit into a clumping growth habit.

Vegetative tillers exhibit two strategies of stem elongation (short shoots and long shoots) resulting in two distinct growth forms. Short shoot tillers do not produce noticeable internode elongation during vegetative growth stages. The leaves of vegetative tillers are basal. The apical meristem remains close to the crown. Production of new leaf primordia continues and developing leaves continue to expand but remain basal. After the apical meristem changes to reproductive status and produces the flower primordia, one to several of the upper internodes and attached leaf sheaths elongate very rapidly by intercalary meristem cell development and the inflorescence reaches near maximum height (Dahl 1995).

Long shoot tillers elevate the apical meristem and several nodes with attached leaf sheaths and leaf blades by internode elongation while still in the vegetative phase (Dahl 1995). These elevated vegetative stems have several evenly distributed erect or arching leaves. Following the status change of the apical meristem from vegetative to reproductive and the development of the flower primordia, additional stem elevation occurs by elongation of one to several of the upper internodes and the inflorescence reaches near maximum height.

The grass plant seed head (inflorescence) develops into three primary forms: spike, an unbranched elongated seed head with flowers or flower clusters attached directly to the single flower axis (rachis) without a supporting stalk; raceme, an unbranched elongated seed head with flowers or flower clusters attached to the flower axis by a stalk; and panicle, a branched seed head with multiple racemes attached to the main flower axis.

The reproductive tiller height is measured from ground level to the top of the seed head and grouped into three categories: short grass, 0.5-2.0 ft. (15-61 cm); mid grass, 2.0-3.0 ft. (61-91 cm); and tall grass, 3.0-7.0 ft. (91-213 cm).

Not all grass tillers cease living at the end of the growing season. The only tillers that terminate are the tillers in which the apical meristem had changed to the reproductive phase and produced a seed head. Reproductive tillers cannot continue growth because these tillers cannot produce additional leaves. Vegetative tillers in which the apical meristem did not change to the reproductive

phase, secondary tillers that did not gain independence until late summer or fall, and fall tillers of cool-season grasses that were initiated after mid August, overwinter, and resume active growth during early spring of the subsequent growing season. Winter dormancy in perennial grasses is not total inactivity, but reduced activity (Leopold and Kriedemann 1975). The crown, portions of the root system, and some leaf tissue remain active and maintain physiological processes throughout the winter by using stored carbohydrates. Cool-season grasses continue leaf growth at slow rates during the winter. At the end of the winter dormancy period, portions of previous years leaves with intact cell walls on surviving tillers regreen with chlorophyll and provide crucial photosynthetic product for new leaf growth (Briske and Richards 1995). New growing leaves draw carbohydrates from these carryover older leaves until maintenance and growth requirements can be met by photosynthetic assimilates produced by the new leaves (Langer 1972, Coyne et al. 1995).

Procedures

Fourteen agricultural grass cultivars and ten horticultural grass cultivars were evaluated in a uniform garden for suitability as ornamental plants in xeric residential landscapes in the Northern Plains during the growing seasons of 1998 to 2002. Individual plots, 3 ft X 3 ft (0.91 m X 0.91 m), were arranged in a randomized block design with three replications. Plugs of plant material were placed in the center of each plot on 5 May 1998. One to one and a half gallons of water were applied to each plot within 3 hours of planting. Supplemental water was not added to the plots during the study. These plots were managed with minimum maintenance, no fertilizer, no herbicides after plot establishment, and hand roguing of weeds only when necessary. Previous years senescent growth was trimmed in early spring during late April prior to active plant growth. The green carryover leaves of vegetative tillers and the leaves of fall tillers of cool-season grasses were not trimmed (table 1).

The plant material on each plot was assessed by two independent observers during mid month from May to September for five growing seasons. The monthly ratings on three replications by two assessors were averaged for each cultivar. Evaluations of the grass cultivars included visual ratings of tiller vigor, leaf color, ornamental value, seed head aesthetics, and seed head phenology. Tiller vigor, ornamental value, and seed head aesthetics were rated on a scale of 1 to 5, with 1 the low score and 5 the high score value (table 2). Leaf color and seed head phenology were rated according to standard categories (table 2). Nomenclature of grass plants follows Flora of North America (2003, 2007).

Study Area

The research plots were on the NDSU Dickinson Research Extension Center located on the western edge of Dickinson, in southwestern North Dakota, USA (46° 53' N, lat., 102° 49' W. long.).

The soils were primarily Morton silt loam, Typic Haploborolls. Long-term mean annual temperature was 40.9° F (4.9° C). January was the coldest month, with a mean temperature of 11.5° F (-11.4° C). July and August were the warmest months, with mean temperatures of 68.8° F (20.4° C) and 67.0° F (19.4° C), respectively. Long-term annual precipitation was 16.00 inches (406.50 mm). The precipitation received during May, June, and July accounted for more than 50% of the annual precipitation. The amount of precipitation received during the perennial plant growing season (April to October) was 13.52 inches (343.21 mm), 84.43% of annual precipitation (Manske 2010).

The precipitation during the growing seasons of 1998 to 2002 was normal or greater than normal (table 3). During 1998, 1999, 2000, 2001, and 2002, 20.51 inches (151.37% of LTM), 14.20 inches (104.80% of LTM), 11.91 inches (87.90% of LTM), 17.74 inches (130.92% of LTM), and 15.47 inches (114.17% of LTM) of precipitation were received, respectively. Perennial plants were under water stress conditions during July and October, 1999; August and September, 2000; August and October, 2001; and September, 2002. Perennial plants did not experience water stress conditions during 1998 (Manske 2010).

Table 1. 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. No irrigation water applied during growing season.
Weed control:	Wood chips used between plants to help prevent weed growth. Weeds were 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 2. Ratings scales used in the evaluation methods of grass cultivars.

Tiller Vigor Ratings Scale					
5	4	3	2	1	0
robust vigor		medium vigor		low vigor	dead

Leaf Color Categories		
Dark Green	Dark Blue	Pink
Green	Blue	Orange
Light Green	Light Blue	Gold Yellow
Yellowgreen	Purple	Yellow
Gray Green	Red	Cream or White
Bluegreen	Light Red	Tan (Void of Color)

Ornamental Value Ratings Scale					
5	4	3	2	1	0
highly decorative		moderately decorative		minimally decorative	not decorative

Seed Head Aesthetics Ratings Scale					
5	4	3	2	1	-
highly attractive		moderately attractive		minimally attractive	not present

Seed Head Phenological Stages (abbreviation)	
Early development (E. develop.)	Seed development (Seed develop.)
Boot Stage (Boot)	Seeds maturing (Seed mature.)
Head emergence (Hd. emerge.)	Mature head (Mature hd.)
Flowering, Anthesis (Flower)	

Table 3. Precipitation in inches for growing-season months and the annual total precipitation for 1998- 2002, Dickinson, North Dakota.

	Apr	May	Jun	Jul	Aug	Sep	Oct	Growing Season	Annual Total
Long-term mean 1892-2007	1.43	2.34	3.55	2.22	1.73	1.33	0.95	13.55	16.00
1998	0.85	1.86	6.55	1.82	2.90	2.03	4.50	20.51	17.63
% of LTM	59.44	79.49	184.51	81.98	167.63	152.63	473.68	151.37	110.19
1999	1.48	3.94	1.99	0.99	3.23	2.25	0.32	14.20	12.81
% of LTM	103.50	168.38	56.06	44.59	186.71	169.17	33.68	104.80	80.06
2000	1.38	1.80	3.09	3.45	0.35	1.11	0.73	11.91	12.58
% of LTM	96.50	76.92	87.04	155.41	20.23	83.46	76.84	87.90	78.63
2001	2.08	1.75	7.15	3.99	0.00	2.53	0.24	17.74	15.76
% of LTM	145.45	74.79	201.41	179.73	0.00	190.23	25.26	130.92	98.50
2002	1.39	2.06	4.75	2.98	2.81	0.17	1.31	15.47	26.58
% of LTM	97.20	88.03	133.80	134.23	162.43	12.78	137.89	114.17	166.13
1998-2002	1.44	2.28	4.71	2.65	1.86	1.62	1.42	15.97	17.07
% of LTM	100.42	97.52	132.56	119.19	107.40	121.65	149.47	117.83	106.70

Agricultural Grass Cultivars

Blue grama	‘Bad River’	*Bouteloua gracilis*
Buffalograss	‘Bismarck’	*Buchloe dactyloides*
Sweetgrass		*Anthoxanthum hirtum*
Green needlegrass		*Nassella viridula*
Sideoats grama	‘Pierre’	*Bouteloua curtipendula*
Little bluestem	‘Badlands’	*Schizachyrium scoparium*
Canada wildrye	‘Mandan’	*Elymus canadensis*
Altai wildrye		*Leymus angustus*
Switchgrass	‘Dacotah’	*Panicum virgatum*
Indiangrass	‘Holt’	*Sorghastrum nutans*
Big bluestem	‘Bison’	*Andropogon gerardi*
Sand bluestem	‘Garden’	*Andropogon hallii*
Prairie sandreed		*Calamovilfa longifolia*
Prairie cordgrass	‘Red River’	*Spartina pectinata*

Blue grama ecotype 'Bad River'

Bouteloua gracilis (Kunth) Lag. ex. Griffiths

Blue grama is a perennial, warm-season, short grass native to the Northern Plains. Its growth habit is dense tufts 2.0 to 9.8 in. (5-25 cm) wide or large mats spreading by short, stout rhizomes. It is considered to have low invasiveness. Vegetative tillers form long shoots that have short internode elongations with basally concentrated curly leaves. The flat leaf blades are 1.2 to 3.9 in. (3-10 cm) long and 0.04 to 0.08 in. (1-2 mm) wide. The margins of the leaves roll inward when dry. Seed head elevation includes 2 or 3 upper stem nodes with small leaves. The inflorescence is a panicle with 2 or 3 comb-like purplish spikes attached to the stem of one internode. The erect reproductive tillers are 6.8 to 19.7 in. (20-50 cm) tall.

The 'Bad River' ecotype was developed from native plant seed harvested in 1988 on a floodplain of the Bad River in Haakon County, central South Dakota, and released in 1996 by USDA, NRCS Plant Materials Center, North Dakota Agricultural Experiment Station, South Dakota Agricultural Experiment Station, and North Dakota Association of Conservation Districts. The plant material for this study was provided by USDA, NRCS Plant Materials Center, Bismarck, North Dakota.

Evaluation ratings for Blue grama ecotype 'Bad River' are on tables 4 and 5. Establishment of blue grama under xeriscape conditions required one growing season. The plant material on all three replications had good vigor during the summer and early fall. During the establishment growing season, mean tiller vigor rating was 3.9 and mean ornamental value rating was 3.0. A few attractive seed heads were produced during the first year and mean seed head aesthetics rating was 4.0. Because blue grama is a warm-season grass, the carryover tillers and new vegetative tillers had relatively low vigor during mid May. The mature plant material on all three replications were shaded by adjacent tall grass cultivars causing some reduction in tiller vigor during the second, third, fourth, and fifth growing seasons; mean tiller vigor rating was 3.4 and mean ornamental value rating was 3.2. Numerous attractive seed heads were produced during the latter three growing seasons and mean seed head aesthetics rating was 3.6. The leaf color was an attractive green during the growing season, even during July and August. Senescent leaves turned a nice light tan in fall. The short curly leaves had good ornamental value, however, the unique purple tinted seed heads provided the strong aesthetic appeal of blue grama. Overall, mean tiller vigor rating was 3.4, mean ornamental value rating was 3.2, and mean seed head aesthetics rating was 3.7 during five growing seasons (tables 4 and 5).

Blue grama can be managed as ornamental hemispherical tufts, as ground cover between landscape flowers, or as an ornamental lawn.

Management of blue grama as ornamental hemispherical tufts requires trimming the previous years senescent leaves and seed heads into half ball shapes the size of softballs to basketballs during the early spring around the last two weeks of April. Do not trim these tufts during the growing season. They will remain attractive until covered by snow.

Management of blue grama as ground cover among landscape plantings requires trimming several times (probably 3) to maintain around a 3 inch height during the growing season from mid April to mid September. Blue grama will not grow well in areas of continuous shade. As a ground cover, blue grama preforms the tasks of soil builder, erosion protector, and weed eliminator, and replaces the need to spread bark or wood chips.

An ornamental blue grama lawn has low maintenance, low inputs, and low upkeep costs. Do not mix blue grama and buffalograss plants for a lawn. Management of blue grama as an ornamental lawn requires an early spring mowing around the last two weeks of April at a height of about 2 inches to remove the previous years senescent leaves and to get sunlight to the new growing tillers. Do not cut so low as to scalp the plants. Leave a thin layer of the clippings as a mulch. The spring rains will move the clippings down to the soil level. During the growing season, the current years grass tillers will only need to be mowed twice. The cutting height should be raised up to about 3 to 3.5 inches. The first mowing should be within a week or so after 21 June (the longest day of the year). This first mowing activates new vegetative tiller growth and helps thicken the tiller density. The second mowing should be around mid August. The plants are starting to develop winter hardiness in preparation for the cold conditions of winter. The second mowing activates fall bud development that will produce new tillers early the following spring. Some seed heads will develop following the second mowing and will remain attractive until covered by snow.

Blue grama is a warm-season grass and green up occurs later than cool-season grass lawns, however, the trade off is that blue grama remains green during mid summer when cool-season grasses go dormant or require large quantities of irrigation water. Blue grama should not be fertilized with commercial fertilizers on the schedule recommended for cool-season lawns. The only fertilization needed by blue grama is to add a thin layer of composted manure or other organic matter during the fall once every five or six years. The 'Bad River' ecotype is sensitive to herbicides. Do not use herbicides that contain banvel, and do not broadcast spray 2,4-D at the recommended rates. It it best to spot spray dicot weeds that grow in spaces between grass plants with low dosages of 2,4-D during early spring and/or late fall. During the growing season, it is best to hand rogue the weedy plants. Problems with weeds are usually greatly reduced during the third growing season.

Table 4. Evaluation ratings for Blue grama ecotype 'Bad River' in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			3.7		4.0	1.7
2nd	2.0	3.7	4.0		3.7	3.3
3rd	4.0	4.3	3.7	3.7	3.0	
4th	2.3	3.3	3.3	3.3	3.0	
5th		2.7	3.0	2.7	3.0	
Mean	2.8	3.5	3.5	3.2	3.3	2.5
			Leaf Color			
1st			Green		Bluegreen	Tan
2nd		Green	Lt. Green		Lt. Green	Tan
3rd		Lt. Green	Lt. Green	Lt. Green	Lt. Green & Tan	Tan
4th	Bluegreen	Green	Green	Green & Tan	Lt. Green & Tan	
5th		Green	Green	Green & Tan	Lt. Green & Tan	
Summary	Bluegreen	Lt. Green to Green	Lt. Green to Green	Lt. Green to Green & Tan	Lt. Green to Lt. Green &Tan	Tan

Table 5. Evaluation ratings for Blue grama ecotype ‘Bad River’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			3.0		3.0	2.0
2nd	1.0	2.7	3.0		3.3	3.0
3rd		3.0	3.3	3.3	3.3	
4th	2.7	4.0	3.3	3.3	4.0	
5th		2.7	3.0	3.0	3.0	
Mean	1.9	3.1	3.1	3.2	3.3	2.5
			Seed Head Aesthetics			
1st			3.5		4.5	3.0
2nd	-	-	2.7		3.3	1.3
3rd	-	-	4.0	3.3	3.0	
4th	-	-	4.0	3.5	4.3	
5th		-	-	4.0	4.0	
Mean	-	-	3.6	3.6	3.8	2.2
			Seed Head Phenology			
Study Mean			Hd. emerg. Flower.	Seed develop.	Seed mature	Mature hd.

Buffalograss ecotype ‘Bismarck’

Buchloe dactyloides (Nutt.) Engelm.

Buffalograss is a perennial, warm-season, short grass native to the Northern Plains. Its growth habit is a solid mat 2.0 to 3.9 in. (5-10 cm) thick spreading by prostrate stolens 11.8 to 19.7 in. (30-50 cm) long that produce tillers at progressive nodes. It is considered to have low invasiveness. The vegetative tillers form long shoots that have short internode elongations with basally concentrated curly leaves. The leaf blades are 0.8 to 3.9 in. (2-10 cm) long and 0.04 to 0.08 in. (1-2 mm) wide. Leaf curling increases when dry. Buffalograss is dioecious having male and female flowers on separate plants. The female flowers are located below the leaf height partially hidden within the leaves and do not elevate. The male inflorescence is elevated above the leaf height by elongation of two or three stem nodes with small leaves. The male flower head consists of 2 or 3 short spikes 0.2 to 0.6 in. (5-15 mm) long attached to one slender internode. The erect male reproductive tillers are 0.4 to 11.8 in. (1-30 cm) tall.

The ‘Bismarck’ ecotype was developed as a composite from plant material collected in Dickey and Morton Counties, central North Dakota, in 1985 and 1986, respectively, and released in 1996 by USDA, NRCS Plant Materials Center and North Dakota Agricultural Experiment Station. The ‘Bismarck’ ecotype consists entirely of male plants and must be propagated vegetatively by plugs. The plant material for this study was provided by USDA, NRCS Plant Materials Center, Bismarck, North Dakota.

Evaluation ratings for Buffalograss ecotype ‘Bismarck’ are on tables 6 and 7. Establishment of buffalograss under xeriscape conditions required two growing seasons. The plant material on all 3 replications struggled the first growing season. During the two establishment growing seasons, mean tiller vigor rating was 3.3 and mean ornamental value rating was 2.5. A few male flower heads were produced during the first two years and mean male head aesthetics rating was 2.7. The male flower heads are technically not seed heads. Because buffalograss is a warm-season grass, the carryover tillers and the new vegetative tillers had relatively low vigor during mid May, except during the third year. The vigor of the plant material improved during the third, fourth, and fifth growing seasons. Mean tiller vigor rating was 4.0 and mean ornamental value rating was 3.6. Numerous male flower heads were produced during the latter three growing seasons and mean male head aesthetics rating was 3.7. The leaf color was mainly gray green giving buffalograss plants a dingy appearance. The thick mat of curly leaves had good ornamental value and the male flower heads had strong aesthetic appeal. Overall, mean tiller vigor rating was 3.8, mean ornamental value rating was 3.3, and mean male flower head aesthetics rating was 3.4 during five growing seasons (tables 6 and 7).

Buffalograss can be managed as ground cover between landscape flowers, or as a xeriscape lawn.

Management of buffalograss as ground cover among landscape plants requires trimming the previous years senescent leaves and male flower heads during early spring around the last two weeks of April. No addition trimming will be needed for the remainder of the growing season. Buffalograss will not grow well in areas of continuous shade. As ground cover, buffalograss performs the tasks of soil builder, erosion protector, and weed eliminator, and replaces the need to spread bark or wood chips.

A xeriscape buffalograss lawn has low maintenance, low inputs, and low upkeep costs. Do not mix buffalograss and blue grama plants for a lawn. Management of buffalograss as a xeriscape lawn requires an early spring mowing around the last two weeks of April at a height that removes the previous years senescent leaves and gets sunlight to the new growing tillers. Do not cut so low as to scalp the plants. Leave a thin layer of the clippings as a mulch. The spring rains will move the clippings down to the soil level. Buffalograss remains short and will not require any additional mowings during the entire growing season. The gray green color of the leaves gives the appearance of a dust covered lawn. Buffalograss lawn would work nicely as grass covered walkways among or between landscape flower beds, or as a lawn in parts of a residential lot with problem clay soils. Buffalograss lawn does not have the aesthetic impact that a blue grama ornamental lawn does. Buffalograss xeriscape lawn and a blue grama ornamental lawn can be grown on the same landscape but at different locations. Buffalograss and blue grama plants should never be mixed together.

Table 6. Evaluation ratings for Buffalograss ecotype ‘Bismarck’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			2.3		3.0	1.0
2nd	2.0	3.7	3.3		4.0	3.0
3rd	4.3	3.7	4.0	3.7	3.3	
4th	3.3	4.0	4.0	4.0	4.0	
5th		4.3	4.3	4.3	4.3	
Mean	3.2	3.9	3.6	4.0	3.7	2.0
			Leaf Color			
1st			Bluegreen		Green	Tan
2nd		Green	Lt. Green		Gray Green	Tan
3rd		Green	Green	Gray Green	Gray Green & Tan	Tan
4th	Bluegreen	Green	Gray Green	Gray Green	Gray Green	
5th		Gray Green	Gray Green	Gray Green & Tan	Gray Green & Tan	
Summary	Bluegreen	Green to Gray Green	Lt. Green to Gray Green	Gray Green to Gray Green & Tan	Gray Green to Gray Green & Tan	Tan

Table 7. Evaluation ratings for Buffalograss ecotype ‘Bismarck’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			2.5		2.5	1.0
2nd	1.0	2.3	2.3		3.0	2.3
3rd		3.0	3.7	3.0	3.0	
4th	2.7	3.0	3.7	3.3	3.3	
5th		5.0	4.7	4.0	4.0	
Mean	1.9	3.3	3.4	3.4	3.2	1.7
			Male Head Aesthetics			
1st			2.0		4.0	1.0
2nd	-	2.0	2.7		3.0	-
3rd	-	4.0	4.0	2.5	2.5	-
4th	-	3.0	4.7	3.0	4.0	
5th		5.0	4.0	3.5	4.0	
Mean	-	3.5	3.5	3.0	3.5	1.0
			Male Head Phenology			
Study Mean		Hd. emerg. Flower.	Hd. develop.	Hd. develop.	Hd. mature.	Mature hd.

Sweetgrass

Anthoxanthum hirtum (Schrauk) Y. Schouten & Veldkamp
Hierochloe odorata (L.) Wahlenb.

Sweetgrass is a perennial, cool-season, mid grass native to the Northern Plains. Its growth habit is loose colonies connected with a strong system of slender creeping rhizomes. It is considered to have low invasiveness when next to vigorous grass communities but quite invasive in areas with little or no competition from active plants. A fairly simple barrier should confine this grass to a designated space. Vegetative tillers form long shoots with evenly distributed erect and arching leaves. The leaf blades are longer towards the base of the stem, lower leaves are 3.9 to 11.8 in. (10-30 cm) long, upper leaves are 1.2 to 2.0 in. (3-5 cm) long, and the leaves are 0.08 to 0.2 in. (2-5 mm) wide. Seed head elevation includes one or two stem nodes with small leaves. The inflorescence is an open, pyramidal panicle 2.0 to 3.9 in. (5-10 cm) long and nearly as wide with compact to loose, slender, drooping branches attached to one internode. A relatively low percent of the tiller population develop seed heads. The erect reproductive tillers are 7.9 to 19.7 in. (20-50 cm) tall.

Sweetgrass plant material from the Northern Plains has not yet been developed; cultivar selection has been in the initial evaluation planting stage since 1992 at the Bismarck Plant Materials Center. The plant material for this study was provided by USDA, NRCS Plant Materials Center, Bismarck, North Dakota.

Evaluation ratings for Sweetgrass are on tables 8 and 9. Establishment of sweetgrass under xeriscape conditions required one growing season. During the first growing season, the plant material on all three replications progressed well; mean tiller vigor rating was 3.1 and mean ornamental value rating was 2.5. No seed heads were produced during the first year. Sweetgrass is an early cool-season grass and starts spring growth in early April; tillers reached near mature height and seed heads were at the flower stage by mid May. The vigor of the plant material improved during the second and third growing seasons and remained high during the fourth and fifth growing seasons. Mean tiller vigor rating was 4.8, mean ornamental value rating was 4.2, and mean seed head aesthetics rating was 3.2 during the latter four growing seasons. The size of the plant colonies greatly increased during the third, fourth, and fifth growing seasons. The leaf color was an attractive yellowgreen during the growing season. The individual tillers and seed heads do not have high attractiveness by themselves; the unique ornamental value of sweetgrass comes from a mass of numerous tillers growing together. No other perennial grass has as much early growth of beautiful yellowgreen foliage that remains for the entire growing season. Overall, mean tiller vigor rating was 4.7, mean ornamental value rating was 4.2, and seed head aesthetics rating was 3.1 during five growing seasons (tables 8 and 9).

The primary ornamental value of sweetgrass would be as a serpentine ribbon of yellowgreen vegetation winding through a landscape flower bed. Management of sweetgrass for vigorous early spring growth requires cutting tillers to a couple of inches in height between mid July and mid August. Cutting the tillers during the fall or spring would lose the aesthetic impact of the impressive April and May vigorous growth. The vegetation can be braided into incense ropes or odoriferous baskets. The dry vegetation gives off a pleasant vanilla-like scent.

Table 8. Evaluation ratings for Sweetgrass in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			2.7		3.5	4.0
2nd	5.0	4.3	5.0		4.7	2.7
3rd	5.0	4.7	4.3	4.3	3.8	
4th	5.0	5.0	5.0	5.0	5.0	
5th		5.0	5.0	5.0	4.7	
Mean	5.0	4.8	4.4	4.8	4.3	3.4
			Leaf Color			
1st			Lt. Green		Lt. Green	Lt. Green & Yellowgreen
2nd		Green	Lt. Green		Lt. Green	Tan
3rd		Lt. Green	Lt. Green	Lt. Green	Yellowgreen	Tan
4th	Lt. Green	Lt. Green	Yellowgreen	Lt. Green	Yellowgreen	
5th		Yellowgreen	Yellowgreen	Yellowgreen	Yellowgreen	
Summary	Lt. Green	Green to Yellowgreen	Lt. Green to Yellowgreen	Lt. Green to Yellowgreen	Lt. Green to Yellowgreen	Lt. Green, Yellowgreen & Tan

Table 9. Evaluation ratings for Sweetgrass in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			2.0		3.0	2.5
2nd	4.5	3.3	3.7		3.0	3.0
3rd		4.0	4.0	3.7	3.7	
4th	5.0	5.0	4.3	5.0	3.3	
5th		5.0	5.0	5.0	4.7	
Mean	4.8	4.3	3.8	4.6	3.5	2.8
			Seed Head Aesthetics			
1st			-		-	-
2nd	5.0	1.3	2.0		-	0.3
3rd	5.0	3.0	4.0	3.0	2.5	-
4th	3.5	3.0	-	-	-	
5th		5.0	3.0	3.0	1.0	
Mean	4.5	3.1	3.0	3.0	1.8	0.3
			Seed Head Phenology			
Study Mean	Boot Hd. emerge. Flower.	Seed develop. Seed mature.	Seed mature.	Seed mature.	Mature hd.	Mature hd.

Green needlegrass

Nassella viridula (Trin.) Barkworth
Stipa viridula Trin.

Green needlegrass is a perennial, cool-season, mid grass native to the Northern Plains. Its growth habit is a tight bunch 3.9 to 11.8 in. (10-30 cm) wide producing rhizomes only rarely. It is considered to not be invasive. Vegetative tillers form long shoots that have short internode elongations with basally concentrated erect and arching leaves. The flat leaf blades are 3.9 to 11.8 in. (10-30 cm) long and 0.04 to 0.1 in. (1-3 mm) wide. Leaves roll inward with the margins overlaping when dry. Seed head elevation includes few stem nodes with erect leaves. The inflorescence is a narrow, thick, dense panicle 3.9 to 7.9 in. (10-20 cm) long and 0.8 to 1.2 in. (2-3 cm) wide attached to one internode. The erect reproductive tillers are 1.0 to 4.9 ft. (30-150 cm) tall.

The green needlegrass plant material plugs for this study were collected from native mixed grass prairie in western North Dakota.

Evaluation ratings for Green needlegrass are on tables 10 and 11. Establishment of green needlegrass under xeriscape conditions required two growing seasons. The plant material on all 3 replications struggled for two growing seasons. The plugs were dug from native prairie in early May. At that time, the leaves of the carryover tillers had regreened and several new tillers had the second leaf coming. Early May appears to be too late to transplant green needlegrass. Subsequent transplants for other studies has been successful when completed during early to mid April. During the two establishment growing seasons, mean tiller vigor rating was 2.1, mean ornamental value rating was 1.7, and seed head aesthetics rating was 2.2. Plant vigor improved greatly during the third growing season and all plants had robust vigor during the fourth and fifth growing seasons. Mean tiller vigor rating was 4.8, mean ornamental value rating was 4.7, and mean seed head aesthetics rating was 4.4 during the latter three growing seasons. The leaf color was an attractive green. The green needlegrass plant material developed into extremely attractive moderate sized bunches with erect and arching basal leaves, and with a few medium height stems that had attractive dense panicles on top. Overall, mean tiller vigor rating was 4.1, mean ornamental value rating was 4.0, and mean seed head aesthetics rating was 3.9 during five growing seasons (tables 10 and 11).

Green needlegrass can be managed as ornamental medium sized tufts. Management of green needlegrass as ornamental tufts requires trimming the previous years senescent leaves and seed heads into hemispherical shapes the size of softballs to basketballs during early spring around mid April. Do not trim these tufts during the growing season. They will remain attractive until covered by snow.

Table 10. Evaluation ratings for Green needlegrass in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			2.3		2.0	1.3
2nd	1.0	2.3	2.0		1.7	1.7
3rd	4.0	5.0	4.5	4.0	3.5	
4th	5.0	5.0	5.0	5.0	5.0	
5th		5.0	5.0	5.0	5.0	
Mean	3.3	4.3	3.8	4.7	3.4	1.5
			Leaf Color			
1st			Green		Green & drying tips	Green base & Tan
2nd		Green	Green		Lt. Green	Tan
3rd		Green	Green	Green	Lt. Green & Tan	Tan
4th	Dk. Green	Green	Green	Green	Green	
5th		Green	Green	Green	Green	
Summary	Dk. Green	Green	Green	Green	Green to Lt. Green & Tan	Green & Tan to Tan

Table 11. Evaluation ratings for Green needlegrass in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			2.0		1.7	1.0
2nd	1.0	1.3	2.0		1.7	1.0
3rd		5.0	4.0	4.0	3.5	2.0
4th	5.0	5.0	5.0	5.0	5.0	
5th		5.0	5.0	5.0	5.0	
Mean	3.0	4.1	3.6	4.7	3.4	1.3
			Seed Head Aesthetics			
1st			1.7		-	-
2nd	-	1.3	1.7		4.0	1.0
3rd	-	5.0	5.0	4.0	3.5	1.0
4th	-	5.0	5.0	4.0	4.0	
5th		4.0	5.0	4.0	4.0	
Mean	-	3.8	3.7	4.0	3.9	1.0
			Seed Head Phenology			
Study Mean		Boot Hd. emerge. Flower.	Seed develop.	Seed mature.	Seed mature.	Mature hd.

Sideoats grama var. 'Pierre'

Bouteloua curtipendula (Michx.) Torr.

Sideoats grama is a perennial, warm-season, mid grass native to the Northern Plains. Its growth habit is a somewhat loose bunch 3.9 to 11.8 in. (10-30 cm) wide. It sometimes produces short, scaly rhizomes and is considered to have low invasiveness. Vegetative tillers form long shoots with evenly distributed erect and arching leaves. Young leaves are erect and older leaves are arching. The flat leaf blades are 2.0 to 5.9 in. (5-15 cm) long and 0.08 to 0.16 in. (2-4 mm) wide. The margins of the leaves roll inward when dry. Seed head elevation includes 2 or 3 stem nodes with small leaves. The inflorescence is a panicle with 25 to 50 oat-like spikes separately attached to the stem of one internode with all the spikes twisted to one side of the slender axis. The erect reproductive tillers are 7.9 to 19.7 in. (20-50 cm) tall and are sometimes solitary but usually form loose groups.

The 'Pierre' variety was developed from native plant seed harvested in 1954 in Stanley County, South Dakota and was an informal release in 1961 by USDA, SCS Plant Materials Center, and South Dakota Agricultural Experiment Station. The plant material for this study was provided by USDA, NRCS Plant Materials Center, Bismarck, North Dakota.

Evaluation ratings for Sideoats grama var. 'Pierre' are on tables 12 and 13. Establishment of sideoats grama under xeriscape conditions required three growing seasons. During the first growing season, the plant material on all three replications appeared to be progressing fine until late summer and fall when the vigor decreased. The plant vigor remained relatively low during the second year and during the third year until mid summer. During the three establishment growing seasons, mean tiller vigor rating was 2.8, mean ornamental value rating was 2.6, and mean seed head aesthetics rating was 3.2. Because sideoats grama is a warm-season grass, the carryover tillers and new vegetative tillers had relatively low vigor during mid May. The vigor of the plant material improved during the fourth and fifth growing seasons. Mean tiller vigor rating was 3.4, mean ornamental value rating was 3.6, and mean seed head aesthetics rating was 3.8 during the latter two growing seasons. The leaf color was an attractive green and the leaves developed a nice red tint during late summer and fall. The sideoats grama plant material developed into extremely attractive medium sized loose bunches with arching basal leaves, and with a few medium height stems that had attractive unique seed heads. Overall, mean tiller vigor rating was 3.1, mean ornamental value rating was 3.0, and mean seed head aesthetics rating was 3.5 during five growing seasons (tables 12 and 13).

Sideoats grama can be managed as ornamental medium sized loose bunches. Management of sideoats grama as ornamental bunches requires trimming the previous years senescent leaves and seed heads into hemispherical shapes the size of softballs to basketballs during early spring around the last two weeks of April. Do not trim these bunches during the growing season. They will remain attractive until covered by snow. If rhizome tillers have developed outside of the desired diameter of the decorative bunch, use a large knife and cut into the soil at the desired bunch size, removing the rhizome tillers to be transplanted at a new location or to be discarded.

Table 12. Evaluation ratings for Sideoats grama var. ‘Pierre’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			3.7		3.3	1.0
2nd	1.0	2.0	2.3		2.7	2.3
3rd	2.7	2.0	2.7	3.5	3.0	
4th	2.5	3.0	3.0	3.0	3.0	
5th		4.0	4.0	3.5	3.5	
Mean	2.1	2.8	3.1	3.3	3.1	1.7
			Leaf Color			
1st			Green		Green	Tan & Lt. Red
2nd		Green	Green		Lt. Green & Red	Very Lt. Red
3rd		Green	Green	Lt. Green	Lt. Green & Tan	Tan
4th	Green	Green	Green	Green	Lt. Green & Red	
5th		Green	Lt. Green	Lt. Green	Lt. Green & Tan	
Summary	Green	Green	Lt. Green to Green	Lt. Green to Green	Lt. Green & Red to Lt. Green & Tan	Lt. Red to Tan & Lt. Red

Table 13. Evaluation ratings for Sideoats grama var. ‘Pierre’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			3.7		3.0	1.3
2nd	1.0	0.7	1.7		3.3	1.7
3rd		2.0	2.8	2.5	3.3	
4th	2.0	3.5	3.5	3.0	4.0	
5th		4.0	4.0	3.5	3.5	
Mean	1.5	2.6	3.1	3.0	3.4	1.5
			Seed Head Aesthetics			
1st			4.0		3.0	1.3
2nd	-	-	0.7		4.0	0.7
3rd	-	-	3.8	4.0	3.0	1.0
4th	-	-	4.0	4.0	4.0	
5th		-	4.0	2.5	4.0	
Mean	-	-	3.3	3.5	3.6	1.0
			Seed Head Phenology			
Study Mean			Boot Hd. emerge.	Hd. emerge. Flower. Seed develop.	Seed mature.	Mature hd.

Little bluestem ecotype ‘Badlands’

Schizachyrium scoparium (Michx.) Nash.
Andropogon scoparius Michx.

Little bluestem is a perennial, warm-season, mid grass native to the Northern Plains. Its growth habit is a dense bunch 7.9 to 11.8 in. (20-30 cm) wide. It sometimes produces short rhizomes and is considered to have low invasiveness. Vegetative tillers form long shoots with erect and arching leaves. The flat leaf blades are 7.9 to 23.6 in. (20-60 cm) long and 0.1 to 0.2 in. (3-6 mm) wide. Seed head elevation includes 6 or more stem nodes with small leaves. The inflorescence is a spike with several curved racemes 1.2 to 2.4 in. (3-6 cm) long attached to each of the elevated stem nodes. The spreading white hairs of the racemes become conspicuous as they dry. The fine erect reproductive tillers are 11.8 to 31.5 in. (30-80 cm) tall and remain attractive through the winter into early spring.

The ‘Badlands’ ecotype was developed as a composite from vegetative plant material collected from 68 sites in southwestern North Dakota and western and central South Dakota and released in 1996 by USDA, NRCS Plant Materials Center, USDA Agricultural Research Service, North Dakota Agricultural Experiment Station, and South Dakota Agricultural Experiment Station. The plant material for this study was provided by USDA, NRCS Plant Materials Center, Bismarck, North Dakota.

Evaluation ratings for Little bluestem ecotype ‘Badlands’ are on tables 14 and 15. Establishment of little bluestem under xeriscape conditions required three growing seasons. During the first growing season, the plant material on all three replications appeared to be progressing well. However, the plant vigor during the second and third growing seasons did not improve much above moderate ratings. During the three establishment growing seasons, mean tiller vigor rating was 3.3, mean ornamental value rating was 3.0, and mean seed head aesthetics rating was 3.5. Because little bluestem is a warm-season grass, the carryover tillers and new vegetative tillers had relatively low vigor during mid May. The vigor of the plant material improved during the fourth and fifth growing seasons. Mean tiller vigor rating was 3.8, mean ornamental value rating was 3.9, and mean seed head aesthetics rating was 4.4 during the latter two growing seasons. The leaf color was an attractive green and the leaves developed a desirable purple tint during mid summer and fall. The little bluestem plant material developed into extremely attractive medium sized bunches with long arching purple basal leaves and fine erect fuzzy seed heads. Overall, mean tiller vigor rating was 3.5, mean ornamental value rating was 3.4, and mean seed head aesthetics rating was 4.0 during five growing seasons (tables 14 and 15).

Little bluestem can be managed as ornamental medium sized dense bunches. Management of little bluestem as ornamental bunches requires trimming the previous years senescent leaves and seed heads into hemispherical shapes the size of basketballs during early spring around the last two weeks of April. Do not trim bunches during the growing season. The bunches remain attractive during winter into spring until they are trimmed for the next season.

Table 14. Evaluation ratings for Little bluestem ecotype ‘Badlands’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			4.0		4.5	3.0
2nd	1.0	3.7	3.3		3.3	3.0
3rd	2.7	1.7	2.7	3.5	3.0	
4th	2.5	3.0	4.0	3.7	4.0	
5th		3.5	4.0	4.0	4.0	
Mean	2.1	3.0	3.6	3.7	3.8	3.0
			Leaf Color			
1st			Green		Lt. Green & Purple	Lt. Green & Purple
2nd		Lt. Green	Green		Lt. Green & Purple	Lt. Red
3rd		Green	Green	Bluegreen	Lt. Green & Purple	Lt. Red
4th	Green	Green	Green	Green & Purple	Purple & Lt. Green	
5th		Green	Green	Green & Purple	Purple & Lt. Green	
Summary	Green	Lt. Green to Green	Green	Bluegreen to Green & Purple	Lt. Green & Purple	Lt. Green & Purple to Lt. Red

Table 15. Evaluation ratings for Little bluestem ecotype ‘Badlands’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			2.5		3.5	3.0
2nd	1.0	2.7	2.7		4.0	3.7
3rd		1.7	2.7	3.5	3.3	2.5
4th	2.0	3.0	4.0	4.3	4.0	
5th		3.5	4.0	4.0	4.0	
Mean	1.5	2.7	3.2	3.9	3.8	3.1
			Seed Head Aesthetics			
1st			3.5		3.5	2.5
2nd	-	-	-		4.0	4.0
3rd	-	-	-	3.5	3.0	2.5
4th	-	-	4.0	4.3	4.3	
5th		-	4.0	5.0	4.5	
Mean	-	-	3.8	4.3	3.9	3.0
			Seed Head Phenology			
Study Mean			Boot Hd. emerge. Flower	Seed develop.	Seed mature.	Mature hd.

Canada wildrye var. ‘Mandan’

Elymus canadensis L.

Canada wildrye is a fast-growing but short-lived, perennial, cool-season, mid grass native to the Northern Plains. Its growth habit is loose bunches connected with short rhizomes about 1.5 in. (4 cm) long and has the potential to be somewhat invasive. Barriers would be required to completely confine this grass to small spaces. Vegetative tillers form long shoots with evenly distributed erect and arching leaves. The leaf blades are 3.9 to 7.9 in. (10-20 cm) long and 0.4 to 0.8 in. (1-2 cm) wide. The leaves roll inward when dry. Seed head elevation includes a few stem nodes with leaves. The inflorescence is a nodding or drooping spike 3.9 to 7.9 in. (10-20 cm) long and 0.4 to 1.2 in. (1-3 cm) thick with numerous spikelets attached to one internode forming a thick, bristly head. The coarse reproductive tillers are 2.0 to 3.3 ft. (60-100 cm) tall.

The ‘Mandan’ cultivar was developed from North Dakota plant material and released in 1946 by USDA Agricultural Research Service, and USDA, SCS Plant Materials Center. The plant material for this study was provided by USDA, NRCS Plant Materials Center, Bismarck, North Dakota.

Evaluation ratings for Canada wildrye var. ‘Mandan’ are on tables 16 and 17. Establishment of Canada wildrye under xeriscape conditions required three growing seasons. During the first growing season, the plant material on all three replications appeared to be progressing well until late summer and fall when the vigor decreased. The plant vigor remained relatively low during the second and third years. During the three establishment growing seasons, mean tiller vigor rating was 2.9, mean ornamental value rating was 2.8, and mean seed head aesthetics rating was 3.7. The vigor of the plant material improved during the fourth and fifth growing seasons, however, shading from adjacent taller grass cultivars prevented improvement of vigor beyond moderate levels. Mean tiller vigor rating was 3.3, mean ornamental value rating was 3.3, and mean seed head aesthetics rating was 3.9 during the latter two growing seasons. The leaf color was green to bluegreen. The Canada wildrye plant material developed into moderate loose clumps of medium height tillers with arching leaves along the stems, and with extremely attractive nodding bristly seed heads. Overall, mean tiller vigor rating was 3.1, mean ornamental value rating was 2.9, and mean seed head aesthetics rating was 3.6 during five growing seasons (tables 16 and 17).

Canada wildrye can be managed as ornamental loose clumps. Management of Canada wildrye as loose clumps requires trimming the previous years senescent stems to a couple of inches in height during the early spring around mid April. Do not trim the current years stems during the growing season. They will remain attractive until snow cover knocks them down. Canada wildrye grows fast, has a short life span, is sensitive to shading, and is difficult to maintain at high vigor. Gardeners who like challenges, will enjoy solving the complex problems related to growing Canada wildrye.

Table 16. Evaluation ratings for Canada wildrye var. ‘Mandan’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			4.0		3.0	2.5
2nd	2.0	3.7	3.7		2.7	2.3
3rd	3.0	2.0	2.6	2.3	2.0	
4th	2.0	2.5	3.7	3.7	2.7	
5th		4.0	3.3	3.0	3.3	
Mean	2.3	3.1	3.5	3.0	2.7	2.4
			Leaf Color			
1st			Lt. Green		Green	Lt. Green & Tan
2nd		Green	Bluegreen		Lt. Green & Tan	Tan
3rd		Bluegreen	Bluegreen	Green	Lt. Green & Tan	Tan
4th	Lt. Green	Green	Bluegreen	Green	Green	
5th		Green	Green	Green	Green	
Summary	Lt. Green	Green to Bluegreen	Green to Bluegreen	Green	Green to Lt. Green & Tan	Lt. Green & Tan to Tan

Table 17. Evaluation ratings for Canada wildrye var. ‘Mandan’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			3.5		3.0	2.0
2nd	4.0	3.3	3.7		2.7	3.0
3rd		2.0	2.8	2.3	2.2	2.0
4th	2.0	2.0	3.7	4.0	3.3	
5th		4.0	3.3	3.0	3.3	
Mean	3.0	2.8	2.7	3.1	2.9	2.3
			Seed Head Aesthetics			
1st			4.0		4.0	2.0
2nd	-	-	4.7		2.7	2.7
3rd	-	-	4.5	3.0	3.0	2.5
4th	-	-	4.3	4.7	3.7	
5th		3.0	4.7	3.0	4.0	
Mean	-	3.0	4.4	3.6	3.5	2.4
			Seed Head Phenology			
Study Mean		Boot Hd. emerge. Flower.	Hd. emerge. Flower. Seed develop.	Seed develop.	Seed mature.	Mature hd.

Altai wildrye

Leymus angustus (Trin.) Pilg.
Elymus angustus Trin.

Altai wildrye is a perennial, cool-season, adapted, mid to tall grass introduced into the Northern Plains from the Altai mountains of Asia through Swift Current, Saskatchewan, Canada. Its growth habit is a large dense spiky bunch that produces rhizomes that are long enough to reach beyond the edge of the bunch. It is considered to have low invasiveness. Vegetative tillers form long shoots that have short internode elongations with basally concentrated coarse, erect leaves that retain leaf stature even under heavy wet snowfall. The leaf blades are 5.9 to 7.9 in. (15-20 cm) long and 0.2 to 0.3 in. (5-7 mm) wide. The stiff leaves roll inward when dry. Seed head elevation includes one or two stem nodes with small leaves. The inflorescence is a long narrow spike 3.9 to 9.8 in. (10-25 cm) long and 0.3 to 0.4 in. (7-10 mm) wide. The erect reproductive tillers are 2.0 to 3.9 ft. (60-120 cm) tall.

Altai wildrye seed from wild plants was collected in Asia and planted in increase fields at Ag. Canada, Swift Current, Saskatchewan. Increase field seed was harvested and planted as a monoculture on 60 acres at the Dickinson Research Extension Center ranch for use as two fall pastures. Young plant plugs from the fall pastures were transplanted to the replicated plots of this study.

Evaluations ratings for Altai wildrye are on tables 18 and 19. Establishment of Altai wildrye under xeriscape conditions required one growing season. During the first growing season, the plant material on all three replications appeared to be progressing slowly; mean tiller vigor rating was 2.7, and mean ornamental value rating was 2.5. No seed heads were produced during the first growing season. The plant material improved in vigor during the second growing season and remained high during the third, fourth, and fifth growing seasons. Mean tiller vigor rating was 4.7, mean ornamental value rating was 4.5, and mean seed head aesthetics rating was 4.2 during the latter four growing seasons. The size of the plant bunches increased during the fourth and fifth growing seasons. Leaf color was a nice blue to bluegreen that faded to tan during fall. The Altai wildrye plant material developed into impressive large spiky blue tufts with stiff erect leaves and with long narrow seed heads on top of tall stalks. Overall, mean tiller vigor rating was 4.5, mean ornamental value rating was 4.3, and mean seed head aesthetics rating was 4.2 during five growing seasons (tables 18 and 19).

Altai wildrye can be managed as ornamental large spiky blue tufts. Management of Altai wildrye as spiky tufts requires trimming the previous years senescent leaves and seed heads. Early spring is the only period that the old and new leaves are flexible. Altai wildrye has carryover tillers, fall tillers, and new tillers that commence active growth very early in April. The previous years senescent leaves are intermingled with the growing leaves. Trimming the senescent leaves requires patience and dexterity. Do not trim Altai wildrye tufts during late season when leaves are stiff. The tufts will remain attractive during winter and into the spring.

Table 18. Evaluation ratings for Altai wildrye in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			2.3		3.0	3.0
2nd	4.0	4.3	4.7		4.7	4.3
3rd	4.7	5.0	4.5	4.3	3.8	3.0
4th	4.3	4.7	5.0	5.0	5.0	
5th		4.7	5.0	4.7	5.0	
Mean	4.3	4.7	4.3	4.7	4.3	3.4
			Leaf Color			
1st			Bluegreen		Lt. Blue	Lt. Bluegreen
2nd		Bluegreen	Bluegreen		Bluegreen	Lt. Green & Tan
3rd		Bluegreen	Bluegreen	Blue	Lt. Bluegreen & Tan	Lt. Green & Tan
4th	Blue	Bluegreen	Bluegreen	Bluegreen	Blue	
5th		Blue	Blue	Bluegreen	Blue	
Summary	Blue	Blue to Bluegreen	Blue to Bluegreen	Blue to Bluegreen	Blue, Bluegreen & Tan	Bluegreen to Lt. Green & Tan

Table 19. Evaluation ratings for Altai wildrye in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			2.3		2.7	2.7
2nd	2.7	4.3	4.3		3.3	4.0
3rd	3.7	5.0	4.3	3.7	3.5	2.3
4th	4.7	5.0	5.0	5.0	5.0	
5th		4.3	5.0	4.7	5.0	
Mean	3.7	4.7	4.2	4.5	3.9	3.0
			Seed Head Aesthetics			
1st			-		-	-
2nd	-	4.3	4.7		3.0	3.3
3rd	-	5.0	4.8	3.3	3.3	3.0
4th	-	5.0	4.7	3.7	5.0	
5th		4.5	5.0	4.0	3.3	
Mean	-	4.7	4.8	3.7	3.7	3.2
			Seed Head Phenology			
Study Mean	E. develop. Boot	Hd. emerge. Flower. Seed develop.	Seed develop.	Seed mature.	Seed mature.	Mature hd.

Switchgrass var. ‘Dacotah’

Panicum virgatum L.

Switchgrass is a perennial, warm-season, tall grass native to the Northern Plains. Its growth habit is thick clumps that enlarge annually with numerous short, scaly, creeping rhizomes. It is considered to have intermediate invasiveness. Barriers are required to confine this grass to small spaces. Vegetative tillers form long shoots with evenly distributed arching leaves. The flat leaf blades are 3.9 to 23.6 in. (10-60 cm) long and 0.1 to 0.6 in. (3-15 mm) wide. Seed head elevation includes a few stem nodes with arching leaves. The inflorescence is an open panicle 3.9 to 11.8 in. (10-30 cm) long and nearly as wide with numerous spreading branches attached to one internode. The erect reproductive tillers are 1.6 to 4.9 ft. (50-150 cm) tall.

The ‘Dacotah’ cultivar was developed from North Dakota plant material and released in 1989 by USDA, NRCS Plant Materials Center. The plant material for this study was provided by USDA, NRCS Plant Materials Center, Bismarck, North Dakota.

Evaluation ratings for Switchgrass var. ‘Dacotah’ are on tables 20 and 21. Establishment of switchgrass under xeriscape conditions required one growing season. During the first growing season, the plant material on all three replications progressed well; mean tiller vigor rating was 4.0, mean ornamental value rating was 3.4, and mean seed head aesthetics rating was 3.4. Because switchgrass is a warm-season grass, the carryover tillers and new vegetative tillers had relatively low vigor during mid May. The vigor of the plant material improved during the second and third growing seasons and was very high during the fourth and fifth growing seasons. Mean tiller vigor rating was 4.5, mean ornamental value rating was 4.5, and mean seed head aesthetics rating was 4.7 during the latter four growing seasons. The size of the plant clumps greatly increased during the fourth and fifth growing seasons. Leaf color was nice and ranged from dark green to light green and turned yellow in late summer and fall. The switchgrass plant material developed into extremely attractive large clumps of tall tillers with arching leaves along the stems, and with large open panicle seed heads on top. Overall, mean tiller vigor rating was 4.5, mean ornamental value rating was 4.4, and mean seed head aesthetics rating was 4.5 during five growing seasons (tables 20 and 21).

Switchgrass can be managed as ornamental large clumps in landscapes that large spaces are available or as attractive clumps in areas that the size is determined by barriers. Management of switchgrass clumps requires trimming the previous years senescent stems to a height of a couple of inches during early spring around the last two weeks of April. Do not trim the tillers during the growing season. The clumps will remain attractive during fall into the winter. Some of the tillers will remain upright all winter.

Table 20. Evaluation ratings for Switchgrass var. 'Dacotah' in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			3.7		4.3	2.0
2nd	2.0	4.3	4.7		3.7	3.0
3rd	3.3	3.3	3.8	4.7	4.3	
4th	2.3	5.0	5.0	4.7	4.7	
5th		4.7	5.0	5.0	5.0	
Mean	2.5	4.3	4.4	4.8	4.4	2.5
			Leaf Color			
1st			Dk. Green		Lt. Green	Lt. Red & Tan
2nd		Dk. Green	Green		Yellowgreen	Very Lt. Red
3rd		Yellowgreen	Green	Green	Yellowgreen & Tan	Tan & Lt. Red
4th	Green	Green	Green	Lt. Green	Yellow	
5th		Green	Lt. Green	Green & Yellow	Yellow	
Summary	Green	Dk. Green to Yellowgreen	Dk. Green to Lt. Green	Lt. Green to Green & Yellow	Lt. Green, Yellow, Yellowgreen & Tan	Lt. Rd to Lt. Red & Tan

Table 21. Evaluation ratings for Switchgrass var. ‘Dacotah’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			3.0		3.7	2.3
2nd	1.0	3.7	4.7		3.3	3.3
3rd		3.7	4.0	4.7	4.5	3.0
4th	2.0	4.3	5.0	4.7	4.7	
5th		4.7	5.0	5.0	5.0	
Mean	1.5	4.1	4.3	4.8	4.2	2.9
			Seed Head Aesthetics			
1st			4.0		2.7	3.5
2nd	-	-	4.7		3.7	4.0
3rd	-	-	4.3	5.0	3.8	3.7
4th	-	-	5.0	5.0	5.0	
5th		-	5.0	5.0	5.0	
Mean	-	-	4.6	5.0	4.0	3.7
			Seed Head Phenology			
Study Mean			Boot Hd. emerge. Flower.	Seed develop.	Seed mature.	Mature hd.

Indiangrass var. ‘Holt’

Sorghastrum nutans (L.) Nash.

Indiangrass is a perennial, warm-season, deep-rooted, tall grass native to the Northern Plains. Its growth habit is large dense clumps that enlarge annually with short, scaly rhizomes. It is considered to be potentially invasive. Barriers are required to confine this grass to small spaces. Vegetative tillers form long shoots with erect and arching leaves. The leaf blades are 11.8 to 23.6 in. (30-60 cm) long and 0.2 to 0.4 in. (5-10 mm) wide. Seed head elevation includes several stem nodes with leaves. The inflorescence is a panicle 3.9 to 11.8 in. (10-30 cm) long with numerous loosely contracted dense branches attached to one internode. These coppery colored plumes are very decorative (Stevens 1963). The erect reproductive tillers are 3.3 to 6.6 ft. (1-2 m) tall.

The ‘Holt’ cultivar was developed from plant material collected in Holt County, Nebraska, and released in 1960 by Nebraska Agricultural Experiment Station. The plant material for this study was provided by USDA, NRCS Plant Materials Center, Bismarck, North Dakota.

Evaluation ratings for Indiangrass var. ‘Holt’ are on tables 22 and 23. Establishment of Indiangrass under xeriscape conditions required three growing seasons. The plant material on all three replications progressed to moderate vigor during the first growing season and remained at that level during the second and third growing seasons. During the three establishment growing seasons, mean tiller vigor rating was 3.6, mean ornamental value rating was 3.2, and mean seed head aesthetics rating was 3.0. Because Indiangrass is a warm-season grass, the carryover tillers and new vegetative tillers had relatively low vigor during mid May. The vigor of the plant material improved during the fourth and fifth growing seasons. Mean tiller vigor rating was 4.2, mean ornamental value rating was 4.5, and mean seed head aesthetics rating was 4.9 during the latter two growing seasons. The size of the plant clumps increased during the fourth and fifth growing seasons. The leaf color was a nice green during the growing season that turned yellowgreen during the late summer and fall. The Indiangrass plant material developed into extremely attractive large clumps of tall tillers with arching leaves along the stems and at the base, and with large dense golden decorative seed heads on top. Overall, mean tiller vigor rating was 3.9, mean ornamental value rating was 3.8, and mean seed head aesthetics rating was 4.1 during five growing seasons (tables 22 and 23).

Indiangrass can be managed as ornamental large clumps in landscapes that large spaces are available or as attractive clumps in areas that the size is determined by barriers. Management of Indiangrass clumps requires trimming the previous years senescent stems to a height of a couple of inches during early spring around the last two weeks of April. Do not trim the tillers during the growing season. The clumps will remain attractive during fall into the winter. Some of the tillers will remain upright all winter.

Table 22. Evaluation ratings for Indiangrass var. 'Holt' in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			3.5		4.5	1.5
2nd	2.0	3.3	4.0		4.3	2.7
3rd	2.7	3.0	3.2	3.3	3.3	
4th	2.3	4.0	4.0	4.3	4.0	
5th		4.0	4.0	4.3	4.7	
Mean	2.3	3.6	3.7	4.0	4.2	2.1
			Leaf Color			
1st			Green		Green & Purple	Lt. Red
2nd		Lt. Green	Green		Lt. Green & Yellow	Lt. Red
3rd		Lt. Green	Green	Green	Lt. Green Yellow & Tan	Tan & Lt. Red
4th	Green	Green	Lt. Green	Lt. Green	Yellowgreen	
5th		Green	Green	Green	Yellowgreen	
Summary	Green	Green to Lt. Green	Green to Lt. Green	Green to Lt. Green	Green, Yellowgreen, Purple & Tan	Lt. Red to Lt. Red & Tan

Table 23. Evaluation ratings for Indiangrass var. 'Holt' in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			2.5		3.0	2.0
2nd	1.0	2.7	3.3		4.3	3.3
3rd		3.0	3.4	3.3	3.4	3.0
4th	2.7	4.0	4.3	4.7	4.7	
5th		4.0	4.3	4.7	5.0	
Mean	1.9	3.4	3.6	4.2	4.1	2.8
			Seed Head Aesthetics			
1st			-		1.0	1.0
2nd	-	-	-		3.7	3.0
3rd	-	-	-	3.5	3.8	2.3
4th	-	-	-	4.7	5.0	
5th		-	-	5.0	5.0	
Mean	-	-	-	4.4	3.7	2.1
			Seed Head Phenology			
Study Mean			E. develop.	Boot Hd. emerge. Flower.	Seed develop. Seed mature.	Mature hd.

Big bluestem var. ‘Bison’

Andropogon gerardi Vitman

Big bluestem is a long-lived perennial, warm-season, tall grass native to the Northern Plains. Its growth habit is large clumps that enlarge annually with short to medium length scaly rhizomes. It is considered to have intermediate invasiveness. Barriers are required to confine this grass to small spaces. Vegetative tillers form short shoots with arching basal leaves. The leaf blades are 11.8 to 31.5 in. (30-80 cm) long and 0.2 to 0.4 in. (5-10 mm) wide and develop a purplish tint when under low water stress. Seed head elevation includes several stem nodes with small leaves. The inflorescence consists of 2 or 3 upper stem nodes, each with a panicle of 3 spikes having a common base that resembles a turkey foot. The erect reproductive tillers are 3.3 to 6.6 ft. (1-2 m) tall.

The ‘Bison’ cultivar was developed from North Dakota plant material and released in 1989 by USDA, NRCS Plant Materials Center. The plant material for this study was provided by USDA, NRCS Plant Materials Center, Bismarck, North Dakota.

Evaluation ratings for Big bluestem var. ‘Bison’ are on tables 24 and 25. Establishment of big bluestem under xeriscape conditions required one growing season. During the first growing season, the plant material on all three replications progressed well; mean tiller vigor rating was 3.9, mean ornamental value rating was 3.5, and mean seed head aesthetics rating was 4.0. Because big bluestem is a warm-season grass, the carryover tillers and new vegetative tillers had relatively low vigor during mid May, except during the third year. The vigor of the plant material improved during the second and third growing seasons and remained high during the fourth and fifth growing seasons. Mean tiller vigor rating was 4.5, mean ornamental value rating was 4.6, and mean seed head aesthetics rating was 4.4 during the latter four growing seasons. The size of the plant clumps greatly enlarged during the fourth and fifth growing seasons. The leaf color was a nice green during spring and developed a purple tint during summer that became a darker purple during late season and turned red during fall. The big bluestem plant material developed into extremely attractive large clumps of tall tillers with arching leaves along the stems and at the base, and with unique seed heads of three spikes attached to each of the elevated stem nodes. Overall, mean tiller vigor rating was 4.4, mean ornamental value rating was 4.5, and mean seed head aesthetics rating was 4.4 during five growing seasons (tables 24 and 25).

Big bluestem can be managed as ornamental large clumps in landscapes that large spaces are available or as attractive clumps in areas that the size is determined by barriers. Management of big bluestem clumps requires trimming the previous years senescent stems to a height of a couple of inches during early spring around the last two weeks of April. Do not trim the tillers during the growing season. The clumps will remain attractive during fall into the winter. Some of the tillers will remain upright all winter.

Table 24. Evaluation ratings for Big bluestem var. ‘Bison’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			3.7		4.0	2.0
2nd	2.0	4.3	4.7		3.3	3.3
3rd	4.0	4.3	4.0	4.0	4.2	
4th	3.0	5.0	5.0	4.3	4.7	
5th		4.7	5.0	5.0	5.0	
Mean	3.0	4.6	4.5	4.4	4.2	2.7
			Leaf Color			
1st			Green & Purple		Green & Purple	Lt. Red & Tan
2nd		Green & Purple	Green & Purple		Lt. Green, Orange, Purple & Tan	Lt. Red
3rd		Green	Green & Purple	Green & Red	Lt. Green, Lt. Red, Purple & Tan	Tan & Lt. Red
4th	Green	Green	Green	Green & Red	Red & Lt. Green	
5th		Lt. Green	Green	Green & Red	Red, Orange & Lt. Green	
Summary	Green	Green to Green & Purple	Green to Green & Purple	Green & Red	Green, Red, Orange, Purple & Tan	Lt. Red & Tan

Table 25. Evaluation ratings for Big bluestem var. ‘Bison’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			3.0		4.0	3.0
2nd	1.0	4.0	4.0		3.7	4.0
3rd		4.7	4.3	4.7	4.4	3.3
4th	3.0	4.7	5.0	5.0	5.0	
5th		4.7	5.0	5.0	5.0	
Mean	2.0	4.5	4.3	4.9	4.4	3.4
			Seed Head Aesthetics			
1st			4.0		4.0	2.7
2nd	-	-	3.7		2.7	3.7
3rd	-	-	4.5	4.7	3.8	3.5
4th	-	-	5.0	5.0	4.7	
5th		-	5.0	5.0	4.7	
Mean	-	-	4.4	4.9	4.0	3.3
			Seed Head Phenology			
Study Mean			Boot Hd. emerge. Flower.	Seed develop.	Seed mature.	Mature hd.

Sand bluestem var. ‘Garden’

Andropogon hallii Hack.

Sand bluestem is a perennial, warm-season, tall grass native to the Northern Plains. Its growth habit is sod forming with small clusters of stems connected to other small clusters of stems by medium to long rhizomes. Barriers are required to confine this grass to small spaces. Vegetative tillers form short shoots with arching basal leaves. The hairy blueish leaf blades are 1.2 to 15.7 in. (3-40 cm) long and 0.08 to 0.4 in. (2-10 mm) wide. Seed head elevation includes several stem nodes with small leaves. The inflorescence consists of 2 or 3 upper stem nodes, each with a panicle of 3 hairy spikes having a common base. The erect reproductive tillers are 2.0 to 4.9 ft. (60-150 cm) tall.

The ‘Garden’ cultivar was developed from plant material collected in Garden County, Nebraska, and released in 1960 by Nebraska Agricultural Experiment Station. The plant material for this study was provided by USDA, NRCS Plant Materials Center, Bismarck, North Dakota.

Evaluation ratings for Sand bluestem var. ‘Garden’ are on tables 26 and 27. Establishment of sand bluestem under xeriscape conditions required one growing season. During the first growing season, the plant material on all three replications progressed well; mean tiller vigor rating was 3.0, mean ornamental value rating was 2.5, and mean seed head aesthetics rating was 3.3. Because sand bluestem is a warm-season grass, the carryover tillers and new vegetative tillers had relatively low vigor during mid May. The vigor of the plant material improved during the second and third growing seasons and remained high during the fourth and fifth growing seasons. Mean tiller vigor rating was 4.3, mean ornamental value rating was 4.2, and mean seed head aesthetics rating was 4.6 during the latter four growing seasons. The size of the plant clumps greatly enlarged during the fourth and fifth growing seasons. The leaves are hairy and the leaf color was a nice bluegreen during early summer and developed yellow and red coloration during late summer and fall. The sand bluestem plant material developed into extremely attractive large clumps consisting of several stem clusters of tall tillers with arching leaves along the stems and at the base, and with unique hairy seed heads of three spikes attached to each of the elevated stem nodes. Overall, mean tiller vigor rating was 4.2, mean ornamental value rating was 4.3, and mean seed head aesthetics rating was 4.6 during five growing seasons (tables 26 and 27).

Sand bluestem can be managed as ornamental clumps of stem clusters in landscapes that large spaces are available or as attractive clumps of stem clusters in areas that the size is determined by barriers. Management of sand bluestem stem clusters requires trimming the previous years senescent stems to a height of a couple of inches during early spring around the last two weeks of April. Do not trim the tillers during the growing season. The stem clusters will remain attractive during fall into the winter. Some of the tillers will remain upright all winter.

Table 26. Evaluation ratings for Sand bluestem var. ‘Garden’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			2.7		3.3	1.7
2nd	1.0	3.3	3.7		4.0	2.7
3rd	2.7	3.3	3.7	4.7	3.7	
4th	2.3	4.3	5.0	5.0	5.0	
5th		4.0	5.0	4.7	5.0	
Mean	2.0	3.7	4.0	4.8	4.2	2.2
			Leaf Color			
1st			Lt. Bluegreen		Bluegreen	Tan & Lt. Red
2nd		Lt. Green	Lt. Green		Bluegreen, Red & Tan	Very Lt. Red
3rd		Bluegreen	Lt. Green	Bluegreen	Bluegreen, Red & Tan	Tan & Lt. Red
4th	Green	Green	Bluegreen	Bluegreen	Yellow Bluegreen	
5th		Green	Bluegreen	Bluegreen	Yellow Bluegreen	
Summary	Green	Green to Bluegreen	Lt. Green to Bluegreen	Bluegreen	Bluegreen, Yellow, Red & Tan	Lt. Red & Tan

Table 27. Evaluation ratings for Sand bluestem var. ‘Garden’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			1.7		3.3	2.3
2nd	1.0	2.7	3.3		3.7	3.7
3rd		3.3	3.8	4.7	3.7	3.7
4th	1.3	4.3	5.0	5.0	5.0	
5th		4.0	5.0	5.0	5.0	
Mean	1.2	3.6	3.8	4.9	4.9	3.2
			Seed Head Aesthetics			
1st			-		3.3	2.7
2nd	-	-	-		3.7	4.0
3rd	-	-	-	5.0	4.0	3.3
4th	-	-	4.0	5.0	5.0	
5th		-	5.0	5.0	5.0	
Mean	-	-	4.5	5.0	4.2	3.3
			Seed Head Phenology			
Study Mean			Boot Hd. emerge. Flower.	Flower. Seed develop.	Seed mature.	Mature hd.

Prairie sandreed

Calamovilfa longifolia (Hook.) Scribn.

Prairie sandreed is a perennial, warm-season, tall grass native to the Northern Plains. Its growth habit is large, loose colonies connected by long, horizontal, terminal rhizomes covered with shiny leathery scales. Barriers are required to confine this grass in residential landscapes. Vegetative tillers form long shoots with erect and arching leaves. The leaf blades are 11.8 to 23.6 in. (30-60 cm) long and 0.2 to 0.3 in. (4-8 mm) wide. Seed head elevation includes a few stem nodes with small leaves. The inflorescence is a panicle of one internode with numerous upward slanting branches 3.9 to 11.8 in. (10-30 cm) long and 0.7 to 4.0 in. (2-10 cm) wide. The erect reproductive tillers are 3.3 to 6.6 ft. (1-2 m) tall.

The 'Goshen' cultivar was developed from plant material collected in east central Wyoming and was released in 1976 by Wyoming Agricultural Experiment Station. The plant material for this study was provided by USDA, NRCS Plant Materials Center, Bismarck, North Dakota.

Evaluation ratings for Prairie sandreed are on tables 28 and 29. All three replications of the 'Goshen' cultivar were severely infected with fungus. The 'Goshen' cultivar has been known to have major problems with leaf and stem rusts. The infected plant material in this study was aesthetically unattractive and the disease caused lodging of most of the reproductive stems each year. This susceptibility to fungal diseases by the 'Goshen' cultivar should eliminate this cultivar from use as an ornamental landscape plant. However, not all prairie sandreed cultivars have this disease problem. In order to assess the potential of prairie sandreed as an ornamental xeriscape plant, the evaluation ratings were made as if the plant material in this study were disease free. Establishment of prairie sandreed under xeriscape conditions required one growing season. During the first growing season, the plant material on all three replications progressed well; mean tiller vigor rating was 3.7, mean ornamental value rating was 3.0, and mean seed head aesthetics rating was 4.0. Because prairie sandreed is a warm-season grass, the carryover tillers and new vegetative tillers had relatively low vigor during mid May, except during the third growing season. The vigor of the plant material improved during the second and third growing seasons and remained high during the fourth and fifth growing seasons. Mean tiller vigor rating was 4.0, mean ornamental value rating was 3.8, and mean seed head aesthetics rating was 4.0 during the latter four growing seasons. The size of the plant colonies increased during the fourth and fifth growing seasons. The leaf color was a nice dark green during spring and early summer and turned yellowgreen during the late summer and fall. The prairie sandreed plant material developed into extremely attractive large colonies of tall tillers with arching leaves along the stems, and with large feathery seed heads on top. Overall, mean tiller vigor rating was 4.0, mean ornamental value rating was 3.8, and mean seed head aesthetics rating was 4.0 during five growing seasons (tables 28 and 29).

Prairie sandreed can be managed as ornamental large colonies in landscape that large spaces are available or as attractive colonies in areas that the size is determined by barriers. Management of prairie sandreed colonies requires trimming the previous years senescent stems to a height of a couple of inches during early spring around the last two weeks of April. Do not trim the tillers during the growing season. The colonies will remain attractive during fall into the winter. Some of the tillers will remain upright all winter.

Table 28. Evaluation ratings for Prairie sandreed in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			3.7		3.7	1.7
2nd	2.0	3.3	4.0		3.7	2.7
3rd	4.0	3.3	3.7	4.3	3.8	
4th	2.3	4.0	4.3	4.0	4.3	
5th		3.7	4.3	4.3	4.7	
Mean	2.8	3.6	4.0	4.2	4.0	2.2
			Leaf Color			
1st			Lt. Green		Green	Lt. Green, Yellowgreen & Tan
2nd		Dk. Green	Dk. Green		Yellowgreen	Tan
3rd		Dk. Green	Dk. Green	Green	Yellowgreen & Tan	Tan
4th	Dk. Green	Green	Green	Yellowgreen	Yellowgreen	
5th		Dk. Green	Bluegreen	Green	Yellowgreen	
Summary	Dk. Green	Dk. Green to Green	Dk Green to Bluegreen	Green to Yellowgreen	Green to Yellowgreen & Tan	Yellowgreen & Tan to Tan

Table 29. Evaluation ratings for Prairie sandreed in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			2.7		3.3	2.0
2nd	1.0	2.3	3.7		4.0	3.0
3rd		3.7	3.7	4.0	3.5	1.5
4th	3.3	4.0	4.3	4.0	3.7	
5th		3.7	4.0	4.3	4.3	
Mean	2.2	3.4	3.7	4.1	3.8	2.2
			Seed Head Aesthetics			
1st			-		4.0	3.0
2nd	-	-	1.0		3.3	3.7
3rd	-	-	-	4.3	3.8	3.0
4th	-	-	4.0	5.0	4.3	
5th		-	4.3	5.0	5.0	
Mean	-	-	3.1	4.8	4.1	3.2
			Seed Head Phenology			
Study Mean			Boot Hd. emerge. Flower.	Flower. Seed develop.	Seed mature.	Mature hd.

Prairie cordgrass ecotype 'Red River'

Spartina pectinata Link

Prairie cordgrass is a perennial, warm-season, tall grass native to the Northern Plains. Its growth habit is extensive loose colonies. The tillers are connected with stout rhizomes covered with purplish brown or light brown overlapping scales. Grown in moist subirrigated soils, it is considered to be invasive, however, when grown in dry upland soils, the invasive spreading is greatly reduced. Barriers are required to confine this grass to small spaces. Vegetative tillers form long shoots with evenly distributed erect and arching leaves. The flat leaf blades are 11.8 to 39.4 in. (30-100 cm) long and 0.2 to 0.6 in. (5-15 mm) wide. The leaves roll inward when dry. The leaf margins are very rough and capable of causing cuts to fingers run down the blade. Seed head elevation includes a few stem nodes with leaves. The inflorescence is a panicle 3.9 to 11.8 in. (10-30 cm) long with 5 to 20 comb-like spikes slanting upward that are 1.6 to 3.1 in. (4-8 cm) long individually attached to one internode. The erect reproductive tillers are 3.3 to 6.6 ft. (1-2 m) tall.

The 'Red River' ecotype was developed from plant material collected from North Dakota, South Dakota, and Minnesota and released in 1998 by USDA, NRCS Plant Materials Center. The plant material for this study was provided by USDA, NRCS Plant Materials Center, Bismarck, North Dakota.

Evaluation ratings for Prairie cordgrass ecotype 'Red River' are on tables 30 and 31. Establishment of prairie cordgrass under xeriscape conditions occurred during the first growing season. The plant material on all three replications progressed exceptionally well; mean tiller vigor rating was 4.2, mean ornamental value rating was 3.7, and mean seed head aesthetics rating was 5.0 during the first year. The vigor of the plant material improved during the second and third growing seasons and remained high during the fourth and fifth growing seasons. Mean tiller vigor rating was 4.6, mean ornamental value rating was 4.7, and mean seed head aesthetics rating was 4.3 during the latter four growing seasons. The size of the plant colonies increased during the fourth and fifth growing seasons. The leaf color was a nice dark green that turned yellowgreen during late summer and fall. The prairie cordgrass plant material developed into extremely attractive large colonies of very tall stiff tillers with arching leaves along the stems, and with long seed heads of numerous large comb-like spikes. Overall, mean tiller vigor rating was 4.6, mean ornamental value rating was 4.6, and mean seed head aesthetics rating was 4.3 during five growing seasons (tables 30 and 31).

Prairie cordgrass can be managed as ornamental large colonies in landscapes that large spaces are available or as attractive colonies in areas that the size is determined by barriers. Management of prairie cordgrass colonies requires trimming the previous years senescent stems to a height of a couple of inches during early spring around the last two weeks of April. Do not trim the tillers during the growing season. The colonies will remain attractive during fall into the winter. Most of the tillers will remain upright all winter.

Table 30. Evaluation ratings for Prairie cordgrass ecotype ‘Red River’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			4.0		4.3	2.3
2nd	3.0	4.7	4.7		4.3	3.7
3rd	4.3	4.3	4.2	4.7	3.8	
4th	3.7	5.0	4.7	5.0	5.0	
5th		4.0	5.0	5.0	5.0	
Mean	3.7	4.5	4.5	4.9	4.5	3.0
			Leaf Color			
1st			Dk. Green		Lt. Green	Lt. Green & Gold Yellow
2nd		Dk. Green	Dk. Green		Yellowgreen	Tan
3rd		Dk. Green	Dk. Green	Dk. Green	Yellowgreen & Tan	Tan
4th	Green	Dk. Green	Dk. Green	Dk. Green	Lt. Green	
5th		Dk. Green	Dk. Green	Dk. Green	Yellowgreen	
Summary	Green	Dk. Green	Dk Green	Dk. Green	Lt. Green, Yellowgreen & Tan	Lt. Green, Gold Yellow, & Tan

Table 31. Evaluation ratings for Prairie cordgrass ecotype ‘Red River’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			3.3		4.0	3.0
2nd	2.7	4.3	4.7		4.3	3.0
3rd	4.0	4.7	4.3	4.7	4.2	2.7
4th	4.0	5.0	4.7	5.0	5.0	
5th		4.0	5.0	5.0	5.0	
Mean	3.6	4.5	4.4	4.9	4.5	2.9
			Seed Head Aesthetics			
1st			-		5.0	3.0
2nd	-	-	3.0		4.0	3.7
3rd	-	-	-	4.7	3.8	3.3
4th	-	-	4.0	5.0	4.3	
5th		-	-	5.0	5.0	
Mean	-	-	3.5	4.9	4.4	3.3
			Seed Head Phenology			
Study Mean			E. develop. Boot Hd. emerge.	Hd. emerge. Flower. Seed develop.	Seed mature.	Mature hd.

Horticultural Grass Cultivars

Blue fescue		*Festuca arvernensis*
Sand lovegrass		*Eragrostis trichodes*
Red switchgrass	‘Rotbraun’	*Panicum virgatum*
Ribbon grass	‘Feesey’	*Phalaris arundinacea*
Feather reed grass	‘Karl Foerster’	*Calamagrostis X acutiflora*
Blue lymegrass		*Leymus arenarius*
Zebra grass	‘Zebrinus’	*Miscanthus sinensis*
Autumn red	‘Purpurascens’	*Miscanthus hybrid*
Giant silver banner grass	‘Robustus’	*Miscanthus sacchariflorus*
Japanese silver grass		*Miscanthus sacchariflorus*

Blue fescue

Festuca arvernensis Auquier, Kerguelen & Markgr.-Dannenb.
Festuca glauca, Festuca cinerea, Festuca ovina
This plant material has been frequently mislabeled.

Blue fescue is a short-lived, perennial, cool-season, short grass native to southern France. Its growth habit is spiky dense small tufts up to 24 in. (61 cm) wide. It is considered not to be invasive. Vegetative tillers form short shoots with stiff basal leaves. Leaf blades are 8 to 12 in. (20-30 cm) long. The inflorescence is a compact panicle 1.0 to 3.5 in. (2.5-9 cm) long. The erect reproductive tillers are 8.7 to 13.8 in. (22-35 cm) tall.

Blue fescue is a horticultural plant developed outside of the Northern Plains. The plant material for this study was provided by the Armstrong Second Nature Greenhouse and Landscape Center, Dickinson, North Dakota.

Evaluation ratings for Blue fescue are on tables 32 and 33. Establishment of blue fescue under xeriscape conditions occurred during the first growing season. The plant material on all three replications progressed exceptionally well; mean tiller vigor rating was 4.5, and mean ornamental value rating was 4.5 during the first year. No seed heads were produced during the first growing season. The vigor of the plant material remained high during the second and third growing seasons; mean tiller vigor rating was 4.3, mean ornamental value rating was 4.2, and mean seed head aesthetics rating was 3.7. The leaf color was a beautiful blue. The vigor of the plant material decreased greatly during the fourth and fifth growing seasons; mean tiller vigor rating was 1.9, mean ornamental value rating was 1.7, and mean seed head aesthetics rating was 2.2. The short life span of two or three years was an undesirable attribute. During the first three years, the blue fescue plant material developed into extremely attractive small spiky blue tufts with stiff erect leaves. Overall, mean tiller vigor rating was 3.1, mean ornamental value rating was 3.0, and mean seed head aesthetics rating was 3.1 during five growing seasons (tables 32 and 33).

Blue fescue can be managed as ornamental small spiky blue tufts. The ornamental impact of spiky blue tufts in residential landscapes is remarkable. Plant material of only a few grasses develop a spiky blue tuft growth habit; Altai wildrye produces a large spiky blue tuft, blue oatgrass produces a medium spiky blue tuft, and blue fescue produces a small spiky blue tuft. Management of healthy blue fescue spiky tufts requires a greater amount of work than most other ornamental grass plant material, but the extra effort will be rewarded. Every 2 or 3 years the blue fescue tufts need to be dug up to remove the dead portions. The living portions can be divided and replanted. Management of blue fescue hemispherical spiky tufts requires trimming the previous years senescent leaves into half ball shapes the size of softballs during early spring around the first two weeks in April. The dry reproductive stems should be trimmed off during mid summer each year.

Table 32. Evaluation ratings for Blue fescue in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			4.7		4.3	4.0
2nd	4.0	5.0	4.0		4.3	4.7
3rd	5.0	5.0	4.2	3.3	4.0	
4th	1.3	2.3	2.0	2.3	2.3	
5th		2.0	1.3	1.0	2.0	
Mean	3.4	3.6	3.2	2.2	3.4	4.4
			Leaf Color			
1st			Dk. Blue		Lt. Blue	Blue
2nd		Lt. Blue	Blue		Blue	Blue
3rd		Blue	Blue	Blue	Lt. Blue & Tan	Tan
4th	Blue	Blue	Blue	Blue	Blue	
5th		Blue	Blue	Blue	Blue	
Summary	Blue	Blue to Lt. Blue	Dk. Blue to Blue	Blue	Blue to Lt. Blue & Tan	Blue to Tan

Table 33. Evaluation ratings for Blue fescue in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			4.7		4.3	4.3
2nd	4.0	4.3	4.0		4.7	4.7
3rd	4.0	5.0	4.3	3.3	4.0	
4th	1.0	1.7	1.3	2.3	2.3	
5th		2.0	1.3	1.0	2.0	
Mean	3.0	3.3	3.1	2.2	3.5	4.5
			Seed Head Aesthetics			
1st			-		-	-
2nd	3.0	4.3	4.3		2.3	2.7
3rd	5.0	5.0	4.3	2.7	2.8	1.5
4th	-	3.0	-	-	-	
5th		2.3	1.3	-	-	
Mean	4.0	3.7	3.3	2.7	2.6	2.1
			Seed Head Phenology			
Study Mean	Boot Hd. emerge. Flower.	Flower. Seed develop.	Seed develop. Seed mature.	Seed mature.	Mature hd.	Mature hd.

Sand lovegrass

Eragrostis trichodes (Nutt.) Alph. Wood

Sand lovegrass is a short-lived, perennial, warm-season, mid grass native to the central and southern plains of North America. Its growth habit is a bunch. It is considered to have low invasiveness. Vegetative tillers form long shoots with evenly distributed arching leaves. The leaf blades are 5.9 to 18.1 in. (15-46 cm) long and 0.06 to 0.3 in. (1.5-8 mm) wide. The margins of the leaves roll inward when dry. The inflorescence is a large open reddish pink to purplish panicle 11.8 to 31.5 in. (30-80 cm) long and 2.4 to 11.8 in. (6-30 cm) wide. The erect reproductive tillers are 11.8 to 47.2 in. (30-120 cm) tall.

Sand lovegrass is a horticultural plant developed outside of the Northern Plains. The plant material for this study was provided by the Horticulture program at NDSU Department of Plant Sciences, Fargo, North Dakota.

Evaluation ratings for Sand lovegrass are on tables 34 and 35. Establishment of sand lovegrass under xeriscape conditions did not occur. Plant material on the first replication died during the first growing season, plant material on the second replication died during the the first winter, and plant material on the third replication died during the second winter. Mean tiller vigor rating was 1.9, mean ornamental value rating was 1.8, and mean seed head aesthetics rating was 3.0 during the first and second growing seasons (tables 34 and 35). Sand lovegrass should not be selected as an ornamental plant under xeriscape conditions.

Table 34. Evaluation ratings for Sand lovegrass in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			3.0		4.5	3.5
2nd	0.0	0.3	0.7		1.0	0.3
3rd	-	-	-	-	-	-
4th	-	-	-	-	-	-
5th	-	-	-	-	-	-
Mean	-	-	-	-	-	-
			Leaf Color			
1st			Dk. Green		Lt. Green	Green with red tips
2nd		Yellowgreen	Green		Green	Tan
3rd	-	-	-	-	-	-
4th	-	-	-	-	-	-
5th	-	-	-	-	-	-
Summary	-	-	-	-	-	-

Table 35. Evaluation ratings for Sand lovegrass in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			3.0		4.5	4.0
2nd	0.0	0.0	0.7		0.7	0.3
3rd	-	-	-	-	-	-
4th	-	-	-	-	-	-
5th	-	-	-	-	-	-
Mean	-	-	-	-	-	-
			Seed Head Aesthetics			
1st			-		4.0	4.5
2nd	-	-	-		2.0	0.3
3rd	-	-	-	-	-	-
4th	-	-	-	-	-	-
5th	-	-	-	-	-	-
Mean	-	-	-	-	-	-
			Seed Head Phenology			
Study Mean					-	-

Red switchgrass var. ‘Rotbraun’

Panicum virgatum L.

Red switchgrass is a perennial, warm-season, mid grass native to North America with selected plant material transplanted to Germany. Its growth habit is large clumps that enlarge annually with short rhizomes. It is considered to have intermediate invasiveness. Barriers are required to confine this grass to small areas. Vegetative tillers form long shoots with evenly distributed arching leaves. The leaf blades are 3.9 to 23.6 in. (10-60 cm) long and 0.08 to 0.6 in. (2-15 mm) wide. The inflorescence is an airy open panicle 3.9 to 21.7 in. (10-55 cm) long and 1.6 to 7.9 in. (4-20 cm) wide tinted pink or red. The erect reproductive tillers of red switchgrass grew to medium height.

Red switchgrass var. ‘Rotbraun’ is a horticultural cultivar developed in Germany. The plant material for this study was provided by the Horticulture program at NDSU Department of Plant Sciences, Fargo, North Dakota.

Evaluation ratings for Red switchgrass var. ‘Rotbraun’ are on tables 36 and 37. Establishment of red switchgrass under xeriscape conditions required one growing season. During the first growing season, the plant material on all three replications progressed well; mean tiller vigor rating was 3.8, mean ornamental value rating was 3.7, and mean seed head aesthetics rating was 2.9. Because red switchgrass is a warm-season grass, the carryover tillers and new vegetative tillers had relatively low vigor during mid May. The vigor of the plant material improved during the second growing season but remained at moderate levels during the third, fourth, and fifth growing seasons. Mean tiller vigor rating was 3.4, mean ornamental value rating was 3.6, and mean seed head aesthetics rating was 3.8 during the latter four growing seasons. The leaf color was a nice green with tints of various shades of red. The red switchgrass plant material developed into extremely attractive moderate clumps of medium height tillers with arching leaves along the stems, and with large open panicle seed heads on top. Overall, mean tiller vigor rating was 3.4, mean ornamental value rating was 3.6, and mean seed head aesthetics rating was 3.5 during five growing seasons (tables 36 and 37).

Red switchgrass var. ‘Rotbraun’ can be managed as ornamental moderate clumps. Small sized clumps would need barriers. Management of red switchgrass clumps requires trimming the previous years senescent stems to a height of a couple of inches during early spring around the last two weeks of April.

Table 36. Evaluation ratings for Red switchgrass var. ‘Rotbraun’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			3.3		4.3	2.7
2nd	1.0	3.3	4.0		4.3	3.0
3rd	1.7	2.3	2.8	3.0	3.2	
4th	1.7	3.7	3.7	4.3	4.0	
5th		2.3	3.3	3.3	3.7	
Mean	1.5	2.9	3.4	3.5	3.9	2.9
			Leaf Color			
1st			Lt. Green & Purple		Green & Red	Lt. Green & Red
2nd		Lt. Green & Purple	Yellowgreen & Purple		Lt. Green	Very Lt. Red & Tan
3rd		Yellowgreen	Green & Purple	Green	Lt. Green & Lt. Red	Tan & Lt. Red
4th	Yellowgreen	Green	Green	Green	Yellowgreen & Red	
5th		Green	Green	Green & Red	Lt. Green & Red	
Summary	Yellowgreen	Yellowgreen to Lt. Green & Purple	Green, Yellowgreen & Purple	Green to Green & Red	Green, Yellowgreen & Red	Lt. Green & Red to Lt. Red & Tan

Table 37. Evaluation ratings for Red switchgrass var. ‘Rotbraun’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			3.0		4.3	3.3
2nd	1.0	3.0	3.7		4.3	3.3
3rd		2.3	2.8	3.7	3.7	1.7
4th	1.7	4.7	4.0	4.3	4.7	
5th		2.3	3.3	3.3	3.7	
Mean	1.4	3.1	3.4	3.8	4.1	2.8
			Seed Head Aesthetics			
1st			2.0		3.7	2.7
2nd	-	-	-		4.3	3.7
3rd	-	-	-	3.3	3.3	3.0
4th	-	-	4.0	4.7	4.3	
5th		-	1.3	4.7	4.3	
Mean	-	-	2.4	4.2	4.0	3.1
			Seed Head Phenology			
Study Mean			E. develop. Hd. emerge.	Hd. emerge. Flower.	Flower. Seed develop.	Seed develop.

Ribbon grass var. ‘Feesey’

Phalaris arundinacea L.

Reed canary grass is a perennial, cool-season, mid grass that is circumboreal. European reed canary grass plant material was used in the development of ribbon grass. Its growth habit is large clumps that enlarge annually by short, moderately stout, terminal rhizomes. Barriers are required to confine this grass to small areas. Vegetative tillers form long shoots with evenly distributed arching leaves. The leaf blades are 3.9 to 11.8 in. (10-30 cm) long and 0.2 to 0.8 in. (5-20 mm) wide with prominent longitudinal white to cream stripes and tinted at times with pink. The inflorescence is a dense panicle 2.0 to 15.7 in. (5-40 cm) long and 0.4 to 1.6 in. (1-4 cm) wide. The coarse reproductive tillers are 1.3 to 7.6 ft. (40-230 cm) tall.

Ribbon grass var. ‘Feesey’ is a horticultural cultivar developed from European plant material. The plant material for this study was provided by the Horticulture program at NDSU Department of Plant Sciences, Fargo, North Dakota.

Evaluation ratings for Ribbon grass var. ‘Feesey’ are on tables 38 and 39. Establishment of ribbon grass under xeriscape conditions required one growing season. During the first growing season, the plant material on all three replications progressed well; mean tiller vigor rating was 3.7, mean ornamental value rating was 3.5, and mean seed head aesthetics rating was 3.6. The vigor of the plant material improved during the second growing season and remained at robust levels during the third, fourth, and fifth growing seasons. Mean tiller vigor rating was 4.9, mean ornamental value rating was 4.9, and mean seed head aesthetics rating was 3.8 during the latter four growing seasons. The size of the plant clumps greatly enlarged during the fourth and fifth growing seasons. The leaf color was light green with longitudinal white lines and a highly desirable tint of pink. The ribbon grass plant material developed into extremely attractive large clumps of mid height tillers with long arching leaves along the stems, and with a dense seed head on top. Overall, mean tiller vigor rating was 4.7, mean ornamental value rating was 4.8, and mean seed head aesthetics rating was 3.6 during five growing seasons (tables 38 and 39).

Ribbon grass var. ‘Feesey’ can be managed as ornamental large dense clumps with medium height tillers. Management of ribbon grass clumps requires trimming the previous years senescent stems to a height of a couple of inches during early spring around mid April. This cultivar will portray a magnificent feminine accent in its portion of the landscape.

Table 38. Evaluation ratings for Ribbon grass var. ‘Feesey’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			3.0		4.3	3.7
2nd	4.0	5.0	5.0		4.7	4.0
3rd	5.0	5.0	5.0	4.0	4.5	
4th	5.0	5.0	5.0	5.0	5.0	
5th		5.0	4.7	5.0	5.0	
Mean	4.7	5.0	4.5	4.7	4.7	3.9
			Leaf Color			
1st			Lt. Green with white stripes		Lt. Green with white stripes	Lt. Green with white stripes
2nd		Lt. Green with white lines	Lt. Green with white lines		Lt. Green with white lines	Lt. Green & Tan
3rd		Lt. Green with Cream	Lt. Green with Cream	Lt. Green with Cream	Yellowgreen with White & Tan	Lt. Tan
4th	Lt. Green with Cream & Pink	Lt. Green with Cream	Lt. Green with Cream	Lt. Green with Cream	Lt. Green with Cream & Pink	
5th		Lt. Green with Cream	Lt. Green with Cream	Lt. Green with Cream & Pink	Lt. Green with Cream	
Summary	Lt. Green with Cream & Pink	Lt. Green with White or Cream	Lt. Green with White or Cream	Lt. Green with Cream & Pink	Lt. Green or Yellowgreen with White or Cream & Pink	Lt. Green with White & Lt. Tan

Table 39. Evaluation ratings for Ribbon grass var. ‘Feesey’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			3.3		3.7	3.7
2nd	4.7	5.0	5.0		4.3	4.0
3rd	5.0	5.0	5.0	4.3	4.7	1.7
4th	5.0	5.0	5.0	5.0	5.0	
5th		5.0	5.0	5.0	5.0	
Mean	4.9	5.0	4.7	4.8	4.5	3.1
			Seed Head Aesthetics			
1st			3.0		-	-
2nd	-	5.0	5.0		1.0	-
3rd	-	5.0	5.0	3.0	3.0	-
4th	-	5.0	4.7	2.7	-	
5th		-	4.0	-	2.0	
Mean	-	5.0	4.3	2.9	2.0	-

		Seed Head Phenology			
Study Mean		Boot Hd. emerge. Flower	Flower. Seed develop.	Seed mature.	Mature hd.

Feather reed grass var. ‘Karl Foerster’

Calamagrostis X acutiflora (Schrad.) D.C.

Feather reed grass is a perennial, cool-season, tall grass that is a hybrid of the Eurasian grasses *Calamagrostis epigejos* L. and *Calamagrostis arundinacea* L. Its growth habit is upright dense bunches that can develop short rhizomes 0.4 to 1.2 in. (1-3 cm) long and 0.08 in. (2 mm) thick. It is considered to have low invasiveness. Vegetative tillers form long shoots with erect leaves. The narrow leaf blades are 18.0 to 24.8 in. (45-63 cm) long and 0.06 to 0.3 in. (1.5-7.5 mm) wide. The inflorescence is a loosely feathered purplish panicle that changes to a narrow verticle plume 5.9 to 11.8 in. (15-30 cm) long and 0.3 to 0.4 in. (0.75-1.0 cm) wide and is usually sterile. The erect reproductive tillers are 4.4 to 6.9 ft. (135-210 cm) tall.

Feather reed grass var. ‘Karl Foerster’ is a horticultural cultivar developed in Europe. The plant material for this study was provided by the Horticulture program at NDSU Department of Plant Sciences, Fargo, North Dakota.

Evaluation ratings for Feather reed grass var. ‘Karl Foerster’ are on tables 40 and 41. Establishment of feather reed grass under xeriscape conditions required one growing season. During the first growing season, the plant material on all three replications progressed well; mean tiller vigor rating was 3.0, mean ornamental value rating was 3.0, and mean seed head aesthetics rating was 2.3. The vigor of the plant material improved during the second growing season and remained at robust levels during the third, fourth, and fifth growing seasons. Mean tiller vigor rating was 4.8, mean ornamental value rating was 4.8, and mean seed head aesthetics rating was 4.6 during the latter four growing seasons. The size of the plant bunches enlarged during the fourth and fifth growing seasons but did not overrun other grass varieties. The leaf color was a nice dark green during the growing season and turned a nice light tan during late fall and remained attractive all winter. The ‘Karl Foerster’ feather reed plant material developed into exceptionally attractive moderate bunches of tall tillers with erect and arching leaves along the stems and at the base, and with large feathery seed heads on top. Overall, mean tiller vigor rating was 4.6, mean ornamental value rating was 4.6, and mean seed head aesthetics rating was 4.1 during five growing seasons (tables 40 and 41).

Feather reed grass can be managed as ornamental moderate bunches of tall tillers. Feather reed grass is nearly care-free. Management of feather reed grass bunches requires trimming the previous years senescent stems to a height of about 5 or 6 inches during early spring around mid to late March. New leaves are actively growing in early April. The plants with variegated leaves are more prone to producing rhizome tillers than the standard plants. The ‘Karl Foerster’ feather reed grass is an impressive ornamental plant; there should be a place for this cultivar in every residential landscape.

Table 40. Evaluation ratings for Feather reed grass var. ‘Karl Foerster’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			3.0		2.7	3.3
2nd	4.0	4.3	4.7		4.3	4.7
3rd	5.0	5.0	5.0	4.0	4.5	
4th	5.0	5.0	5.0	4.7	5.0	
5th		5.0	5.0	5.0	5.0	
Mean	4.7	4.8	4.6	4.6	4.3	4.0
			Leaf Color			
1st			Green		Green	Green with red tips
2nd		Green	Dk. Green		Dk. Green	Green & Red
3rd		Dk. Green	Dk. Green	Dk. Green	Green & Tan	Tan
4th	Dk. Green	Dk. Green	Dk. Green	Dk. Green	Green	
5th		Dk. Green	Dk. Green	Dk. Green	Green	
Summary	Dk. Green	Dk. Green to Green	Dk. Green to Green	Dk. Green	Dk. Green to Green & Tan	Green & Red to Tan

Table 41. Evaluation ratings for Feather reed grass var. ‘Karl Foerster’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			3.3		2.7	2.3
2nd	3.3	3.7	4.7		4.7	4.0
3rd	4.0	5.0	5.0	4.3	4.7	3.7
4th	5.0	5.0	5.0	4.7	5.0	
5th		5.0	5.0	5.0	5.0	
Mean	4.1	4.7	4.6	4.7	4.4	3.3
			Seed Head Aesthetics			
1st			3.0		1.5	1.0
2nd	-	1.0	5.0		4.3	4.0
3rd	-	5.0	5.0	4.7	4.5	4.0
4th	-	-	5.0	4.7	5.0	
5th		-	5.0	5.0	5.0	
Mean	-	3.0	4.6	4.8	4.1	3.0
			Seed Head Phenology			
Study Mean		Boot Hd. emerge. Flower.	Flower. Seed develop.	Seed develop.	Mature hd.	Mature hd.

Blue lymegrass

Leymus arenarius (L.) Hochst.
Elymus arenarius L.

Blue lymegrass is a perennial, cool-season, mid grass native to Great Britain and Europe. Its growth habit is widely spaced numerous medium spiky bunches connected by long stout rhizomes covered with a waxy coating. It is considered to be extremely invasive and, unless a sand dune requires stabilization, its aggressive growth form is undesirable in residential landscapes. Barriers are compulsory to confine this grass to small areas. Vegetative tillers form short shoots with stiff basal leaves. The inflorescence is a narrow spike 4.7 to 13.8 in. (12-35 cm) long and 0.6 to 1.0 in. (15-25 mm) wide. The reproductive tillers are 1.6 to 4.9 ft. (50-150 cm) tall.

Blue lymegrass is a horticultural plant developed in Europe. The plant material for this study was provided by the Horticulture program at NDSU Department of Plant Sciences, Fargo, North Dakota.

Evaluation ratings for Blue lymegrass are on tables 42 and 43. Establishment of blue lymegrass under xeriscape conditions required one growing season. During the first growing season, the plant material on all three replications progressed well; mean tiller vigor rating was 3.5, mean ornamental value rating was 3.2. No seed heads were produced during the first growing season. The vigor of the plant material improved during the second growing season, remained high during the third and fourth growing seasons, and decreased to moderate levels during the fifth growing season. Mean tiller vigor rating was 3.9, mean ornamental value rating was 3.5, and mean seed head aesthetics rating was 3.2 during the latter four growing seasons. The growth of long rhizomes resulted in large open spaces between bunches giving the plant material a scraggly appearance. The number of bunches greatly increased and the unrestrained growth became extremely invasive during the fourth and fifth growing seasons. The individual bunch of blue lymegrass plant material was an attractive moderate sized blue spiky tuft with stiff erect leaves. Unfortunately, this plant does not remain as single bunches; the growth of numerous long rhizomes resulted in an undesirable invasive growth habit. Overall, mean tiller vigor rating was 3.9, mean ornamental value rating was 3.4, and mean seed head aesthetics rating was 3.3 during five growing seasons (tables 42 and 43).

Blue lymegrass will be a challenge and can not be managed as ornamental bunches in residential landscapes without stout barriers. Sturdy bottomless buckets sunk into the soil may restrain blue lymegrass. This grass should be tested as late season pasture forage.

Table 42. Evaluation ratings for Blue lymegrass in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			3.3		3.7	3.3
2nd	3.0	3.3	3.7		4.3	4.3
3rd	4.3	4.7	4.2	3.3	3.3	
4th	4.0	4.7	4.7	4.7	4.7	
5th		2.7	3.7	3.3	3.5	
Mean	3.8	3.9	3.9	3.8	3.9	3.8
			Leaf Color			
1st			Lt. Bluegreen		Lt. Bluegreen	Lt. Bluegreen
2nd		Lt. Blue	Blue		Bluegreen	Bluegreen & Tan
3rd		Bluegreen	Bluegreen	Blue	Lt. Bluegreen & Tan	Tan & Bluegreen
4th	Blue	Blue	Blue	Blue	Blue	
5th		Blue	Blue	Blue	Blue	
Summary	Blue	Blue to Bluegreen	Blue to Bluegreen	Blue	Blue to Bluegreen & Tan	Bluegreen to Bluegreen & Tan

Table 43. Evaluation ratings for Blue lymegrass in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			3.0		3.3	2.3
2nd	2.3	3.0	3.0		3.7	3.7
3rd		4.0	3.3	3.3	3.2	2.0
4th	3.7	5.0	4.0	3.7	4.3	
5th		2.7	3.3	3.0	2.3	
Mean	3.0	3.7	3.3	3.3	3.4	2.7
			Seed Head Aesthetics			
1st			-		-	-
2nd	-	1.3	1.7		2.0	2.3
3rd	-	4.0	4.0	3.0	3.8	2.3
4th	-	5.0	4.0	4.0	3.5	
5th		4.0	1.3	3.5	3.0	
Mean	-	3.6	2.8	3.5	3.1	1.7
			Seed Head Phenology			
Study Mean	E. develop. Boot	Hd. emerge. Flower. Seed develop.	Seed develop.	Seed mature.	Seed mature.	Mature hd.

Zebra grass var. ‘Zebrinus’

Miscanthus sinensis Anderson
Eulalia japonica Trinius

Zebra grass is a perennial, warm-season, tall grass native to Japan and southern Asia. Its growth habit is large dense clumps that expand by short, thick rhizomes. It is considered to have low invasiveness. Vegetative tillers form long shoots with arching leaves. The leaf blades are 7.9 to 27.6 in. (20-70 cm) long and 0.2 to 0.8 in. (6-20 mm) wide with irregular horizontal bands of yellow variegation. The inflorescence is a panicle 5.9 to 9.8 in. (15-25 cm) long and 3.1 to 11.0 in. (8-28 cm) wide. The erect reproductive tillers are 2.0 to 6.6 ft. (60-200 cm) tall.

Zebra grass var. ‘Zebrinus’ is a very old and popular cultivar from Japan. The plant material for this study was provided by the Horticulture program at NDSU Department of Plant Sciences, Fargo, North Dakota.

Evaluation ratings for Zebra grass var. ‘Zebrinus’ are on tables 44 and 45. Establishment of zebra grass under xeriscape conditions did not occur. The plant material on two replications died during the first winter and the plant material on the third replication died during the second winter. Mean tiller vigor rating was 1.4, and mean ornamental value rating was 1.5 during the first and second growing seasons. No seed heads were produced (tables 44 and 45). Zebra grass should not be selected as an ornamental plant under xeriscape conditions.

Table 44. Evaluation ratings for Zebra grass var. Zebrinus' in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			2.3		3.0	3.0
2nd	0.0	0.7	0.3		0.7	0.3
3rd	-	-	-	-	-	-
4th	-	-	-	-	-	-
5th	-	-	-	-	-	-
Mean	-	-	-	-	-	-
			Leaf Color			
1st			Lt. Green with yellow patches		Lt. Green with yellow patches	Lt. Green with yellow patches, Tan
2nd		Lt. Green	Lt. Green		Lt. Green with yellow patches	Tan
3rd	-	-	-	-	-	-
4th	-	-	-	-	-	-
5th	-	-	-	-	-	-
Summary	-	-	-	-	-	-

Table 45. Evaluation ratings for Zebra grass var. Zebrinus' in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			2.7		3.0	3.0
2nd	0.0	0.3	0.3		1.0	0.3
3rd	-	-	-	-	-	-
4th	-	-	-	-	-	-
5th	-	-	-	-	-	-
Mean	-	-	-	-	-	-
			Seed Head Aesthetics			
1st			-		-	-
2nd	-	-	-		-	-
3rd	-	-	-	-	-	-
4th	-	-	-	-	-	-
5th	-	-	-	-	-	-
Mean	-	-	-	-	-	-
			Seed Head Phenology			
Study Mean						

Autumn red var. ‘Purpurascens’

Miscanthus hybrid with obscure origin.

Autumn red is a perennial, warm-season, mid grass that was a selection made of material grown in Germany from seed obtained from Japan. Its growth habit is moderate clumps that expand annually by short, thick rhizomes. It is considered to have low invasiveness. Vegetative tillers form long shoots with erect and arching leaves that have a reddish tint, becoming bright orange, and then reddish brown in fall. The leaf blades are up to 0.5 in. (12.7m) wide. The silvery inflorescence is a narrow vertical panicle with a few raceme branches. The erect reproductive tillers are 4.0 ft. (1.2 m) tall.

Autumn red var. ‘Purpurascens’ is a horticultural cultivar with an undocumented or unintentional origin. The plant material for this study was provided by the Horticulture program at NDSU Department of Plant Sciences, Fargo, North Dakota.

Evaluation ratings for Autumn red var. ‘Purpurascens’ are on tables 46 and 47. Establishment of autumn red under xeriscape conditions required one growing season. During the first growing season, the plant material on all three replications progressed well; mean tiller vigor rating was 3.8, mean ornamental value rating was 3.5, and mean seed head aesthetics rating was 4.0. The vigor of the plant material improved during the second and third growing seasons and remained at robust levels during the fourth and fifth growing seasons. Mean tiller vigor rating was 4.5, mean ornamental value rating was 4.5, and mean seed head aesthetics rating was 4.4 during the latter four growing seasons. The size of the plant clumps increased during the fourth and fifth growing seasons but did not overrun other grass varieties. The leaf color was a nice green during spring and early summer, and turned orange and red during late summer and fall. The autumn red plant material developed into extremely attractive moderate clumps of mid height tillers with erect and arching leaves along the stem, and with exquisite fan shaped seed heads of silvery plumes during late summer and fall. Overall, mean tiller vigor rating was 4.4, mean ornamental value rating was 4.4, and mean seed head aesthetics rating was 4.3 during five growing seasons (tables 46 and 47).

Autumn red var. ‘Purpurascens’ can be managed as ornamental moderate clumps with medium height tillers with showy seed heads. Management of autumn red clumps requires trimming the previous years senescent stems to a height of a couple of inches during early spring around the last two weeks of April.

Table 46. Evaluation ratings for Autumn red var. ‘Purpurascens’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			3.3		4.3	2.3
2nd	3.0	3.3	3.7		5.0	3.7
3rd	3.3	3.3	4.0	4.0	4.2	
4th	4.0	5.0	5.0	5.0	5.0	
5th		4.7	5.0	5.0	5.0	
Mean	3.4	4.1	4.2	4.7	4.7	3.0
			Leaf Color			
1st			Dk. Green		Green with fine white line	Lt. Red
2nd		Green & Purple	Green		Green & Red	Lt. Red
3rd		Lt. Yellowgreen	Green	Green	Lt. Green & Red	Tan & Lt. Red
4th	Green	Green	Green	Green	Lt. Green & Red	
5th		Green	Green	Green & Red	Lt. Green & Orange	
Summary	Green	Yellowgreen, Green & Purple	Dk. Green to Green	Green to Green & Red	Green or Lt. Green & Red or Orange	Lt. Red to Lt. Red & Tan

Table 47. Evaluation ratings for Autumn red var. ‘Purpurascens’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			3.0		4.0	4.0
2nd	1.3	4.0	3.7		4.3	4.0
3rd		3.0	3.8	4.0	4.3	2.7
4th	3.7	5.0	5.0	5.0	5.0	
5th		4.7	5.0	5.0	5.0	
Mean	2.5	4.2	4.1	4.7	4.5	3.6
			Seed Head Aesthetics			
1st			-		4.0	3.0
2nd	-	-	-		5.0	4.0
3rd	-	-	-	-	2.7	2.3
4th	-	-	-	-	5.0	
5th		-	-	-	5.0	
Mean	-	-	-	-	4.3	3.1
			Seed Head Phenology			
Study Mean					Boot. Hd. emerge. Flower.	Seed develop.

Giant silver banner grass var. ‘Robustus’

Miscanthus sacchariflorus (Maxim.) Benth.

Giant silver banner grass is a perennial, warm-season, very tall grass native to Japan and temporate regions of eastern Asia. Its growth habit is large dense colonies that expand by aggressive stout rhizome systems. Vegetative tillers form long shoots with arching leaves. Leaf blades are 7.9 to 31.5 in. (20-80 cm) long and 0.2 to 1.2 in. (0.5-3 cm) wide with a distinct white midrib. The silvery inflorescence is a fan shaped panicle that appear during very late summer or early fall. The erect reproductive tillers are 2.0 to 8.2 ft. (60-250 cm) tall. The seeds rarely mature because of the late season.

Giant silver banner grass var. ‘Robustus’ is a horticultural cultivar developed in Japan. The plant material for this study was provided by the Horticulture program at NDSU Department of Plant Sciences, Fargo, North Dakota.

Evaluation ratings for Giant silver banner grass var. ‘Robustus’ are on tables 48 and 49. Establishment of giant silver banner grass under xeriscape conditions was not successful. During the first growing season, the plant material on all three replications progressed well; mean tiller vigor rating was 4.4, mean ornamental value rating was 4.5, and mean seed head aesthetics rating was 4.0. A few seed heads developed after mid September during the first year and no seed heads were produced during subsequent years. Plant material on the first replication died during the first winter, plant material on the second replication died during the second winter, and plant material on the third replication struggled the third growing season, nearly rallied during the fourth growing season, but died during the fourth winter. Mean tiller vigor rating was 2.2, and mean ornamental value rating was 2.3 during the second, third, and fourth growing seasons (tables 48 and 49). Giant silver banner grass should not be selected as an ornamental plant under xeriscape conditions.

Table 48. Evaluation ratings for Giant silver banner grass var. “Robustus’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			4.0		4.7	3.7
2nd	1.0	1.3	1.0		2.3	2.0
3rd	1.0	1.0	1.5	2.0	2.0	
4th	2.0	2.0	3.0	4.0	4.0	
5th		-	-	-	-	
Mean	-	-	-	-	-	-
			Leaf Color			
1st			Dk. Green with white line		Dk. Green with white line	Dk. Green, white line, red tips
2nd		Green	Dk. Green with white stripe		Dk. Green with white line	Tan
3rd		Dk. Green with white line	Dk. Green with white line	Green with white line	Yellowgreen with white line	Tan
4th	Dk. Green with white line	Dk. Green with white line	Dk. Green with white line	Dk. Green with white line	Dk. Green with white line	
5th		-	-	-	-	
Summary	-	-	-	-	-	-

Table 49. Evaluation ratings for Giant silver banner grass var. “Robustus’ in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			4.3		4.7	3.7
2nd	1.0	1.0	1.0		1.3	2.0
3rd		1.0	1.5	3.0	2.0	1.0
4th	1.0	2.0	4.0	4.0	4.0	
5th		-	-	-	-	
Mean	-	-	-	-	-	-
			Seed Head Aesthetics			
1st			-		-	4.0
2nd	-	-	-		-	-
3rd	-	-	-	-	-	-
4th	-	-	-	-	-	
5th	-	-	-	-	-	
Mean	-	-	-	-	-	-
			Seed Head Phenology			
Study Mean						-

Japanese silver grass var. unknown

Miscanthus sacchariflorus (Maxim.) Benth.

Japanese silver grass is a perennial, warm-season, very tall grass native to Japan and temporate regions of eastern Asia. Its growth habit is large dense colonies that expand by aggressive strout rhizome systems. This grass requires large areas to grow and it should not be grown in small areas. Vegetative tillers form long shoots with arching leaves. The inflorescence is a silvery fan-shaped panicle with numerous silky racemes that become fluffy white when dry. The erect reproductive tillers are 5.5 to 8.0 ft. (168-244 cm) tall.

Japanese silver grass is a horticultural plant developed in Japan. The plant material for this study was provided by the Armstrong Second Nature Greenhouse and Landscape Center, Dickinson, North Dakota.

Evaluation ratings for Japanese silver grass are on tables 50 and 51. Establishment of Japanese silver grass under xeriscape conditions occurred during the first growing season. The plant material on all three replications progressed exceptionally well; mean tiller vigor rating was 4.2, mean ornamental value rating was 4.0, and mean seed head aesthetics rating was 4.7 during the first year. The vigor of the plant material improved during the second growing season and remained at robust levels during the third, fourth, and fifth growing seasons. Mean tiller vigor rating was 4.9, mean ornamental value rating was 4.7, and mean seed head aesthetics rating was 4.7 during the latter four growing seasons. The size of the plant colonies increased greatly during the fourth and fifth growing seasons; one replication expanded beyond the study perimeter border with a colony greater than 25 foot (762 cm) in diameter. The leaf color was a nice light green to yellowgreen during spring and early summer, turning yellow, orange, and red during late summer and fall. The Japanese silver grass plant material developed into magnificent very large colonies of very tall tillers with arching leaves along the stems, and with exquisite fan shaped silvery seed heads of silky plumes during late summer and fall. Overall, mean tiller vigor rating was 4.8, mean ornamental value rating was 4.7, and mean seed head aesthetics rating was 4.8 during five growing seasons (tables 50 and 51).

Japanese silver grass can be managed as ornamental, exceptionally large colonies with extremely tall tillers that have beautiful showy seed heads in residential landscapes with large spaces. Management of Japanese silver grass colonies requires trimming the previous years senescent stems to a height of a couple of inches during early spring around the last two weeks of April.

Table 50. Evaluation ratings for Miscanthus var. unknown in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Tiller Vigor			
1st			3.7		4.7	1.3
2nd	4.0	5.0	5.0		4.3	3.7
3rd	3.0	5.0	4.8	4.7	4.2	
4th	4.3	5.0	5.0	5.0	5.0	
5th		5.0	5.0	5.0	5.0	
Mean	3.8	5.0	4.7	4.9	4.6	2.5
			Leaf Color			
1st			Lt. Green		Green	Lt. Red
2nd		Green	Lt. Green		Yellowgreen & Yellow	Lt. Red
3rd		Lt. Green	Lt. Green	Lt. Green	Yellowgreen, Yellow & Tan	Lt. Red
4th	Green	Green	Yellowgreen	Lt. Green	Yellow & Lt. Green	
5th		Lt. Green	Lt. Green	Lt. Green	Yellow, Orange, Lt. Green	
Summary	Green	Green to Lt. Green	Lt. Green to Yellowgreen	Lt. Green	Yellowgreen, Yellow, Orange, Lt. Green & Tan	Lt. Red

Table 51. Evaluation ratings for Miscanthus var. unknown in xeriscape ornamental perennial grass trial.

Years	mid May	mid Jun	mid Jul	mid Aug	mid Sep	mid Nov
			Ornamental Value			
1st			3.3		4.7	3.3
2nd	1.7	4.3	4.7		4.7	4.0
3rd		4.3	4.2	4.3	4.3	3.0
4th	4.0	5.0	5.0	5.0	5.0	
5th		5.0	5.0	5.0	5.0	
Mean	2.9	4.7	4.4	4.8	4.7	3.4
			Seed Head Aesthetics			
1st			-		4.7	4.0
2nd	-	-	-		5.0	4.0
3rd	-	-	-	-	3.3	3.5
4th	-	-	-	5.0	5.0	
5th		-	-	-	5.0	
Mean	-	-	-	5.0	4.6	3.8
			Seed Head Phenology			
Study Mean			E. develop.	Boot Hd. emerge.	Flower. Seed develop.	Seed develop.

Summary

This study evaluated fourteen agricultural grass cultivars and ten horticultural grass cultivars for suitability as ornamental xeriscape plants for use in residential landscapes. Two independent observers assessed the plant material monthly during five growing seasons. The leaf color and seed head phenology were rated according to standard categories and tiller vigor, ornamental value, and seed head aesthetics were rated on a scale of 1 to 5. A summary of the evaluation ratings are on tables 52 and 53.

To ensure xeriscape conditions were maintained, supplemental water was not added during this study after the first day. During the first year, none of the growing season months had water deficiency conditions. Even with favorable above normal growth conditions, three of the horticultural grass cultivars failed to become established. Six of the agricultural grass cultivars required two or three growing seasons to become established without supplemental water. Eight of the agricultural grass cultivars and seven of the horticultural grass cultivars became established during one growing season under xeriscape conditions without irrigation water.

The growth habit of the grass cultivars were highly variable. Two cultivars, blue grama and buffalograss, produce short dense mats with low invasiveness. Six cultivars, green needlegrass, sideoats grama, little bluestem, Altai wildrye, blue fescue, and feather reed grass, produce tufts or bunches with low invasiveness. Eight cultivars, Canada wildrye, switchgrass, Indiangrass, big bluestem, sand bluestem, red switchgrass, ribbon grass, and autumn red, produce large clumps with intermediate invasiveness that require barriers to confine to small areas. Three cultivars, sweetgrass, prairie sandreed, and prairie cordgrass, produce large colonies with moderate invasiveness that require barriers to confine to designated areas. One cultivar, blue lymegrass, produces extensive colonies of bunches that are extremely invasive and require stout barriers. One cultivar, Japanese silver grass, produces exceptionally large colonies that require large spaces.

Selection of ornamental xeriscape plant material for use in residential landscapes should have evaluation ratings of 3 or better and should have the residents' desired characteristics of growth habit, leaf color, and seed head height.

Table 52. Mean evaluation ratings for the agricultural grass cultivars in xeriscape ornamental perennial grass trial.

Cultivar	Time to Establish	Tiller Vigor Rating		Ornamental Value Rating		Seed Head Aesthetics Rating	
	Years	Mature Plants	5 Year Mean	Mature Plants	5 Year Mean	Mature Plants	5 Year Mean
Blue grama	1	3.4	3.4	3.2	3.2	3.6	3.7
Buffalograss	2	4.0	3.8	3.6	3.3	3.7	3.4
Sweetgrass	1	4.8	4.7	4.2	4.2	3.2	3.1
Green needlegrass	2	4.8	4.1	4.7	4.0	4.4	3.9
Sideoats grama	3	3.4	3.1	3.6	3.0	3.8	3.5
Little bluestem	3	3.8	3.5	3.9	3.4	4.4	4.0
Canada wildrye	3	3.3	3.1	3.3	2.9	3.9	3.6
Altai wildrye	1	4.7	4.5	4.5	4.3	4.2	4.2
Switchgrass	1	4.5	4.5	4.5	4.4	4.7	4.5
Indiangrass	3	4.2	3.9	4.5	3.8	4.9	4.1
Big bluestem	1	4.5	4.4	4.6	4.5	4.4	4.4
Sand bluestem	1	4.3	4.2	4.2	4.3	4.6	4.6
Prairie sandreed	1	4.0	4.0	3.8	3.8	4.0	4.0
Prairie cordgrass	1	4.6	4.6	4.7	4.6	4.3	4.3

Table 53. Mean evaluation ratings for the horticultural grass cultivars in xeriscape ornamental perennial grass trial.

Cultivar	Time to Establish	Tiller Vigor Rating		Ornamental Value Rating		Seed Head Aesthetics Rating	
	Years	Mature Plants	5 Year Mean	Mature Plants	5 Year Mean	Mature Plants	5 Year Mean
Blue fescue	1	4.3	3.1	4.2	3.0	3.7	3.1
Sand lovegrass	0		1.9		1.8		3.0
Red switchgrass	1	3.4	3.4	3.6	3.6	3.8	3.5
Ribbon grass	1	4.9	4.7	4.9	4.8	3.8	3.5
Feather reed grass	1	4.8	4.6	4.8	4.6	4.6	4.1
Blue lymegrass	1	3.9	3.9	3.5	3.4	3.2	3.3
Zebra grass	0		1.4		1.5		0
Autumn red	1	4.5	4.4	4.5	4.4	4.4	4.3
Giant silver banner grass	0		2.2		2.3		4.0
Japanese silver grass	1	4.9	4.8	4.7	4.7	4.7	4.8

Literature Cited

Beard, J.B. 1973. Turfgrass: science and culture. Prentice-Hall, Inc., Englewood Cliffs, NJ.

Briske, D.D., and J.H. Richards. 1995. Plant response to defoliation: a physiological, morphological, and demographic evaluation. p. 635-710. *in* D.J. Bedunah and R.E. Sosebee (eds.). Wildland plants: physiological ecology and developmental morphology. Society for Range Management, Denver, CO.

Coyne, P.I., M.J. Trlica, and C.E. Owensby. 1995. Carbon and nitrogen dynamics in range plants. p. 59-167. *in* D.J. Bedunah and R.E. Sosebee (eds.). Wildland plants: physiological ecology and developmental morphology. Society for Range Management, Denver, CO.

Dahl, B.E., and D.N. Hyder. 1977. Developmental morphology and management implications. p. 257-290. *in* R.E. Sosebee (ed.). Rangeland plant physiology. Range Science Series No. 4. Society for Range Management, Denver, CO.

Dahl, B.E. 1995. Developmental morphology of plants. p. 22-58. *in* D.J. Bedunah and R.E. Sosebee (eds.). Wildland plants: physiological ecology and developmental morphology. Society for Range Management, Denver, CO.

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.

Esau, K. 1960. Anatomy of seed plants. Wiley and Sons, New York, NY.

Evans, M.W., and F.O. Grover. 1940. Developmental morphology of the growing point of the shoot and the inflorescence in grasses. Journal of Agricultural Research 61:481-520.

Flora of North America Editorial Committee, eds. 2003, 2007. Flora of North America. Oxford University Press, New York, N.Y. Vols. 24-25.

Hyder, D.N. 1974. Morphogenesis and management of perennial grasses in the U.S. p. 89-98. *in* Plant morphogenesis as the basis for scientific management for range resources. USDA Miscellaneous Publication 1271.

Langer, R.H.M. 1972. How grasses grow. Edward Arnold, London, Great Britain.

Leopold, A.C., and P.E. Kriedemann. 1975. Plant growth and development. McGraw-Hill Book Co., New York, NY.

Manske, L.L. 2010. Environmental factors to consider during planning of management for range plants in the Dickinson, North Dakota, region, 1892-2009. NDSU Dickinson Research Extension Center. Range Research Report DREC 10-1018m. Dickinson, North Dakota. 37 p.

Manske, L.L. and J.C. Larson. 1999. Xeriscape ornamental perennial grass trial for low water use landscaping. NDSU Dickinson Research Extension Center. Range Research Report DREC 99-1023. Dickinson, North Dakota. 14p.

Manske, L.L. and J.C. Larson. 2000. Xeriscape ornamental perennial grass trial for low water use landscaping. NDSU Dickinson Research Extension Center. Range Research Report DREC 00-1023b. Dickinson, North Dakota. 15p.

Manske, L.L. and J.C. Larson. 2001. Xeriscape ornamental perennial grass trial for low water use landscaping. NDSU Dickinson Research Extension Center. Range Research Report DREC 01-1023c. Dickinson, North Dakota. 16p.

Manske, L.L. and J.C. Larson. 2002. Xeriscape ornamental perennial grass trial for low water use landscaping. NDSU Dickinson Research Extension Center. Range Research Report DREC 02-1023d. Dickinson, North Dakota. 15p.

Manske, L.L. and J.C. Larson. 2003. Xeriscape ornamental perennial grass trial for low water use landscaping. NDSU Dickinson Research Extension Center. Range Research Report DREC 03-1023e. Dickinson, North Dakota. 14p.

Moser, L.E. 1977. Carbohydrate translocation in range plants. p. 47-71 *in* R.E. Sosebee (ed.). Rangeland plant physiology. Range Science Series No. 4. Society for Range Management, Denver, CO.

Rechenthin, C.A. 1956. Elementary morphology of grass growth and how it affects utilization. Journal of Range Management 9:167-170.

Stevens, O.A. 1963. Handbook of North Dakota plants. North Dakota Institute for Regional Studies, Fargo, ND. 329p.