

**Plant Materials Center  
Bismarck, North Dakota**

# Technical Report, 2004-2006

Part 1 of 2: Grasses, Forbs, and Legumes

Prairie sandreed  
*Calamovilfa longifolia*



Hitchcock, A.S. 1951. *Manual of the Grasses of the United States*. United States Department of Agriculture. Miscellaneous Publication No. 200.

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**United States Department of Agriculture  
Natural Resources Conservation Service  
Bismarck Plant Materials Center**

## **Technical Report**

### **Part I (Grasses, Forbs, and Legumes)**

**2004-2006**

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**PART I**  
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# **INTRODUCTION**

## **INTRODUCTION: TECHNICAL REPORT – 2004-2006**

### **Plant Materials Problems and Needs**

The USDA Natural Resources Conservation Service (NRCS), Plant Materials Center (PMC), Bismarck, North Dakota, primarily serves the states of North Dakota, South Dakota, and Minnesota. Activities are directed toward meeting the needs and priorities set forth in the three States' long-range programs.

### **Objectives and Functions**

1. Identify, select, and improve plants to meet the resource conservation needs of the three States.
2. Determine cultural techniques for successful propagation and establishment of these plants.
3. Assemble and comparatively evaluate materials on and off the PMC.
4. Make comparative field plantings for final testing of promising plants and techniques with conservation districts and cooperators.
5. Work with universities, experiment stations, and other State and Federal agencies to cooperatively release improved conservation plants.
6. Produce limited quantities of foundation or foundation quality seed, which is made available to commercial seed growers for establishing seed increase fields.
7. Encourage conservation districts, commercial seed growers, and commercial and State nurseries to produce adapted plant materials and named cultivars.
8. Promote these materials in conservation programs.

**Long Range Plan 2001-2005**

<b>PLANT MATERIALS NEEDS AND PRIORITIES SUMMARY</b>
<b>Native Prairie Ecosystems Restoration</b> <ul style="list-style-type: none"><li>- identify additional species</li><li>- develop propagation, enhancement, establishment, and management technology</li><li>- develop sources</li></ul>
<b>Wetland and Riparian Plant Materials</b> <ul style="list-style-type: none"><li>- identify additional species</li><li>- develop propagation, enhancement, establishment, and management technology</li></ul>
<b>Streambank and Lakeshore Stabilization</b> <ul style="list-style-type: none"><li>- identify suitable species</li><li>- develop propagation and establishment techniques</li></ul>
<b>Riparian Plant Materials and Methods</b> <ul style="list-style-type: none"><li>- identify suitable species</li><li>- develop establishment and management technology</li></ul>
<b>Tree and Shrub Related Technology</b> <ul style="list-style-type: none"><li>- increase species diversity and adapted varieties</li><li>- windbreak improvement and renovation</li><li>- need additional tall tree species</li><li>- need improved native shrub species</li></ul>
<b>Warm Season Grass Promotion and Development</b> <ul style="list-style-type: none"><li>- identify species for critical areas and develop technology</li><li>- document and promote forage techniques</li></ul>
<b>Saline/Alkaline Tolerant Plant Materials</b> <ul style="list-style-type: none"><li>- identify woody/herbaceous species and develop establishment technology</li></ul>
<b>Filter Strips/Nutrient Management</b> <ul style="list-style-type: none"><li>- document methods of nutrient uptake</li><li>- promote effective plants for waste management systems</li></ul>
<b>Urban Conservation</b> <ul style="list-style-type: none"><li>- promote effective species/varieties</li><li>- promote effective establishment and management technology</li><li>- promote environmental benefits</li><li>- promote backyard conservation</li></ul>
<b>Alternative Income Plants</b> <ul style="list-style-type: none"><li>- promote agroforestry</li><li>- promote potential high income species</li><li>- identify species and technology</li></ul>
<b>Information and Education</b> <ul style="list-style-type: none"><li>- identify and promote perennial plants for wildlife food plots</li><li>- remarket old plant releases</li><li>- promote big bluestem as high quality warm-season pasture</li><li>- identify specific outreach opportunities</li></ul>



**PLANT MATERIALS CENTER LONG RANGE PLAN  
BISMARCK, NORTH DAKOTA  
2006-2010**

**I. Introduction**

The mission of the Plant Materials Program is to develop and transfer effective state-of-the-art plant science technology to meet customer and resource needs. The purpose of the Plant Materials Program is to carry out specialized activities in resource conservation, as part of the overall program of the Natural Resources Conservation Service (NRCS). It is the responsibility of the Plant Materials Center (PMC) to:

1. Assemble, test, and release plant materials for conservation use.
2. Determine techniques for the successful use and management of conservation species.
3. Facilitate the commercial increase of conservation species.
4. Provide for the development and transfer of applied plant science technology to solve conservation problems.
5. Promote the use of plant science technology to meet the goals and objectives of the USDA and NRCS Strategic Plans.

The PMC Long Range Plan (LRP) identifies, guides, and directs PMC operation toward solving high-priority resource problems identified in the States' PMC LRP. The PMC LRP is consistent with goals and objectives identified in the NRCS Strategic Plan, National Plant Materials Program Strategic Plan, and State Strategic Plans. Recommended action items and specific products are identified in individual State Annual Plans which are reviewed and updated annually.

**II. Long Range Plan Development**

The LRP is in accordance with the revised National Plant Materials Manual, Part 540.22. This plan acts as a guide for directing PMC activities within Minnesota, North Dakota, and South Dakota. NRCS representatives from all three states met in Fargo, North Dakota, on March 8, 2006, to determine the basis for this plan. Feedback in the form of survey questionnaires was received from various NRCS offices, conservation districts, and partners in the three States. The "*Plant Materials Program Strategic Plan Survey Responses*" publication (2/7/05) was also used to provide insight and guidance to the decision making process.

**General Description of the Service Area**

**Climate** – USDA Plant Hardiness Zones 2, 3, 4, and 5 are within the area serviced. Precipitation is quite varied both in annual amount and in seasonal distribution, and predominantly occurs in the form of rainfall. Long-term average annual precipitation varies from 12 inches to 35 inches. The growing season ranges from 95 days to 155 days. The titles of the four Land Resource Regions include:

- Northern Great Plains Spring Wheat
- Western Great Plains Range and Irrigated
- Central Feed Grains and Livestock
- Northern Lake States Forest and Forage

A detailed description of the major land resource areas, land use, and climate may be found in the reference “*Land Resource Regions and Major Land Resource Areas of the United States,*” Agricultural Handbook 296.

### **III. Goals**

Three broad-based goals have been identified.

#### **Goal 1:**

- Identify and evaluate plants and develop technology for their successful establishment and maintenance to solve natural resource problems.

#### **Goal 2:**

- Provide plant materials and plant technology that are economically feasible for solving conservation problems and to meet emerging energy and environmental needs.

#### **Goal 3:**

- Provide equal access for all Americans to the Plant Materials Program. All products and services must be delivered fairly and equitably. Promote the increased use of plant materials to address human health, safety, cultural, and aesthetic issues.

### **IV. Plant Materials Priorities and Resource Concerns**

#### Native Prairie Ecosystems Restoration

- Identify additional species and develop sources.
- Develop establishment and management protocol.
- Market PMC releases.

#### Warm-Season Grass Promotion and Development

- Promote economic as well as conservation benefits.
- Promote the benefits of big bluestem.
- Promote proven management techniques to minimize invasive species.
- Select a switchgrass or other native species as alternatives to smooth brome in grassed waterways.

#### Tree and Shrub Related Technology

- Increase species diversity in windbreaks.
- Identify/develop additional tall tree species.
- Identify/develop additional native shrub species.
- Identify and promote alternatives for invasive species.

#### Wetland and Riparian Plant Materials

- Identify/develop additional species.
- Develop establishment and management protocol.

#### Saline/Alkaline Tolerant Plant Materials

- Develop and distribute information.

#### Filter Strips/Nutrient Management

- Develop/promote effective plants for nutrient uptake.

#### Streambank and Lakeshore Stabilization

- Develop establishment and management protocol.

Information, Education, and Outreach

- Promote the value of PMC releases.
- Identify and promote perennial plants for wildlife food plots.
- Remarket older plant releases.
- Target specific outreach opportunities to non-traditional clientele.

Alternative and Specialized Use of Conservation Plants

- Utilize agroforestry technology.
- Recognize alternative income species.
- Promote switchgrass as a biomass fuel for energy savings.


Urban Conservation


- Provide information on effective species/varieties.
- Promote native landscaping as low energy and reduced maintenance.
- Sell the economic as well as the environmental benefits.


**V. Partners and Cooperators**

Plant Materials Program activities are conducted in cooperation with universities, State and Federal agencies, industries, conservation groups, soil and water conservation districts and associations, and others. The primary customers are the NRCS field offices in Minnesota, North Dakota, and South Dakota. Improved plant materials will be released with cooperating agencies, Agricultural Experiment Stations, and State crop improvement associations. Seed growers and conservation nurseries will be kept informed of the availability of new plants and production techniques.

Approved by: Bismarck Plant Materials Center Advisory Committee

  
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Date

  
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Date

  
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Date

## **Location**

The Bismarck Plant Materials Center is located in south central North Dakota, near the center of the North American landmass. It is on the east bank of the Missouri River in a shallow basin 7 miles wide and 11 miles long. Elevation is 1,647 feet, latitude 46°46'N and longitude 100°45'W.

## **Physical Facilities and Evaluation Sites**

The PMC does not own land but manages a total of approximately 138 acres split among three separate sites within 25 miles of each other. These locations are:

1. Lincoln-Oakes Nursery, Bismarck, North Dakota. The USDA Natural Resources Conservation Service, Plant Materials Center operates under a cooperative working agreement with the North Dakota Association of Soil Conservation Districts (NDASCD). The Association owns and operates the Lincoln-Oakes Nursery which in turn provides the PMC with 70 acres of land located on the nursery. This site is primarily used by the PMC for foundation quality grass seed production. The PMC shares a building site with the Nursery, with the NRCS buildings located on the north part of the acreage. Buildings include an office, greenhouse, lathhouse, machine storage shed (housing tree and seed storage refrigeration units), seed cleaning building, chemical storage shed, and a second equipment storage building containing a small shop.
2. North Dakota Game and Fish Department, McKenzie, North Dakota. The Department, under cooperative agreement, provides the PMC with a 24-acre tract on the McKenzie Slough Game Management Area. Since 1972, this site has been used for the initial evaluation of woody plant material established in single row, nonreplicated plots. It is now used for long-term observation of plant performance, as well as seed collection.
3. USDI Fish and Wildlife Service (FWS), Apple Creek Township, Burleigh County, North Dakota. The FWS has granted the use of 44 acres on a Waterfowl Production Area (WPA) near Apple Creek for woody test plantations and seed orchards. Three large assemblies of native shrubs, including chokecherry, buffaloberry, and hawthorn are established on this site.
4. Off-center evaluation sites in Minnesota, South Dakota and North Dakota. These 8 other off-center evaluation sites, located in the three-state area, are cooperative with various state and federal agencies. These locations provide long-term testing sites for trees, shrubs, and grasses evaluated under uniform culture and management. Refer to map, page 11.

## **Soils**

At the PMC, the soil type is a Mandan silt loam. The Mandan series typically consists of deep, well-drained soils formed in silty sediments on uplands and terraces. The surface layer is dark grayish-brown and grayish-brown silt loam 20 inches thick. The subsoil is grayish-brown silt loam 9 inches thick. The underlying material is 28 inches of light brownish-gray silt loam over light brownish-gray loam. Slopes range 0 to 7 percent. Ordinarily, surface runoff is medium and fertility is high. Controlling erosion is the major concern in management. Both soil blowing and water erosion are hazards. This soil is well-suited to small grain, corn, and alfalfa. Capability unit Iie5, windbreak group 3.

## **Climatological Information and 2004-2006 Weather Summary**

Climate of the area is semiarid, typically continental in character. During the summer, there are a few hot and humid days, but the winters are quite cold and fairly long. The relative humidity during the summer is generally low, and high temperature and high humidity are seldom experienced together.

Precipitation averages 16.84 inches per year. Refer to Table 1 (page 9) for 2004-2006 weather data. More than 75 percent of this falls during the six-month period of April through September, and 50 percent normally falls in May, June, and July. Most summer precipitation occurs during thunderstorms that occur about 34 days per year. Damaging hail occurs about once in 10 years.

The winter season begins in late November and continues until late March. Nearly all winter precipitation is snow, often associated with strong winds and low temperatures. Snow has been reported for all months except July and August. Occasional winter blizzards can be severe.

Temperatures range from an average mean of 6.7 degrees F in January to a mean of 70.4 degrees F in July. During short periods, the temperatures may climb as high as 100 degrees F in summer or drop as low as -40 degrees F in winter. Frequent clear and partly cloudy days contribute to a high percentage of possible sunshine, with the total annual average about 2,700 hours out of a possible 4,470 hours. The average wind speed is a little less than 11 miles per hour, with a prevailing direction from the west-northwest. April and May are the windiest months. The average freeze-free period is 134 days from mid-May to late September.

**Table No. 1: 2004-2006 Weather Summary - Official Station - Bismarck, North Dakota**

Month	Mean Temperature				Precipitation (inches)							
	(degrees Fahrenheit)				Actual				Deviation from Normal			
	2004	2005	2006	Normal*	2004	2005	2006	Normal*	2004	2005	2006	
January	7.7	9.5	26.8	10.2	0.59	0.36	0.18	0.45	0.14	-0.09	-0.27	
February	17.4	24.0	20.1	18.1	0.31	0.11	0.20	0.51	-0.20	-0.40	-0.31	
March	35.2	32.5	31.4	29.7	1.25	0.54	0.54	0.85	0.40	-0.31	-0.31	
April	45.9	48.7	49.8	43.3	0.78	1.04	0.73	1.46	-0.68	-0.42	-0.73	
May	53.6	53.7	57.5	56.0	1.39	2.37	1.77	2.22	-0.83	0.15	-0.45	
June	61.6	67.6	67.8	64.7	3.17	6.23	0.83	2.59	0.58	3.64	-1.76	
July	70.1	72.2	77.2	70.4	2.83	2.65	0.58	2.58	0.25	0.07	-2.00	
August	64.4	68.1	71.6	69.0	2.29	2.87	2.50	2.15	0.14	0.72	0.35	
September	61.1	61.3	57.0	57.7	2.08	0.26	1.74	1.61	0.47	-1.35	0.13	
October	46.0	46.9	41.5	45.2	1.09	1.21	1.11	1.28	-0.19	-0.07	-0.17	
November	35.1	33.7	29.8	28.0	0.14	0.74	0.09	0.70	-0.56	0.04	-0.61	
December	22.0	19.5	23.4	15.2	0.18	0.84	0.83	0.44	-0.26	0.40	0.39	
<b>Annual</b>	<b>43.3</b>	<b>44.8</b>	<b>46.2</b>	<b>42.3</b>	<b>16.10</b>	<b>19.22</b>	<b>11.10</b>	<b>16.84</b>	<b>-0.74</b>	<b>2.38</b>	<b>-5.74</b>	
*National Climate Data Center 1971-2000 Monthly Normals												
					<u>2004</u>	<u>2005</u>	<u>2006</u>					
				Last Frost (28 degrees)	14-May	15-May	12-May					
				First Frost (28 degrees)	28-Sep	6-Oct	28-Sep					
				Frost Free Period	136 days	143 days	138 days					

## **REGIONAL DESCRIPTION**

## **REGIONAL DESCRIPTION: TECHNICAL REPORT – 2004-2006**

### **Major Land Resource Areas**

The three States served by the PMC, North Dakota, South Dakota, and Minnesota, include portions of 23 Major Land Resource Areas in four Land Resource Regions. They are the Northern Great Plains Spring Wheat Region, Western Great Plains Range and Irrigated Region, Northern Lake States Forest and Forage Region, and the Central Feed Grains and Livestock Region.

### **Potential Natural Vegetation**

Most of central and western North and South Dakota support a mixed grass prairie of predominantly western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), needleandthread (*Hesperostipa comata*), slender wheatgrass (*Elymus trachycaulus*), and prairie junegrass (*Koeleria macrantha*). Little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), plains muhly (*Muhlenbergia cuspidata*), sedge (*Carex*), and blue grama (*Bouteloua gracilis*) are the principal climax species on xeric soils, steeper eroded slopes or thin uplands. Prairie sandreed (*Calamovilfa longifolia*) is important on sandy soils throughout the region. Moist sites support such species as big bluestem (*Andropogon gerardii*) and prairie cordgrass (*Spartina pectinata*). Whitetop (*Scolochloa festucacea*), bulrushes (*Scirpus*), and common reed (*Phragmites australis*) are typical of lowland meadows and marshes. Snowberry (*Symphoricarpos albus*), rose (*Rosa*), buffaloberry (*Shepherdia argentea*), and chokecherry (*Prunus virginiana*) are abundant shrubs in draws and narrow valleys. Rocky mountain juniper (*Juniperus scopulorum*) is common in the western Badlands. Eastern South Dakota, southern Minnesota, and the Red River Valley support vegetation dominated by tall grass prairie species; principally big bluestem, switchgrass (*Panicum virgatum*), and Indiangrass (*Sorghastrum nutans*). Other important species include little bluestem, prairie dropseed (*Sporobolus heterolepis*), porcupine grass (*Stipa spartea*), green needlegrass, and prairie cordgrass. Bur oak (*Quercus macrocarpa*), basswood (*Tilia americana*), hackberry (*Celtis occidentalis*), cottonwood (*Populus deltoides*), and willow (*Salix*) follow major draws and floodplains.

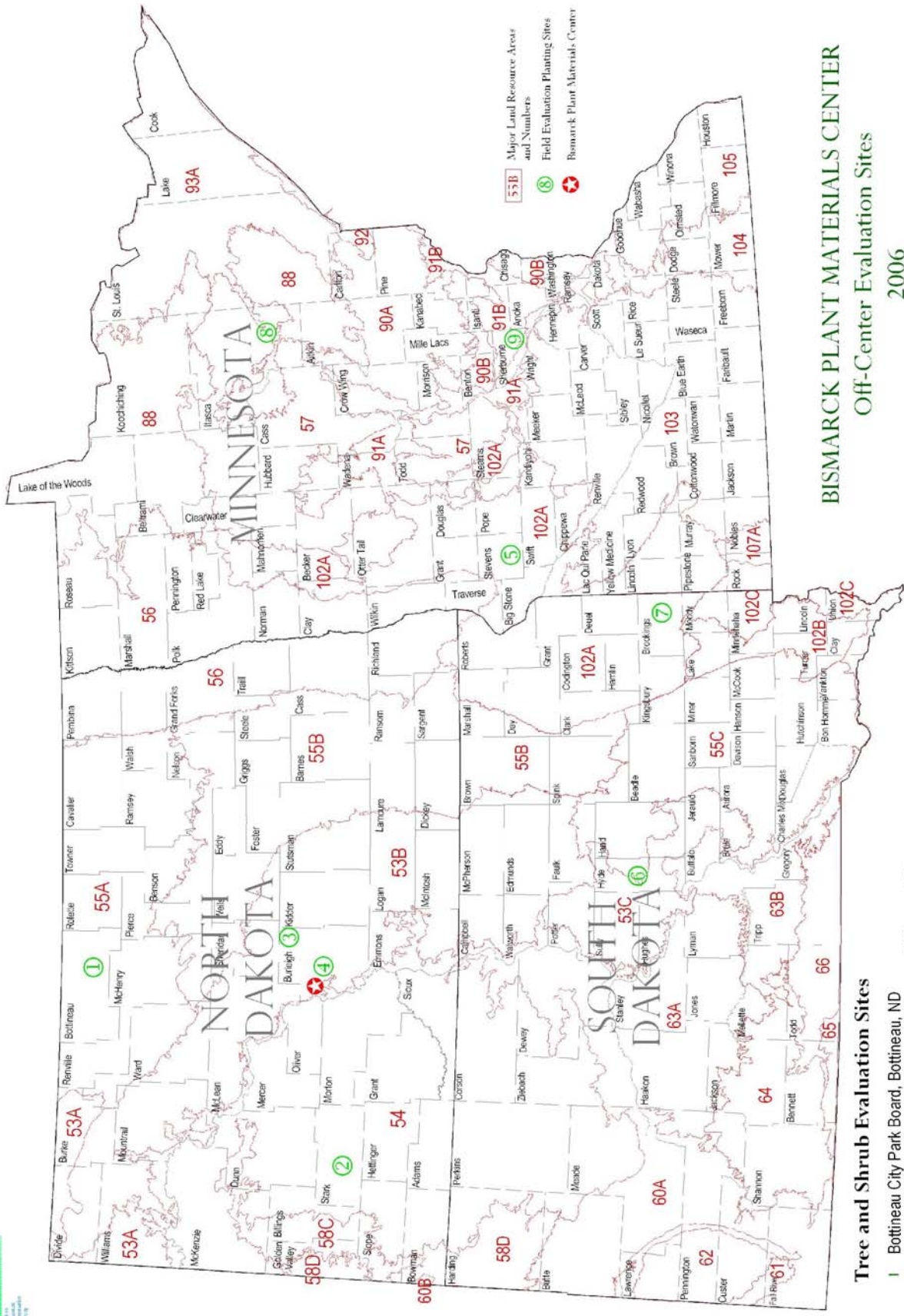
Two distinct forested regions occur within the three-State area. The first is the Black Hills of South Dakota where Ponderosa pine forest (*Pinus ponderosa*) and pine/oak savannas dominate. The second is the northern and eastern sections of Minnesota, which support mixed hardwood and conifer forests. Principal species include oak (*Quercus*), maple (*Acer*), elm (*Ulmus americana*), aspen (*Populus*), jackpine (*Pinus banksiana*), red pine (*Pinus resinosa*), and balsam fir (*Abies balsamea*). Black spruce (*Picea mariana*), tamarack (*Larix laricina*), and white cedar (*Thuja occidentalis*) are typical of lowlands and swamps.

### **Climate and Species Adaptation**

North Dakota and Minnesota are the two coldest States in the nation excluding Alaska. Mean annual temperatures range from 36 degrees F to 48 degrees F for all reporting stations. Plant hardiness zones (USDA) vary from 3 to 4 with mean minimum temperatures between -10 degrees F and -50 degrees F. Annual precipitation varies from 13 inches in western North Dakota to 30 inches or more in southeast Minnesota. Growing seasons are short, averaging from 110 to 150 days. The central and western Dakotas are principally semiarid in nature while the eastern Dakotas and Minnesota are considered subhumid.



## **MAPS**



**BISMARCK PLANT MATERIALS CENTER**  
 Off-Center Evaluation Sites  
 2006

**Herbaceous/Misc. Plants Evaluation Sites**

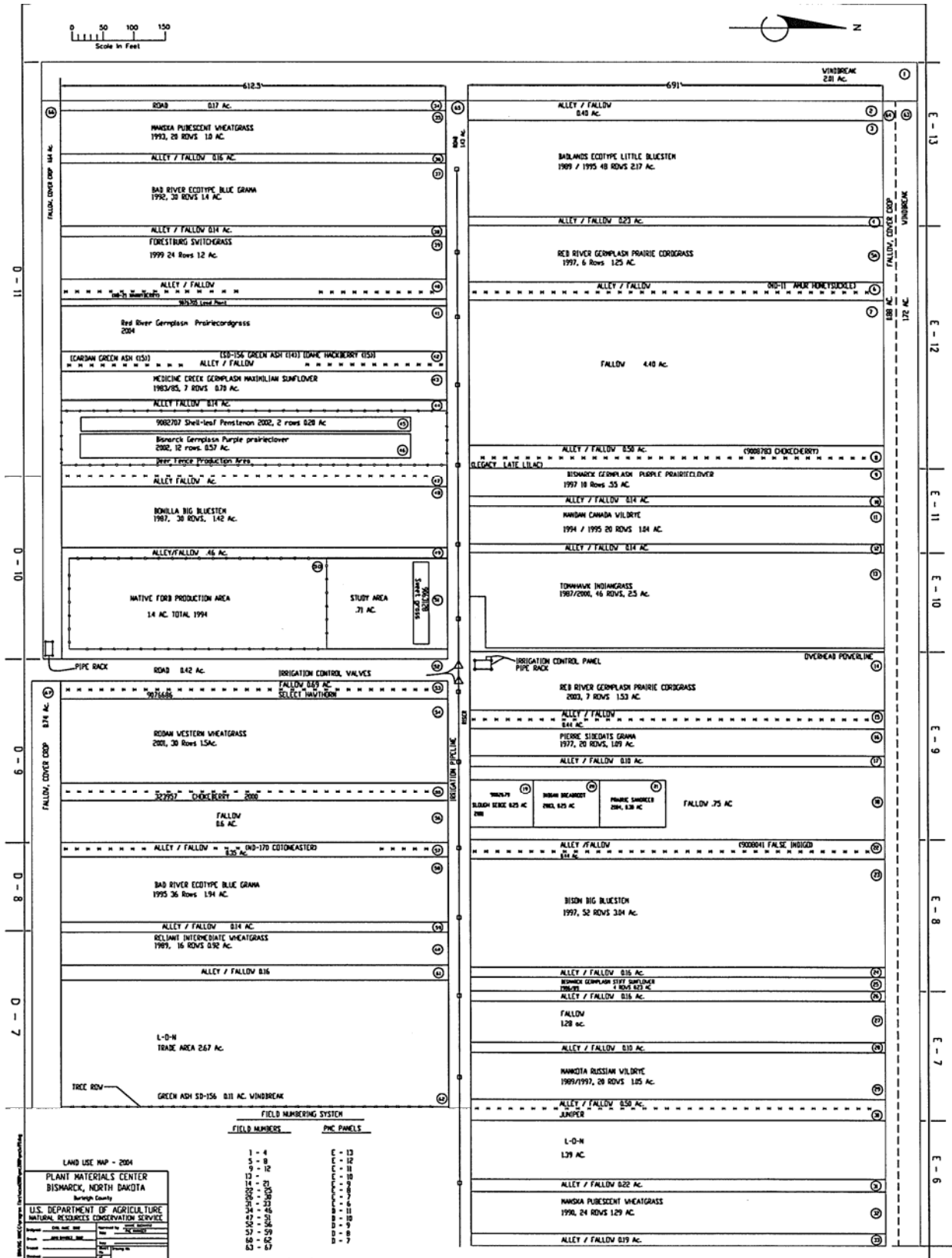
- 3 North Dakota Game & Fish Department, Burleigh Co., ND
- 7 Eastern South Dakota Soil & Water Research Farm, Brookings, SD

**Tree and Shrub Evaluation Sites**

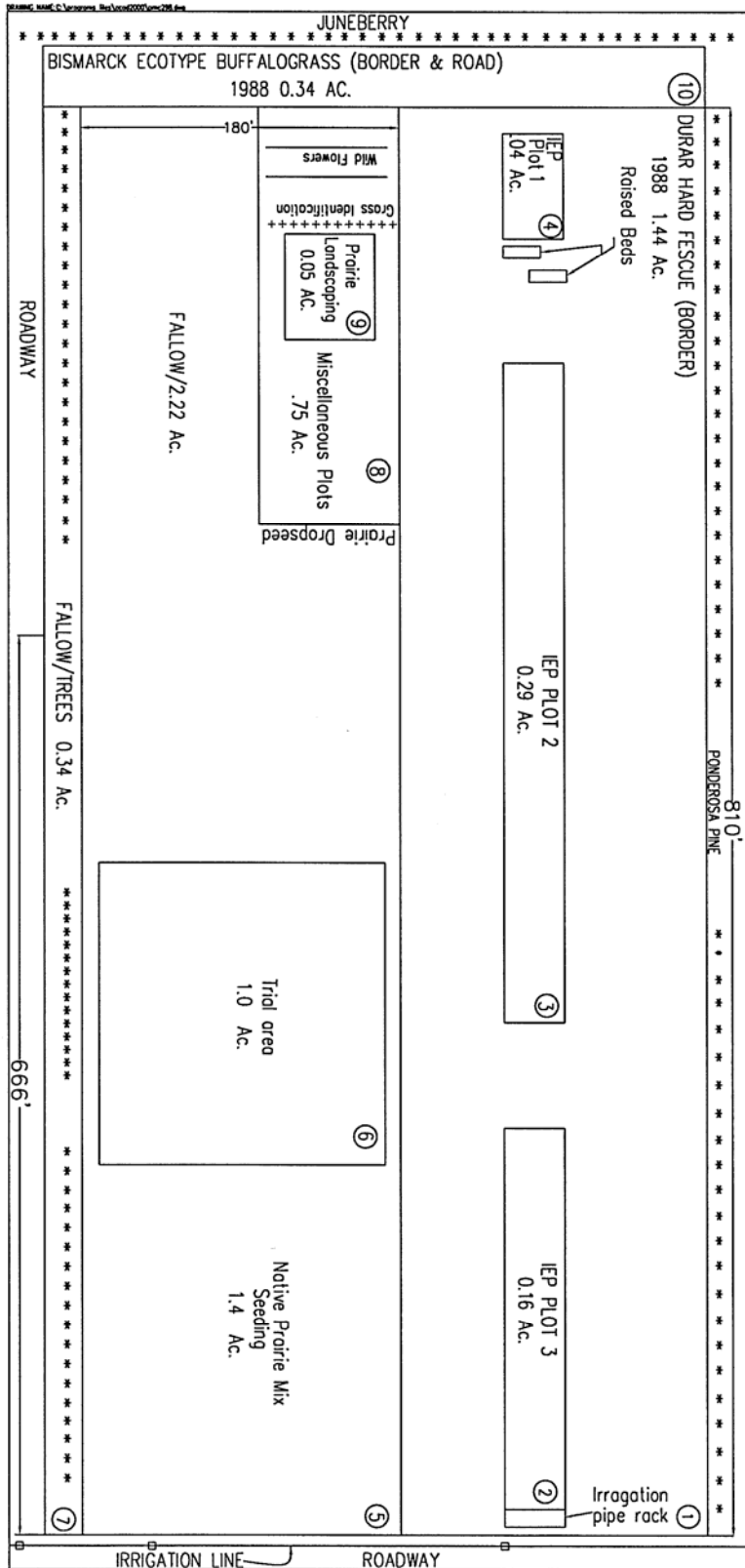
- 1 Bottineau City Park Board, Bottineau, ND
- 2 NDSU, Dickinson Research Extension Center, Dickinson, ND
- 4 USDI Fish & Wildlife Service, Apple Creek Twp., Burleigh Co., ND
- 5 Univ. of Minn., West Central Research & Outreach Center, Morris, MN
- 6 SDSU, Central Crops & Soils Research Station, Highmore, SD
- 8 Univ. of Minn., North Central Research & Outreach Center, Grand Rapids, MN
- 9 Univ. of Minn., Sand Plain Research Farm, Becker, MN



# PMC Land Use Map - 2004



PMC Land Use Map, Panel A - 2004

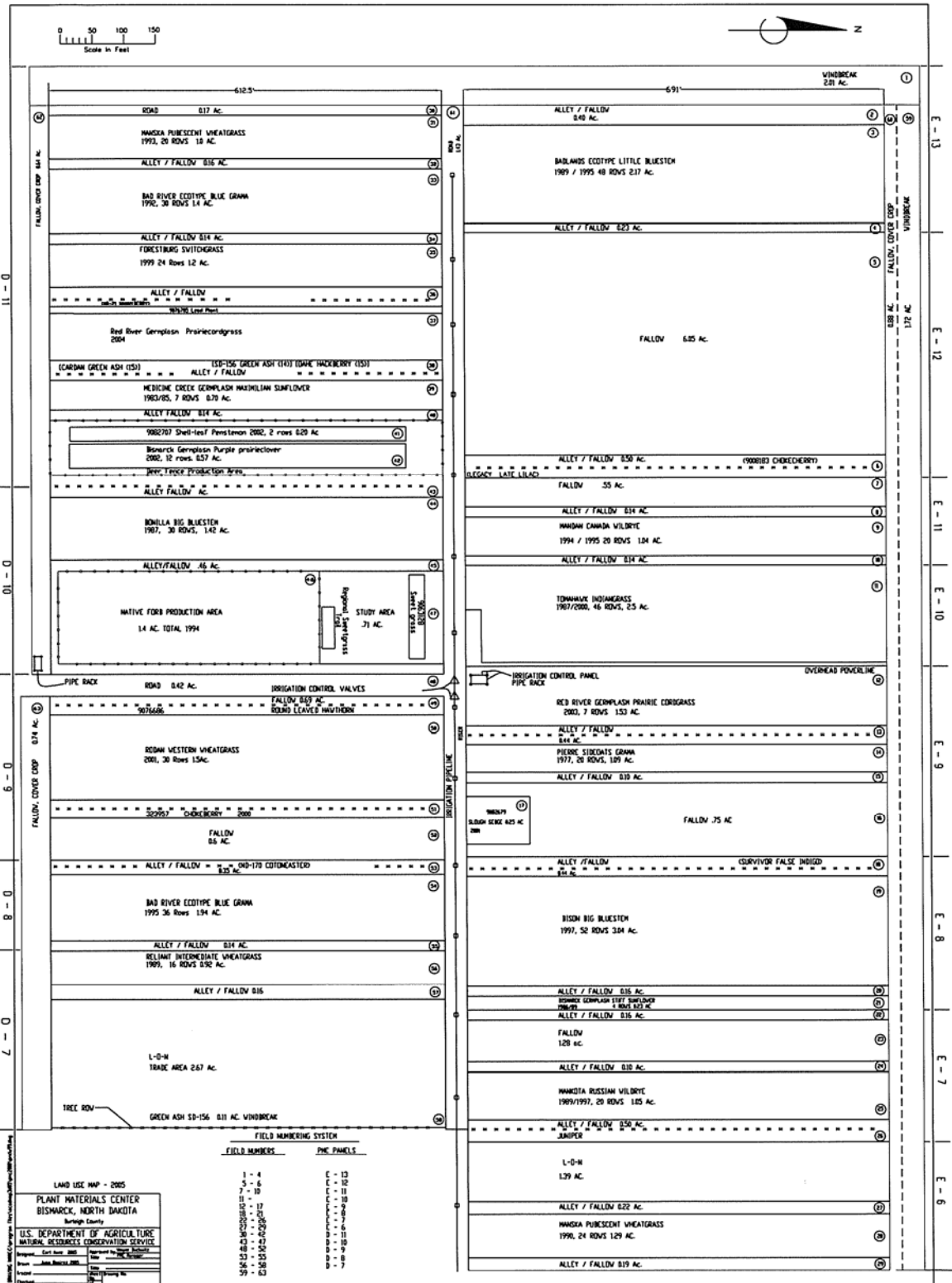


PANEL A  
SCALE: 1" = 50'

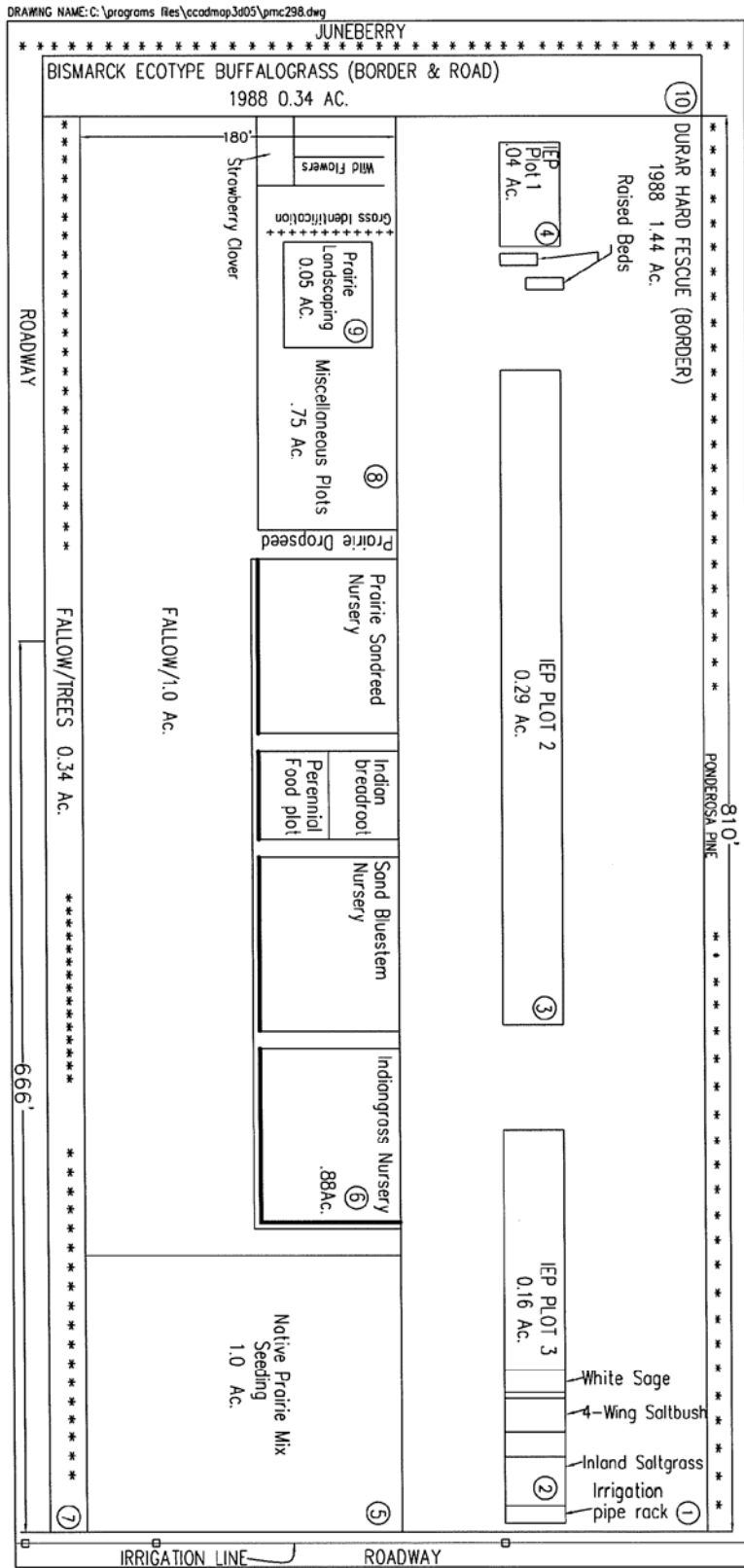
REVISED: 3/2004



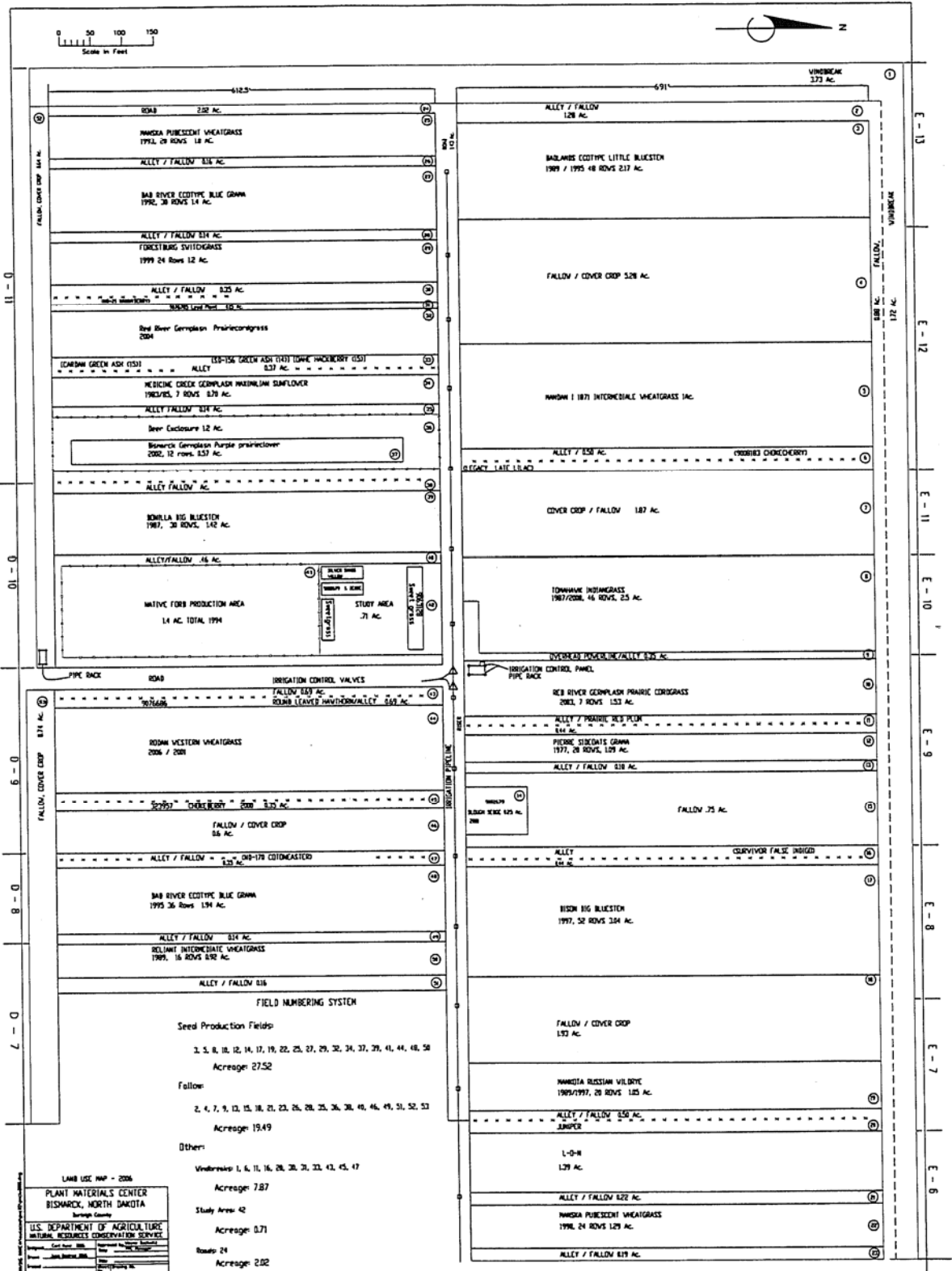
# PMC Land Use Map - 2005



PMC Land Use Map, Panel A - 2005

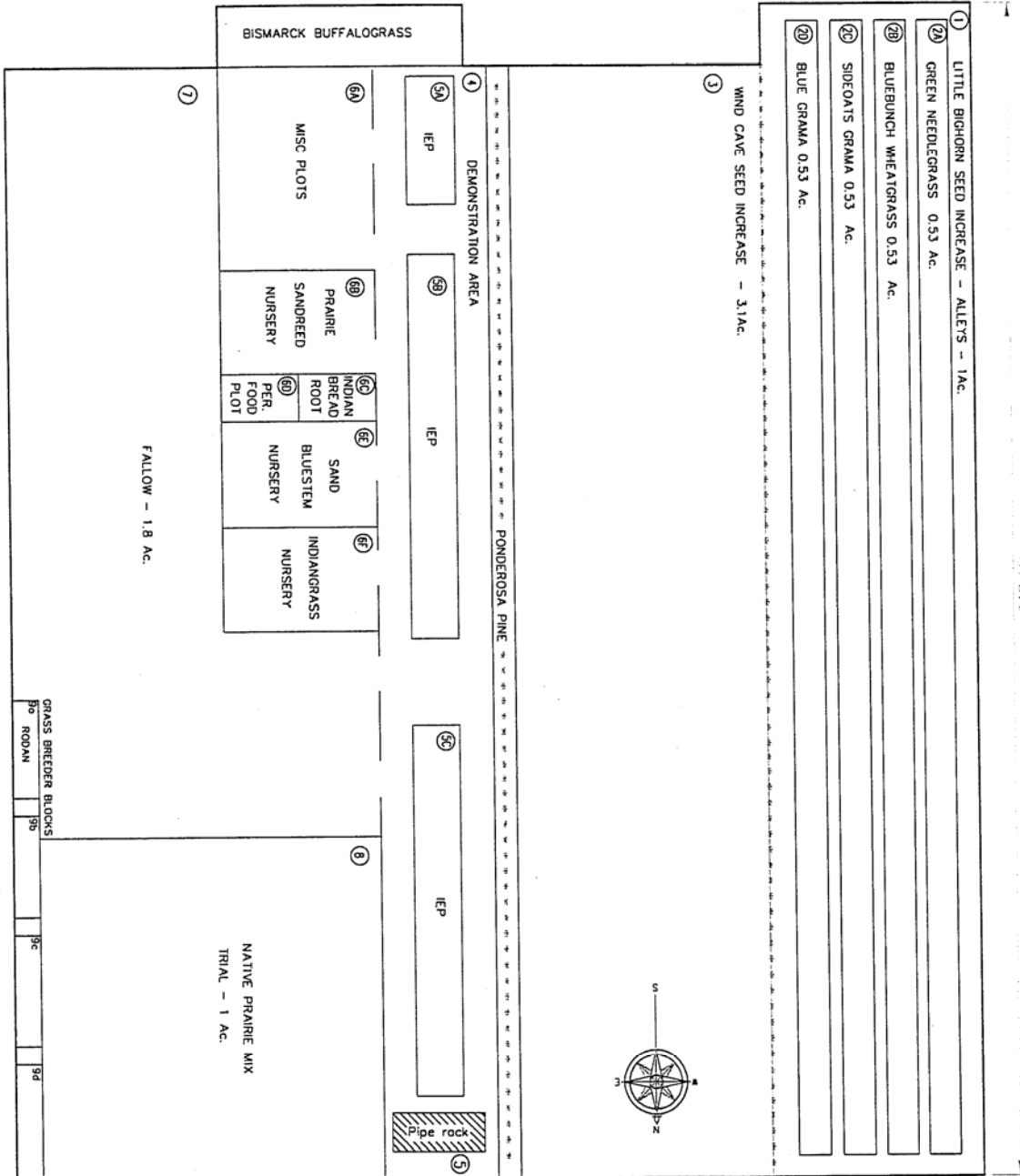


PMC Land Use Map - 2006





PMC Land Use Map, Panel A - 2006



## **ACTIVE STUDIES**

## ACTIVE STUDIES: TECHNICAL REPORT – 2004-2006

### Study 38I027W

Study Title: Evaluation of slough sedge, *Carex atherodes*

Introduction: Wetlands are important, diverse, and productive ecosystems. Wetlands are one of the most important producers of hay and forage in the prairie pothole region of the north central US and south central Canada (Higgins). Many of these areas have been drained or disturbed in the past. Restoration, enhancement, and creation efforts increase the demand for seed of adapted species. Plant materials for such endeavors are limited. The Bismarck Plant Materials Center initiated collection and evaluation of *Carex atherodes* in response to meeting a small part of this need.

*Carex atherodes* is most commonly called slough sedge. Other names include awned sedge and wheat sedge. Slough sedge tolerates light to moderate grazing but decreases with heavy grazing. Mowing of a wetland with whitetop and slough sedge tends to favor the whitetop. Slough sedge tolerates or may be favored by burning (Fulton et.al. 1986). According to Hubbard (1984), multiple harvest of slough sedge in the same season are not recommended. Research in Alberta has shown that more than two cuts in a growing season reduces yields and vigor of the plants, and that two cuts (one early and one late) produce the same yield as one late season cut. He indicates that the optimum time to harvest is when seeds are mature and ready to shatter. At this stage, the energy reserves are past the annual low point, yields should be close to maximum, and crude protein and digestibility are acceptable.

Native Americans of the Thomson Tribe used *Carex atherodes* as fodder for animals. "Swamp hay" was also softened by rubbing and used as insoles for moccasins (Moerman 1998).

Objective: The purpose of the study is to evaluate growth habit of *Carex atherodes* with intent to release a seed-propagated selection adapted to North Dakota, South Dakota, Minnesota, and south central Canada. Expected uses are wetland restoration, enhancement, and creation.

Cooperators: USDA, NRCS Plant Materials Center, Bismarck, North Dakota  
USDA, NRCS of North Dakota, South Dakota, and Minnesota  
Ducks Unlimited, Canada

Description: It is a perennial herb with thickened rootstocks, which are long scaly rhizomes. It is loosely tufted, growing in loose clumps. The leaves are 3-12 mm long. There are few to several to a culm and are not clustered at the base. The blades are thin, flat, and elongated. They are up to ½ inch broad. Blades are mostly smooth on the upper surface, and hairy on the lower surface. The sheaths are hairy, brown, reddish or purple tinged. They are deeply concave at the mouth and the basal sheaths become filamentous at maturity. The bracts are leaf-like and exceed the inflorescence. Male and female flowers are in separate spikes that are sessile or short peduncled. There are 2-6 male (staminate) spikes. These are terminal. There are 2-4 erect, cylindrical female (pistillate) spikes found below the male spikes. They range from 2-12 cm long. There are three stigmas. The perigynium is the saclike or scalelike structure that completely encloses the ovary or achene. It is ovoid, 6-11 mm long, and many nerved. It tapers into a smooth beak with teeth that are smoothed and recurved. The beak ranges from 1.2-3mm long. The seed is an achene. It is 2-3.2 mm long and 1.2-1.5 mm wide. It is three-sided with blunt angles and is brown in color.

Distribution: It is a freshwater wetland species found naturally circumboreal, in North America south to New York, Missouri, Nebraska, Colorado, Utah, and Oregon (Larson 1993). In large wetlands, it grows in the shallow marsh zone along with whitetop, marsh smartweed, giant burreed, and numerous forbs (Higgins 1984). It can be found in various other locations including wet meadows, ditches, stream

and pond margins, usually in shallow water (Larson 1993). It is characteristic of seasonal wetlands in the prairie pothole region. Seasonal wetlands are usually ponded for 1-2 months. They may be dry in drought years and contain water in high precipitation years (Hubbard 1984).

### **Methods and Materials**

Seed was collected in North Dakota, South Dakota, Minnesota, Manitoba, and Saskatchewan. This seed was propagated in a germination chamber with controlled temperature and light. The plants were grown in the greenhouse and planted in Panel A at the Plant Materials Center. This assembly was evaluated in 1998, 1999, and 2000. In 2000, seed was collected from selected individual plants in Panel A. Collected seed from each accession was kept separate and propagated in a germination chamber and grown in the greenhouse. These seedlings were transplanted to a field in Panel E-9 at the Plant Materials Center. This field is intended to be the foundation field for seed increase. Rhizomes are also being evaluated as a propagation material because of the poor seed set of the specie. Following are the details of the collection, propagation, assembly and evaluation.

Collection/Assembly: Seed was collected from July through August of 1997 by various Area, Field Office, and Plant Materials personnel of USDA, NRCS, and Ducks Unlimited, Canada. Small amounts of seed (< 50 grams when cleaned for each accession) comprised each collection. Collections were from various sites in South Dakota, North Dakota, Minnesota, Manitoba, and Saskatchewan. Seed was hand stripped or heads were clipped from numerous plants at a site. A separate accession number was assigned to composited seed from each collection site. Table SS-1 provides collection details.

Seed Processing: Perigynium was removed from seed by rubbing seed over a rubber corrugated rub board and running through a food blender on the lowest setting. Chaff was removed using pan screens and a South Dakota Seed Blower. Seed weights of four accessions were calculated. Seed was counted out by hand at the PMC and weighed on a Mettler Balance scale at the USDA, ARS in Mandan, ND. A range exists for weight of 500 seeds. The average number of seeds per pound ranges from 218,000 to 243,000 depending on method of calculation. Table SS-2 is a list of weights.

Propagation of Collection - 1998: Seed amounts were minimal for propagation. Preliminary data in germination boxes at room temperature indicated a low germination. Scarification by rubbing seed between medium textured sandpaper and soaking some seeds in hot tap water were used in an attempt to enhance germination. Seed was planted on blue blotters soaked with distilled water. One hundred seeds/box were planted. Light and temperature in the germination chamber was set at 30°C/20°C alternating temperature and 12 hours light/12 hours dark alternating with the temperature. Table SS-3 lists germination of accessions. Once seed germinated, seedlings were transplanted to cone-tainers in the greenhouse, using a tweezer to remove seedlings from the germination boxes. Size of the plants was less than 1" when transplanted. Approximately 14 plants from each of the accessions that germinated were transplanted to cone-tainers. The remainder of the seedlings in the boxes was discarded. A medium of peat, perlite, and vermiculite was used in the cone-tainers.

#### **Field Panel A**

Planting Plan: Once hardened off in the lath house, seedlings were transplanted to a plot in panel A at the Plant Materials Center. Figure SS-1 is a map of the field planting in panel A.

Maintenance: The site was prepared for planting by tilling and harrowing. The field was devoid of growing weeds at the time of transplanting. A berm, approximately 1-2 feet in height was constructed on all four sides of the field to pond water.

1998	1999	2000	2001
hand weeded	hand weed	alley strips mowed 5-6 rows	Buctril for weeds at 1 pt/acre on July 2 <sup>nd</sup> .
walk behind roto-till	walk behind roto-till	residue clipped to 2-3" with sickle mower-October	Mowed off residue in fall
Irrigation 2X	removal of berm for weed control		
	mowed off residue in fall		

Evaluations:

1998-1999: Plants were evaluated in September of 1998 and June of 1999. Table SS-4 is a composite of data collected for each plant. By the end of the growing season in September of 1999, plants had spread extensively by rhizomes. This made it difficult to define individual accessions. A few plants initiated flowering in 1999. No seed was harvested. Forage samples were collected on 6/11/99. Twenty stems were clipped at a 2-3 inch stubble height from each plant. Accessions were randomly selected for clipping. Samples were tested by the Regional Plant and Water Testing Laboratory, Jamie L. Whitten Plant Materials Center at Coffeerville, MS. See Table SS-5 for test results.

2000-2002: After visual observation and consideration of measured data collected in 1998, twenty plants from the initial crossing block (Panel A) were selected for seed set, vigor, and leafiness. Seed was hand harvested from the selected plants. As *Carex atherodes* is cross pollinated, half of its parentage is known. Table SS-6 is a list of the parent plants from which seed was collected. Fine and wide leaf characteristics are indicated. Seed amounts collected were minimal, all collections being less than 100 grams. Seed was cleaned by rubbing off perigynium and separating chaff using pan screens. Germination tests in potting soil and on blotters were conducted. Results can be found in Tables SS-7 and SS-8. Seed was propagated in 2001 in a germination chamber and the greenhouse. These seedlings were planted to start the field in Panel E-9. In the fall of 2001, rhizome material was dug from Panel A to be planted. Following, in the next segment, is a description of procedures for evaluating the rhizome material from Panel A.

2003: The assembly in Panel A was destroyed using glyphosate and cultivation.

Rhizome Planting Methods: Rhizomes were dug from the edge of the original assembly block in Panel A on November 14, 2001. Rhizomes were separated into single or a few stalk units. Rhizomes were pruned 2-6 inches, depending on the plant. Top leaves were cut to a 2-4 inch length. These rhizomes were planted at a site at Horizon Middle School in Bismarck, ND, the same day. Rhizomes were planted going down the slope from the estimated water line on a drainage basin area with a water control structure. The site had been tilled prior to planting and the soil was moist, but not wet. Few or no weeds were visible. Approximately 50-75 rhizomes were planted around the structure. Three rhizomes were planted in a group. They were planted 1-2 feet apart in a row going down the slope. In this same area, three rhizomes of *Spartina pectinata* were planted going up the slope. The rhizomes were planted 2-6 inches deep. A spade was used to make an opening in the soil. The rhizomes were covered over with soil and packed in by stepping.

Approximately 50 additional rhizomes, dug on November 14, 2001, were stored and intended to be planted in the spring of 2002. The rhizomes were placed in two-gallon plastic freezer bags that were punctured for aeration. Wetted sphagnum moss was packed around the rhizomes in these bags and placed in a tree cooler at Lincoln-Oakes Nursery. The temperature maintained in the cooler was

approximately 25-35°F. On 5/16/2002, rhizomes were removed from the cooler and planted to a row in panel D-10, adjacent to a dormant planting of *Spartina pectinata* rhizomes. The rhizomes were planted using a tree planter.

Rhizomes were dug in the spring of 2002 from the edge of the field in Panel A and used for demonstrations and shoreline stabilization projects.

#### **Field Panel E-9**

Planting Plan: Seedlings grown from seed of selected plants in Panel A were planted to panel E-9 on May 29, 2001. Seedlings were planted by hand using a cone-tainer planting bar. Figure SS-2 is a map of the accessions planted.

Maintenance: Seedlings were irrigated after planting to aid establishment.

2001: handweeded

2002: handweeded, residue from 2001 removed in early spring

2003: residue removed in early spring by mowing and raking

2004: mowed and residue raked in early spring

2005: A fairly complete burn was done in late April with little or no residue remaining.

2006: tillage around edge of plot

Seed Harvest: No seed was harvested in 2001, the year of establishment, from Panel E-9. A small amount of seed was hand harvested in 2002. No seed was harvested in 2003. In 2004, a small amount of seed was produced, but was not harvested. No harvest in 2005 or 2006.

Forage Quality: Samples were harvested mid September/early October 2002 from plants for forage analyses. Three stems were clipped from randomly selected plants throughout the field in Panel E-9. The forage consisted of leaves and stem material. The stalks were clipped 2-3 inches from ground level. Ten random samples were collected. The samples were dried in a forage dryer at 30-40 degrees C. On 11/19/2002, samples from 3 bags were bulked together and named sample 1. Three other samples were also bulked and named sample 2. These two samples were then sent to SDSU Station Biochemistry lab for analyses of ADF, NDF, and crude protein. See Table SS-9 for results.

Field Plantings: Bareroot plant/rhizome pieces were distributed for field plantings and demonstrations beginning in 2003.

2003: 850 rhizomes at 16 locations (field plantings)

2004: 800 rhizomes at 17 locations (field plantings); 600 rhizomes at 3 locations (demonstrations)

2005: 250 rhizomes at 3 locations (demonstrations)

#### **Field Panel D-10**

2005: Rhizomes were dug in the fall of 2005 from field E-9. Attempts were made to dig rhizomes from all accessions represented in the planting. This was to maintain germplasm from all selected accessions. Rhizomes were planted in two 34-ft long rows shortly after digging. Rhizomes were irrigated right after planting to establish plants.

2006: All rhizomes from E-9 established plants in field D-10. Weeds were controlled by hand weeding.

### **Results and Discussion**

Original seed collections were from a wide area of collection in North Dakota, South Dakota, Minnesota, and parts of Canada. It was difficult to distinguish the species from other *Carex* at some locations. Misidentified species were separated from the collection and planted in a separate row of the assembly.

Some of the original seed collections exhibited smut in the heads and kernels, indicating some disease of the species.

Propagation from seed is difficult for the species. Differences exist in germination of seed from plant to plant grown in the same environment. Seed coat treatments of scarification and hot water soaking only slightly improved germination. This indicates dormancy is due to both physical and physiological characteristics. Additional studies, such as dormant seeding or seeding in water, are needed to determine requirements for seed germination of the species. Seed processing was not difficult. Perigynium can be removed by a rubbing action and hulls removed with air. The ease of handling and cleaning of seed is due in part to its larger size and triangular shape.

Once germinated, plants readily grew in the greenhouse. Seedling survival in the original assembly and in the selected seed increase assembly was greater than 95 percent, indicating seedling vigor for the species.

Plants exhibit variation in ability to set seed, as seen in both field assemblies. It is believed that this is at least partially heritable. No one accession, however, was a prolific seed producer under dry conditions, short periods of standing water, or average moisture conditions. Flooded conditions for extended time periods were not tested and may have produced different results. Plant characteristics of leafiness and vigor were also variable and considered heritable. No smut has been found in our field assemblies.

Plants established from seedlings and from rhizomes were very vigorous. Seedlings and rhizomes were growing and producing new plant shoots within the first growing season. The plants growing from planted rhizomes were bigger the first year compared to the seedlings. Planting rhizomes along streambanks and shorelines would get plants established more quickly than from seeding, and would control erosion sooner. However, it may be more feasible to seed large sites.

The leafiness of the species makes it a potential species for haying or grazing. Preliminary forage quality tests indicate a 6-9 percent crude protein in June. Additional studies would be needed to make recommendations of this species for hay or grazing.

Evaluation of the field plantings indicated that survival was generally good (> 50%) where water levels and moisture conditions were adequate throughout the growing season. Plants established more than 2 feet above the waterline generally did not survive. On the wetter sites where the slough sedge did well, local sources tended to volunteer on their own and it was questionable whether planting was necessary.

### **References**

Information on plant distribution, description, plant performance, and use was taken from the following references.

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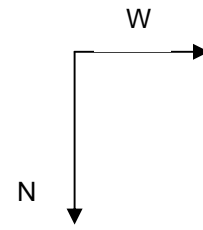
Hurd, E. et al. 1998. Field Guide to Intermountain Sedges. USDA FS Rocky MT Forest and Range Experiment Station. General Technical Report RMRS-GTR-10.



Figure SS-1. Field map of the slough sedge (*Carex atherodes*) evaluation (initial selection block)

Study 38I027W  
 Plant Materials Center  
 Field: Panel A

795	794	793	792	791	790
796	797	798	799	800	801
815	814	805	804	803	802
816	817	818	819	820	821
827	826	825	824	823	822
828	829	830	831	832	833
841	840	839	837	836	835
845	846	847	848 (2)	849	850
856	855	854	853	852	851
857	858	803	849	822	855
827	817	847	856	823	829 (1)
815	796	833	795	851	799
853	818	792	790	814	828
826	825	850	837	852	857
805	804	835	791	840	832
800	801	845 (1)	839	816	802
858	820	794	830 (2)	831	819
797	798	793	821	846	836
821	851	822	796	851	841
791	801	833	794	852	853
803	847	856	855	800	837
840	792	816	820	831	815
802	832	846	826 (1)	804	818
799	825 (1)	795	841	858	819
823	817 (2)	805	827	835	850 (2)
793	798	849	814	857	790
			797	828	824 (1)
813	812	811	810 (1)	809	808
842	843	844	812	844	842
812	844	813	843	808	809
	843	809	813	842	808



\*Planting Date: 6/24/1998

\*Each accession number begins with the prefix 9076

\*3 plants per accession unless noted. (2) indicates that 2 plants were planted.

\*42-inch spacing of plants within and between accessions

\*7 feet to berm (berm removed in 1999 to control weeds)

**Table SS-1. Carex atherodes collection information.**

Accession	State	County	Location	Collector	Collection Date	Dirty(gm) Amount	Clean(gm) Amount
9076790	ND	Eddy	1-66-150	Halko	07/24/97	42	27.6
9076791	ND	Benson	23-153-67	Halko	07/21/97	22.6	14.4
9076792	ND	Stutsman	29-141-63	Anderson	08/01/97	58.6	37.9
9076793	ND	Cass		Anderson	07/29/97	21	7
9076794	ND	Dickey	10-129-64	Anderson	07/25/97	47.2	32.9
9076795	ND	Steele		Anderson	07/29/97	66.1	44.3
9076796	ND	Ramsey	26-156-66	Halko	07/24/97	20.1	3.5
9076797	ND	McLean	10-145-80	Jensen	07/24/97	NA	NA
9076798	ND	Sheridan	2-147-77	Jensen	07/23/97	NA	33.9
9076799	ND	Emmons	22-136-77	Knudson	07/21/97	47.1	27.2
9076800	ND	Ransom	8-134-55	Anderson	07/21/97	29.2	10.7
9076801	ND	Bottineau	8-161-78	Maier, Halko	07/25/97	42.4	25.4
9076802	ND	Bottineau		Poole		NA	6.5
9076803	ND	McHenry	9-156-79	Maier	07/28/97	25.1	10.5
9076804	ND	Ward	3-156-82	Maier	07/28/97	40.9	24.2
9076805	ND	Kidder	1-142-74	Tober	08/25/97	29.2	17.2
9076806	ND	LaMoure	2-136-64	Haas	08/01/97	13.5	2.2
9076814	SD	Minnehaha	19-103-52	Washachek		8.3	2.8
9076815	SD	Roberts	19-126-52	Anderson	07/22/97	53.9	35.6
9076816	SD	Clark	14-119-55	Anderson	07/24/97	NA	29.1
9076817	SD	Marshall	3-126-56	Anderson	07/22/97	35.9	17.3
9076818	SD	Grant	22-120-50	Anderson	07/23/97	26	5.3
9076819	SD	Codington	10-117-53	Washachek	07/24/97	6.8	1.4
9076820	SD	Deuel	35-116-48	Washachek	07/24/97	6.7	1.7
9076821	SD	Lake	2-106-52	Washachek		7.5	1.1
9076822	SD	Day	35-125-53	Anderson	07/23/97	20.4	4.4
9076823	SD	Brookings	5-112-51	Washachek	07/23/97	8.4	2.3
9076824	SD	Moody	36-107-50	Washachek	07/22/97	15.3	7.3
9076825	MN	Marshall	33-156-42	O'Clair	07/29/97	25.9	11.2
9076826	MN	Polk	13-148-45	O'Clair	07/29/97	35.1	15.6
9076827	MN	Roseau	1-163-42	Kittleson	07/30/97	44.1	22.6
9076828	MN	Clearwater	28-149-36	Kollman		4.2	0.2
9076829	MN	Kittson	15-159-45	Kollman	08/14/97	3.1	0.3
9076830	MN	Mahnomen	8-146-42	Kollman	07/30/97	20.6	10.1
9076831	MN	Pope	33-124-36	Oja	08/16/97	8.4	0.9
9076832	MN	Stevens	12-124-43	Haas	08/05/97	13.1	2.5
9076833	MN	Lyon	7-111-40	Luttner	07/28/97	27.4	5
9076834	MN	Lyon	7-111-40	Luttner	07/28/97	6.9	0.1
9076835	MN	Blue Earth	25-108-25	Oja	07/24/97	7.8	0.7
9076836	MN	Brown	27-110-32	Luttner	07/25/97	16.4	6.3
9076837	MN	Brown	20-110-31	Luttner	07/25/97	18.8	4.5
9076838	MN	McLeod	27-116-30	Wolff	08/01/97	4.1	0.8
9076839	MN	Meeker	23-121-31	Wolff	08/01/97	5.2	0.2

9076840	MN	Nicollet	11-110-29	Oja	07/24/97	11	4
9076841	MN	Faribault	3-104-25	Luttner	07/24/97	9.4	1.1
9076845	MAN		22-8-12(w2)	Nazar	08/01/97	NA	0.7
9076846	MAN		7-6-3(w2)	Nazar	07/01/97	NA	NA
9076847	MAN		27-4-18(w2)	Nazar		NA	1.4
9076848	MAN		2-6-7(w2)	Nazar	07/01/97	NA	0.7
9076849	MAN		7-19-18	Wark	07/27/97	NA	4.7
9076850	MAN		29-12-26	Wark	07/31/97	NA	2.5
9076851			18-9-22		07/31/97	NA	8.3
9076852			31-12-18(w1)		07/30/97	NA	2.6
9076853			29-14-3(e1)	Poole	08/14/97	NA	4.8
9076854			1-4-21(w1)	Poole	08/04/97	NA	19.5
9076855			26-14-7(w1)	Poole	08/10/97	NA	3.6
9076856			6-18-26(w1)	Wark	07/31/97	NA	0.3
9076857			19-14-23(w1)	Wark	07/31/97	NA	3.7
9076858			17-5-14(w1)	Poole	08/01/97	NA	14.8

**Table SS-2. Seed counts of selected accessions of *Carex atherodes*, 8/27/1998**

Accession Number	weight of 500 seeds (gms)	Calculated seeds/lb
9076795	1.135	199,819
9076800	0.589	385.051
9076815	1.476	153,655
9076817	0.967	234,535
seeds/lb	217705.78	243,265

**Table SS-3. Germination of initial collections of *Carex atherodes* accessions (1998).\***

accession	16 days	29 days	46 days	59 days	70 days
9076790	1	14	22		
9076790 hw	1	11	30		
9076791	0	1	6	7	8
9076791 hw	0	0	1	8	
9076792	0	5	9		
9076792 hw	2	9	16		
9076793	0	1	1	2	3
9076793 hw	0	4	8	14	
9076794	0	0	1	3	5
9076794 hw	0	1	2	8	10
9076796		0	0	10	
9076796 hw		0	8	35	
9076797	0	3	4		
9076797 hw	1	3	19		
9076798	0	3	20		

**Table SS-3 (continued)**

accession		16 days	29 days	46 days	59 days	70 days
9076798	hw	3	16	34		
9076799		11	17	29		
9076799	hw	18	30	38		
9076800		3	11	18		
9076800	hw	6	33	53		
9076801		0	4	8		
9076801	hw	1	3	15		
9076802		0	0	1	1	1
9076802	hw	0	4	12	12	14
9076803		1	2	7	14	
9076803	hw	0	3	7	12	
9076804		0	2	11		
9076804	hw	0	6	15		
9076805		0	7	13		
9076805	hw	1	15	31		
9076806		0	0	0	0	0
9076808		0	2	14		
9076808	hw	0	9	32		
9076809		0	0	3		
9076809	hw	1	9	20		
9076811	hw		1	1	2	4
9076812		0	0	1	3	
9076812	hw	1	4	8	15	
9076813		21	69	74		
9076813	hw	42	92	93		
9076814		0	1	3	6	
9076814	hw	0	1	4	7	
9076815		4	17	39		
9076815	hw	2	16	52		
9076816		0	2	15		
9076816	hw	0	4	17		
9076817		0	0	0	3	6
9076817	hw	0	0	0		6
9076818		0	0	5		
9076818	hw	1	12	27		
9076819		0	0	4		
9076819	hw	0	2	15		
9076820		0	1	5		9
9076820	hw	1	5	6		14
9076821		0	1	9		15
9076821	hw	0	0	1	13	13
9076823		0	2	3	4	
9076823	hw	0	4	10	15	
9076824		0	0	1	1	1
9076824	hw	0	1	2	2	3
9076825		0	0	0	1	3
9076825	hw	0	0	0	1	4

**Table SS-3 (continued)**

accession		16 days	29 days	46 days	59 days	70 days
9076826		0	1	1	1	2
9076826	hw	1	1	3	3	6
9076827		0	0	3	6	
9076827	hw	0	2	10	15	
9076828		0	5	16	22	
9076829		0	0	1	3	4
9076830		0	0	1		
9076830	hw	0	6	14		
9076831		0	0	1		
9076831	hw	1	9	14		
9076832		0	2	2	4	11
9076832	hw	0	3	5	6	
9076833			0	1	1	3
9076833	hw		0	5	8	13
9076835		0	2	5	7	12
9076835	hw	0	8	11	11	12
9076836		1	1	2	4	5
9076836	hw	0	1	1	1	3
9076837		0	0	6		
9076837	hw	0	1	13		
9076839		0	1	3	5	8
9076840		0	4	11	15	4
9076840	hw	0	3	9	13	
9076841		1	1	2	2	3
9076841	hw	1	3	9	15	25
9076845		0	0	0	0	2
9076845	hw	0	0	1	1	2
9076847		0	0	2	4	4
9076847	hw	0	0	7	9	12
9076848		0	0	0	1	3
9076848	hw	0	0	0	1	2
9076849		0	3	10		
9076849	hw	0	4	21		
9076850		0	0	1	1	2
9076850	hw	0	1	4	6	8
9076851		0	1	6	7	11
9076851	hw	0	9	18	18	19
9076852		0	1	1	4	10
9076852	hw	0	0	1	7	24
9076853		0	5	12		
9076853	hw	1	14	26		
9076854		0	0	0	0	0
9076854	hw	0	0	1	1	2
9076855		1	8	20		
9076855	hw	0	7	24		
9076856		1	11	29		
9076856	hw	0	20	50		

**Table SS-3 (continued)**

accession		16 days	29 days	46 days	59 days	70 days
9076857		3	12	28		
9076857	hw	6	13	32		
9076858		0	0	0	1	3
9076858	hw	0	2	8	11	11

\*Seeds were germinated in a germination chamber set at 20/30 degrees C alternating with 12 hours of dark and 12 hours of light. Small clear plastic boxes lined with blue blotter paper soaked with distilled water held the seed while in the chamber. Boxes were placed in the germinator on 1/12/98. Those entries marked with hw were soaked in hot, but not boiling, tap water prior to planting. Accessions that were a *Carex* species other than *Carex atherodes* were not tested. One hundred seeds per box were planted. Seed was considered germinated if it had a shoot and a root. Percent germination is the number of seeds germinated from planting time up to the number of days indicated. Number of days indicates the number of days elapsed from planting.

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

							Key: Spread: 1=great spread, 3=not spreading			
1998 collection date: 9/24/1998							Amount shoots: 1=many, 3=few to none			
1999 collection date: 6/08/1999							Crown density: 1=dense, 3=open			
							Seed production: 1=good, 3=poor/none			
							Leaf width: 1=fine 3=wide			
plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
1	9076790	1998	1	44	50	2				
1	9076790	1999	1	47	2			1	3	2
1	9076790	1998	2	40	76	1				
1	9076790	1999	2	47	1			1	2	2
1	9076790	1998	3	32	46	1				
1	9076790	1999	3	51	1		dk grn	1	3	2
2	9076790	1998	1	40	33	3				
2	9076790	1999	1	51	2			1	3	2
2	9076790	1998	2	40	60	2				
2	9076790	1999	2	59	2			1	3	2
2	9076790	1998	3	32	62	2				
2	9076790	1999	3	47	2			2	3	2
3	9076790	1998	1	47	80	1				
3	9076790	1999	1	50	2			1	2	2
3	9076790	1998	2	45	90	1				
3	9076790	1999	2	39	1			3	3	1
3	9076790	1998	3	30	85	2				
3	9076790	1999	3	43	2			2	3	2
1	9076791	1998	1	40	53	2				
1	9076791	1999	1	39	2			2	2	2
1	9076791	1998	2	37	100	1				
1	9076791	1999	2	37	1			2	2	1
1	9076791	1998	3	45	85	1				
1	9076791	1999	3	51	1			2	2	2
2	9076791	1998	1	40	70	1				
2	9076791	1999	1	41	1			2	3	2
2	9076791	1998	2	65	86	1				
2	9076791	1999	2	54	1			1	3	1
2	9076791	1998	3	45	80	2				
2	9076791	1999	3	47	1			2	3	2
3	9076791	1998	1	40	55	2				
3	9076791	1999	1	44	2			1	3	2
3	9076791	1998	2	35	80	2				

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
3	9076791	1999	2	48	2			2	3	1
3	9076791	1998	3	45	70	2				
3	9076791	1999	3	62	2			2	1	1
1	9076792	1998	1	44	84	1				
1	9076792	1999	1	31	1			1	2	2
1	9076792	1998	2	48	84	1				
1	9076792	1999	2	34	1			3	2	2
1	9076792	1998	3	40	85	1				
1	9076792	1999	3	33	1			2	3	2
2	9076792	1998	1	33	53	2				
2	9076792	1999	1	31	2			2	3	1
2	9076792	1998	2	39	80	2				
2	9076792	1999	2	37	1			2	3	2
2	9076792	1998	3	45	60	1				
2	9076792	1999	3	48	1			2	3	2
3	9076792	1998	1	39	75	1				
3	9076792	1999	1	29	1			2	3	2
3	9076792	1998	2	40	70	2				
3	9076792	1999	2	41	2			2	3	2
3	9076792	1998	3	40	90	1				
3	9076792	1999	3	46	1			2	3	2
1	9076793	1998	1	45	45	2				
1	9076793	1999	1	58	2		unique 1 in accn	2	2	2
1	9076793	1998	2	44	70	2				
1	9076793	1999	2	56	2			2	3	2
1	9076793	1998	3	26	6	3				
1	9076793	1999	3	37	3			1	3	2
2	9076793	1998	1	39	38	3				
2	9076793	1999	1	38	2			2	3	2
2	9076793	1998	2	50	55	2				
2	9076793	1999	2	59	1			2	3	2
2	9076793	1998	3	55	65	1				
2	9076793	1999	3	41	1			2	3	2
3	9076793	1998	1	42	40	3				
3	9076793	1999	1	37	2			2	3	2
3	9076793	1998	2	50	70	1				
3	9076793	1999	2	69	1		leafy	1	3	2
3	9076793	1998	3	36	59	2				
3	9076793	1999	3	39	1			3	2	2
1	9076794	1998	1	33	40	3	very small			
1	9076794	1999	1	34	2			3	3	2
1	9076794	1998	2	42	40	3				
1	9076794	1999	2	45	3			3	3	2
1	9076794	1998	3	50	95	1				
1	9076794	1999	3	62	1			1	3	2
2	9076794	1998	1	29	60	1				
2	9076794	1999	1	30	2			2	3	2
2	9076794	1998	2	46	65	2				
2	9076794	1999	2	51	2			2	3	2
2	9076794	1998	3	45	75	2				
2	9076794	1999	3	42	1			2	2	2
3	9076794	1998	1	35	65	1	fine-leaved			

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
3	9076794	1999	1	53	2		off type-ylw, many seeds	1	1	1
3	9076794	1998	2	42	64	3				
3	9076794	1999	2	51	2			2	3	2
3	9076794	1998	3	35	65	2				
3	9076794	1999	3	36	1			2	3	2
1	9076795	1998	1	38	34	3				
1	9076795	1999	1	34	2			2	3	2
1	9076795	1998	2	45	90	2				
1	9076795	1999	2	55	1			2	3	2
1	9076795	1998	3	34	50	2				
1	9076795	1999	3	45	2			2	3	2
2	9076795	1998	1	18	none	none	single stem			
2	9076795	1999	1	13	3		small crown	3	3	2
2	9076795	1998	2	35	65	2				
2	9076795	1999	2	44	2			1	3	2
2	9076795	1998	3	40	58	1				
2	9076795	1999	3	52	2		dark green	1	3	2
3	9076795	1998	1	34	40	2				
3	9076795	1999	1	36	2			2	3	2
3	9076795	1998	2	35	86	1				
3	9076795	1999	2	36	2			1	3	2
3	9076795	1998	3	35	65	1				
3	9076795	1999	3	43	2		dark green	1	3	2
1	9076796	1998	1	29	none	none	single stem			
1	9076796	1999	1	27	3		single stem	3	3	2
1	9076796	1998	2	45	91	1				
1	9076796	1999	2	45	1			2	1	1
1	9076796	1998	3	45	80	1				
1	9076796	1999	3	45	1			2	3	2
2	9076796	1998	1	34	10	none	no shoots from crown			
2	9076796	1999	1	35	3			2	2	2
2	9076796	1998	2	30	85	2				
2	9076796	1999	2	48	1			2	3	1
2	9076796	1998	3	45	105	1				
2	9076796	1999	3	50	1			2	2	2
3	9076796	1998	1	35	48	2				
3	9076796	1999	1	40	1			1	2	3
3	9076796	1998	2	32	60	2				
3	9076796	1999	2	50	2			2	3	1
3	9076796	1998	3	50	52	2				
3	9076796	1999	3	60	2			2	3	2
1	9076797	1998	1	70	50	1				
1	9076797	1999	1	39	1			2	3	2
1	9076797	1998	2	32	35	3				
1	9076797	1999	2	36	3			2	3	2
1	9076797	1998	3	50	80	1				
1	9076797	1999	3	46	1			3	3	2
2	9076797	1998	1	48	50	2				
2	9076797	1999	1	38	1			2	3	3
2	9076797	1998	2	40	50	3				
2	9076797	1999	2	41	2			2	3	2
2	9076797	1998	3	40	80	1				



**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
2	9076797	1999	3	49	2		very dense, leafy	1	3	2
3	9076797	1998	1	55	50	1				
3	9076797	1999	1	42	1			2	3	3
3	9076797	1998	2	51	65	1				
3	9076797	1999	2	65	1			1	2	2
3	9076797	1998	3	55	72	1				
3	9076797	1999	3	52	2			2	3	2
1	9076798	1998	1	40	72	2				
1	9076798	1999	1	35	1			1	3	2
1	9076798	1998	2	40	90	1				
1	9076798	1999	2	53	1			2	2	1
1	9076798	1998	3	30	30	2				
1	9076798	1999	3	36	2			2	3	2
2	9076798	1998	1	40	91	1				
2	9076798	1999	1	45	1			1	1	2
2	9076798	1998	2	35	63	2				
2	9076798	1999	2	40	2			2	1	1
2	9076798	1998	3	35	88	1				
2	9076798	1999	3	55	1			2	3	2
3	9076798	1998	1	34	58	1				
3	9076798	1999	1	33	1			1	3	2
3	9076798	1998	2	35	70	2				
3	9076798	1999	2	57	2			2	3	2
3	9076798	1998	3	29	72	2				
3	9076798	1999	3	34	1			2	3	2
1	9076799	1998	1	42	79	1	fine-leaved, yellow tint			
1	9076799	1999	1	44	1		yellow, seeds, wrong sp.	3	1	1
1	9076799	1998	2	53	100	1				
1	9076799	1999	2	62	1		yellow-leaved	3	1	1
1	9076799	1998	3	50	50	2				
1	9076799	1999	3	56	2		yellow, fine-leaved	2	1	1
2	9076799	1998	1	53	27	3	fine-leaved, yellow tint			
2	9076799	1999	1	57	2		fine-leaved, yellow tint	2	1	1
2	9076799	1998	2	43	91	2				
2	9076799	1999	2	46	1		fine-leaved, yellow tint	3	2	1
2	9076799	1998	3	38	77	2				
2	9076799	1999	3	44	2		fine-leaved, yellow tint	2	1	1
3	9076799	1998	1	46	58	2	fine-leaved, ylw, loose crn			
3	9076799	1999	1	44	1		fine-leaved, ylw, loose crn	3	1	1
3	9076799	1998	2	39	83	1				
3	9076799	1999	2	50	1		fine-leaved, ylw, loose crn	3	1	1
3	9076799	1998	3	37	110	2				
3	9076799	1999	3	48	1		fine-leaved, ylw, loose crn	2	1	1
1	9076800	1998	1	42	32	3				
1	9076800	1999	1	35	2			3	3	3
1	9076800	1998	2	50	110	1				
1	9076800	1999	2	55	1			2	3	2
1	9076800	1998	3	40	33	3				
1	9076800	1999	3	55	3			2	3	2
2	9076800	1998	1	52	62	1				
2	9076800	1999	1	46	1			1	2	3
2	9076800	1998	2	40	50	2				

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
2	9076800	1999	2	53	2			2	3	2
2	9076800	1998	3	49	95	1				
2	9076800	1999	3	48	1			2	3	2
3	9076800	1998	1	60	68	1				
3	9076800	1999	1	50	1			1	2	3
3	9076800	1998	2	52	110	1				
3	9076800	1999	2	52	1			2	2	2
3	9076800	1998	3	60	60	2				
3	9076800	1999	3	54	2			2	3	2
1	9076801	1998	1	48	75	2				
1	9076801	1999	1	57	2		variable accession	2	1	1
1	9076801	1998	2	50	50	2				
1	9076801	1999	2	71	2			1	2	2
1	9076801	1998	3	50	85	2				
1	9076801	1999	3	60	1			2	3	2
2	9076801	1998	1	40	73	1				
2	9076801	1999	1	45	1		variable accession	1	3	2
2	9076801	1998	2	50	60	1				
2	9076801	1999	2	70	2			2	2	2
2	9076801	1998	3	50	60	2				
2	9076801	1999	3	58	2			2	2	2
3	9076801	1998	1	55	60	2				
3	9076801	1999	1	68	2		tall	3	3	3
3	9076801	1998	2	40	52	2				
3	9076801	1999	2	67	2			2	3	2
3	9076801	1998	3	40	85	1				
3	9076801	1999	3	60	1			1	3	2
1	9076802	1998	1	40	47	2				
1	9076802	1999	1	51	2			1	2	2
1	9076802	1998	2	56	53	1	dense			
1	9076802	1999	2	88	2		leafy	1	1	2
1	9076802	1998	3	50	67	2				
1	9076802	1999	3	60	2			2	3	2
2	9076802	1998	1	42	70	2				
2	9076802	1999	1	63	1			1	3	2
2	9076802	1998	2	55	87	2				
2	9076802	1999	2	65	1			2	1	2
2	9076802	1998	3	50	70	1				
2	9076802	1999	3	51	1			1	3	2
3	9076802	1998	1	50	60	2				
3	9076802	1999	1	64	2			2	3	1
3	9076802	1998	2	56	75	1				
3	9076802	1999	2	62	1		leafy	2	3	2
3	9076802	1998	3	40	80	1				
3	9076802	1999	3	58	1			2	3	2
1	9076803	1998	1	50	100	2	wide-leaved			
1	9076803	1999	1	65	1		dense and leafy	1	3	3
1	9076803	1998	2	35	90	2				
1	9076803	1999	2	40	1			2	1	2
1	9076803	1998	3	30	35	3				
1	9076803	1999	3	40	2			2	3	2
2	9076803	1998	1	30	60	2				

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
2	9076803	1999	1	50	1			1	3	2
2	9076803	1998	2	35	40	3				
2	9076803	1999	2	34	2			2	1	2
2	9076803	1998	3	40	65	2				
2	9076803	1999	3	30	2			3	3	2
3	9076803	1998	1	50	65	2				
3	9076803	1999	1	46	1			2	1	2
3	9076803	1998	2	32	42	2				
3	9076803	1999	2	43	2			1	1	2
3	9076803	1998	3	30	64	2				
3	9076803	1999	3	25	2			2	2	2
1	9076804	1998	1	37	75	2				
1	9076804	1999	1	30	1			3	3	2
1	9076804	1998	2	35	47	2				
1	9076804	1999	2	42	2			2	3	1
1	9076804	1998	3	27	40	3				
1	9076804	1999	3	36	3			1	3	2
2	9076804	1998	1	30	34	3				
2	9076804	1999	1	34	2			3	3	2
2	9076804	1998	2	35	100	1				
2	9076804	1999	2	44	1			1	3	1
2	9076804	1998	3	40	70	1				
2	9076804	1999	3	35	1			1	3	2
3	9076804	1998	1	30	44	2				
3	9076804	1999	1	28	2			3	3	2
3	9076804	1998	2	26	70	2				
3	9076804	1999	2	36	2			2	3	1
3	9076804	1998	3	30	82	1				
3	9076804	1999	3	34	2			2	3	2
1	9076805	1998	1	36	60	2				
1	9076805	1999	1	34	2			2	3	2
1	9076805	1998	2	out						
1	9076805	1999	2	out						
1	9076805	1998	3	40	62	2				
1	9076805	1999	3	45	1			1	2	2
2	9076805	1998	1	36	60	1				
2	9076805	1999	1	29	2			3	3	2
2	9076805	1998	2	45	58	1	dense crown			
2	9076805	1999	2	68	2			1	1	2
2	9076805	1998	3	36	73	2				
2	9076805	1999	3	48	3			2	2	2
3	9076805	1998	1	40	63	1				
3	9076805	1999	1	40	2			2	3	2
3	9076805	1998	2	38	75	2				
3	9076805	1999	2	46	1			3	3	2
3	9076805	1998	3	35	65	2				
3	9076805	1999	3	55	3			1	1	2
1	9076814	1998	1	65	90	2	coarse-leaved			
1	9076814	1999	1	51	1			2		2
1	9076814	1998	2	50	55	2				
1	9076814	1999	2	52	1			2		2
1	9076814	1998	3	55	75	2				

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
1	9076814	1999	3	42	1			2		2
2	9076814	1998	1	50	103	2	coarse-leaved			
2	9076814	1999	1	42	1			3		2
2	9076814	1998	2	65	100	1				
2	9076814	1999	2	67	1			2		3
2	9076814	1998	3	65	80	1				
2	9076814	1999	3	60	1			2		2
3	9076814	1998	1	38	37	3				
3	9076814	1999	1	44	2			2		2
3	9076814	1998	2	60	90	1				
3	9076814	1999	2	41	1		very open crown	3		3
3	9076814	1998	3	38	88	1				
3	9076814	1999	3	39	1			3		2
1	9076815	1998	1	48	50	2	plant 1 and 2 together			
1	9076815	1999	1	54	2			2		3
1	9076815	1998	2	55	55	1				
1	9076815	1999	2	61	2			2		2
1	9076815	1998	3	60	80	1				
1	9076815	1999	3	84	2		leafy	1		2
2	9076815	1998	1	60	82	1				
2	9076815	1999	1	48	1			2		2
2	9076815	1998	2	58	78	1				
2	9076815	1999	2	65	2			2		2
2	9076815	1998	3	56	70	1				
2	9076815	1999	3	56	2			1		2
3	9076815	1998	1	60	100	1	coarse-leaved			
3	9076815	1999	1	62	1			1		3
3	9076815	1998	2	45	43	2				
3	9076815	1998	2	59	2			2		2
3	9076815	1998	3	40	60	1				
3	9076815	1998	3	58	2			2		2
1	9076816	1998	1	50	90	2	dark green			
1	9076816	1998	1	54	2			2		2
1	9076816	1998	2	55	95	1				
1	9076816	1998	2	63	2			2		2
1	9076816	1998	3	55	110	1				
1	9076816	1998	3	44	1			2		2
2	9076816	1998	1	45	57	2				
2	9076816	1998	1	39	1			3		2
2	9076816	1998	2	55	42	2				
2	9076816	1998	2	63	3			2		2
2	9076816	1998	3	40	53	2				
2	9076816	1998	3	52	1			2		2
3	9076816	1998	1	45	72	2				
3	9076816	1998	1	53	2			2		2
3	9076816	1998	2	45	45	3				
3	9076816	1998	2	63	2			2		2
3	9076816	1998	3	50	91	1				
3	9076816	1998	3	63	1		dark green, leafy	2		2
1	9076817	1998	1	40	60	2				
1	9076817	1998	1	32	1			3		2
1	9076817	1998	2	45	36	2				

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
1	9076817	1998	2	46	1			2		2
1	9076817	1998	3	35	78	2				
1	9076817	1998	3	47	2			1		2
2	9076817	1998	1	47	77	2				
2	9076817	1998	1	52	1			2		2
2	9076817	1998	2	36	56	2				
2	9076817	1998	2	44	2			2		2
2	9076817	1998	3	out						
2	9076817	1998	3	out						
3	9076817	1998	1	40	70	2				
3	9076817	1998	1	38	2			2		2
3	9076817	1998	2	65	84	2				
3	9076817	1998	2	58	1			2		2
3	9076817	1998	3	out						
3	9076817	1998	3	out						
1	9076818	1998	1	53	73	1				
1	9076818	1998	1	42	1			2		2
1	9076818	1998	2	55	73	2				
1	9076818	1998	2	47	1			1		2
1	9076818	1998	3	65	70	1				
1	9076818	1998	3	49	1			2		3
2	9076818	1998	1	40	56	2	dark green, wide-leaved			
2	9076818	1998	1	39	1			2		2
2	9076818	1998	2	58	82	2				
2	9076818	1998	2	49	2			2		2
2	9076818	1998	3	50	70	1				
2	9076818	1998	3	31	1			3		3
3	9076818	1998	1	54	70	2				
3	9076818	1998	1	50	1			2		3
3	9076818	1998	2	52	110	1				
3	9076818	1998	2	44	1			3		2
3	9076818	1998	3	50	90	1				
3	9076818	1998	3	48	1			2		2
1	9076819	1998	1	66	90	2	coarse-leaved			
1	9076819	1998	1	64	1		wide-leaved	2		3
1	9076819	1998	2	75	67	2				
1	9076819	1998	2	93	2		leafy	2		2
1	9076819	1998	3	65	120	1				
1	9076819	1998	3	83	1			2		2
2	9076819	1998	1	68	60	2				
2	9076819	1998	1	60	1		leafy	1		3
2	9076819	1998	2	55	56	2				
2	9076819	1998	2	73	2		leafy	1		2
2	9076819	1998	3	55	44	2				
2	9076819	1998	3	82	2			2		2
3	9076819	1998	1	68	82	2				
3	9076819	1998	1	68	2		leafy	2		3
3	9076819	1998	2	80	90	1				
3	9076819	1998	2	89	1		leafy	1		2
3	9076819	1998	3	60	85	2				
3	9076819	1998	3	54	1			3		2
1	9076820	1998	1	56	35	3				

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
1	9076820	1998	1	44	2			2		3
1	9076820	1998	2	54	60	2				
1	9076820	1998	2	54	2			2		2
1	9076820	1998	3	45	60	2	yellow-leaved			
1	9076820	1998	3	66	2		yellow, variegated	1		2
2	9076820	1998	1	64	70	2				
2	9076820	1998	1	66	1			1		3
2	9076820	1998	2	61	79	2				
2	9076820	1998	2	57	2			2		2
2	9076820	1998	3	58	75	1				
2	9076820	1998	3	47	2		dying	2		2
3	9076820	1998	1	59	61	2				
3	9076820	1998	1	59	1			1		3
3	9076820	1998	2	65	75	2				
3	9076820	1998	2	53	1		yellow-leaved	2		2
3	9076820	1998	3	40	70	2				
3	9076820	1998	3	34	1			2		2
1	9076821	1998	1	49	15	3				
1	9076821	1998	1	44	3			3		2
1	9076821	1998	2	55	60	2				
1	9076821	1998	2	58	1			1		2
1	9076821	1998	3	49	90	1	very leafy	1		2
2	9076821	1998	1	54	62	2				
2	9076821	1998	1	54	2			2		3
2	9076821	1998	2	67	85	1				
2	9076821	1998	2	62	2			2		2
2	9076821	1998	3	55	63	2				
2	9076821	1998	3	71	1			1		2
3	9076821	1998	1	55	60	2				
3	9076821	1998	1	58	1			2		3
3	9076821	1998	2	55	85	1				
3	9076821	1998	2	79	1		leafy	1		2
3	9076821	1998	3	55	70	2				
3	9076821	1998	3	55	2			2		2
1	9076822	1998	1	53	55	2				
1	9076822	1998	1	66	1			1		3
1	9076822	1998	2	66	56	1				
1	9076822	1998	2	70	2		leafy, nice plant	1		2
1	9076822	1998	3	60	110	1				
1	9076822	1998	3	64	2			1		2
2	9076822	1998	1	60	65	2				
2	9076822	1998	1	42	1			1		3
2	9076822	1998	2	40	6	3				
2	9076822	1998	2	48	3			2		2
2	9076822	1998	3	65	80	1				
2	9076822	1998	3	53	1			2		2
3	9076822	1998	1	50	50	2				
3	9076822	1998	1	64	2			1		3
3	9076822	1998	2	50	60	2				
3	9076822	1998	2	45	1			2		2
3	9076822	1998	3	out						

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
3	9076822	1998	3	out						
1	9076823	1998	1	50	45	2				
1	9076823	1998	1	56	2			2		2
1	9076823	1998	2	60	100	1	coarse-leaved			
1	9076823	1998	2	56	1		leafy plant	1		3
1	9076823	1998	3	60	52	2				
1	9076823	1998	3	74	2		leafy	1		2
2	9076823	1998	1	58	50	3				
2	9076823	1998	1	67	2			2		2
2	9076823	1998	2	63	75	2				
2	9076823	1998	2	64	1		leafy	2		3
2	9076823	1998	3	45	64	2				
2	9076823	1998	3	49	2			2		2
3	9076823	1998	1	52	57	2				
3	9076823	1998	1	69	2			2		2
3	9076823	1998	2	64	75	1				
3	9076823	1998	2	73	1		leafy	1		3
3	9076823	1998	3	50	60	2				
3	9076823	1998	3	49	2			2		2
1	9076824	1998	1	60	36	3				
1	9076824	1998	1	34	2			3		3
1	9076824	1998	3	45	85	2				
1	9076824	1998	3	42	1			2		2
2	9076824	1998	1	57	60	3				
2	9076824	1998	1	35	1			3		2
2	9076824	1998	3	out						
2	9076824	1998	3	out						
3	9076824	1998	1	52	60	2				
3	9076824	1998	1	38	2			3		2
3	9076824	1998	3	out						
3	9076824	1998	3	out						
1	9076825	1998	1	60	60	2				
1	9076825	1998	1	66	1			2		2
1	9076825	1998	2	60	110	2				
1	9076825	1998	2	70	1			2		2
1	9076825	1998	3	out						
1	9076825	1998	3	out						
2	9076825	1998	1	60	73	2				
2	9076825	1998	1	60	1			2		2
2	9076825	1998	2	55	70	2				
2	9076825	1998	2	74	2			2		2
2	9076825	1998	3	out						
2	9076825	1998	3	out						
3	9076825	1998	1	50	67	2				
3	9076825	1998	1	50	1			3		2
3	9076825	1998	2	35	40	3				
3	9076825	1998	2	43	3			3		3
3	9076825	1998	3	56	115	2				
3	9076825	1998	3	77	2			2		2
1	9076826	1998	1	48	50	3				
1	9076826	1998	1	50	1			2		2
1	9076826	1998	2	45	25	2	wrong species?			

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
1	9076826	1998	2	55	3		yellow, very fine leaf	3		1
1	9076826	1998	3	50						
1	9076826	1998	3	44	2			2		2
2	9076826	1998	1	60	110	2				
2	9076826	1998	1	40	2			3		2
2	9076826	1998	2	60	64	2	wrong species?			
2	9076826	1998	2	76	2		offtype	2		2
2	9076826	1998	3	out						
2	9076826	1998	3	out						
3	9076826	1998	1	60	54	2				
3	9076826	1998	1	53	2		leaf disease	3		2
3	9076826	1998	2	40	80	2	wrong species?			
3	9076826	1998	2	53	2		yellow, very fine leaf	3		1
3	9076826	1998	3	out						
3	9076826	1998	3	out						
1	9076827	1998	1	55	115	2				
1	9076827	1998	1	72	1			2		2
1	9076827	1998	2	36	12	3				
1	9076827	1998	2	39	3			2		2
1	9076827	1998	3	55	83	1				
1	9076827	1998	3	77	1			2		2
2	9076827	1998	1	57	86	2				
2	9076827	1998	1	59	1			2		2
2	9076827	1998	2	45	45	2				
2	9076827	1998	2	54	2			2		2
2	9076827	1998	3	55	70	2				
2	9076827	1998	3	62	1			2		2
3	9076827	1998	1	70	125	1				
3	9076827	1998	1	39	1			3		2
3	9076827	1998	2	65	79	1				
3	9076827	1998	2	67	1		wide	2		3
3	9076827	1998	3	60	85	1				
3	9076827	1998	3	77	1			2		2
1	9076828	1998	1	50	86	2				
1	9076828	1998	1	45	2			2		2
1	9076828	1998	2	54	42	2				
1	9076828	1998	2	39	3		yellow mottled plant	1		2
1	9076828	1998	3	50	80	1				
1	9076828	1998	3	41	1		dark green	2		2
2	9076828	1998	1	40	42	2				
2	9076828	1998	1	41	2			2		2
2	9076828	1998	2	52	80	1				
2	9076828	1998	2	61	1			2		2
2	9076828	1998	3	45	35	2				
2	9076828	1998	3	56	3			1		2
3	9076828	1998	1	43	60	2				
3	9076828	1998	1	39	2			2		2
3	9076828	1998	2	50	80	2				
3	9076828	1998	2	62	2			2		2
3	9076828	1998	3	45	100	1				
3	9076828	1998	3	39	1			2		2
1	9076829	1998	1	50	90	2				



**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
1	9076829	1998	1	53	1			3		2
1	9076829	1998	2	31	11	3				
1	9076829	1998	2	37	3			2		2
2	9076829	1998	1	45	56	1	fine-leaved			
2	9076829	1998	1	60	1			1		2
2	9076829	1998	2	out						
2	9076829	1998	2	out						
3	9076829	1998	1	55	75	2				
3	9076829	1998	1	55	1			2		2
3	9076829	1998	2	out						
3	9076829	1998	2	out						
1	9076830	1998	1	50	80	2				
1	9076830	1998	1	49	2			1		2
1	9076830	1998	2	52	90	1				
1	9076830	1998	2	49	1			2		2
2	9076830	1998	1	51	30	3				
2	9076830	1998	1	45	3			2		2
2	9076830	1998	2	58	80	2				
2	9076830	1998	2	68	2			2		2
3	9076830	1998	1	45	55	2				
3	9076830	1998	1	43	1			2		2
3	9076830	1998	2	out						
3	9076830	1998	2	out						
1	9076831	1998	1	59	40	2				
1	9076831	1998	1	42	1		fine-leaved	2		1
1	9076831	1998	2	65	70	1				
1	9076831	1998	2	75	1			2		2
1	9076831	1998	3	80	120	2				
1	9076831	1998	3	49	1			3		2
2	9076831	1998	1	66	56	2				
2	9076831	1998	1	60	1			2		2
2	9076831	1998	2	74	35	2				
2	9076831	1998	2	64	2			2		3
2	9076831	1998	3	75	65	2				
2	9076831	1998	3	80	2			2		2
3	9076831	1998	1	70	38	2				
3	9076831	1998	1	62	2			2		3
3	9076831	1998	2	74	70	1				
3	9076831	1998	2	81	2			2		2
3	9076831	1998	3	70	70	2				
3	9076831	1998	3	70	2		leafy	2		2
1	9076832	1998	1	48	22	3				
1	9076832	1998	1	28	3		poor plant	3		1
1	9076832	1998	2	50	80	1				
1	9076832	1998	2	54	1			2		2
1	9076832	1998	3	50	50	2				
1	9076832	1998	3	52	2			2		2
2	9076832	1998	1	55	50	2				
2	9076832	1998	1	62	1			2		2
2	9076832	1998	2	60	75	2				
2	9076832	1998	2	61	1			2		2
2	9076832	1998	3	40	40	2				

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
2	9076832	1998	3	46	3			1		2
3	9076832	1998	1	46	45	3				
3	9076832	1998	1	54	2			2		2
3	9076832	1998	2	50	75	1				
3	9076832	1998	2	57	1			2		2
3	9076832	1998	3	40	60	2				
3	9076832	1998	3	52	3			1		2
1	9076833	1998	1	60	60	2				
1	9076833	1998	1	74	2		very leafy	1		2
1	9076833	1998	2	55	64	2				
1	9076833	1998	2	62	3			1		2
1	9076833	1998	3	65	70	2				
1	9076833	1998	3	86	2			2		2
2	9076833	1998	1	65	50	2				
2	9076833	1998	1	75	2		very leafy	1		2
2	9076833	1998	2	45	63	2				
2	9076833	1998	2	52	3			2		2
2	9076833	1998	3	50	90	1				
2	9076833	1998	3	55	1			2		2
3	9076833	1998	1	50	56	2				
3	9076833	1998	1	56	2		very leafy	2		2
3	9076833	1998	2	54	60	2				
3	9076833	1998	2	56	2			2		2
3	9076833	1998	3	60	85	1				
3	9076833	1998	3	77	1			1		2
1	9076835	1998	1	65	32	2				
1	9076835	1998	1	61	2			2		2
1	9076835	1998	2	68	115	1				
1	9076835	1998	2	60	1		very uniform	2		2
1	9076835	1998	3	60	65	2				
1	9076835	1998	3	68	2			2		2
2	9076835	1998	1	60	76	2				
2	9076835	1998	1	66	1			1		2
2	9076835	1998	2	60	110	1				
2	9076835	1998	2	62	1			2		2
2	9076835	1998	3	55	35	2				
2	9076835	1998	3	60	3			1		2
3	9076835	1998	1	69	64	3				
3	9076835	1998	1	61	1			2		2
3	9076835	1998	2	65	105	1				
3	9076835	1998	2	60	1			2		2
3	9076835	1998	3	60	70	2				
3	9076835	1998	3	68	2		yellow	2		3
1	9076836	1998	1	0	0					
1	9076836	1998	1	out						
1	9076836	1998	2	70	70	1				
1	9076836	1998	2	65	1		yellowish	1		2
2	9076836	1998	1	66	52	2				
2	9076836	1998	1	70	1			2		2
2	9076836	1998	2	40	24	3				
2	9076836	1998	2	63	3			2		2
3	9076836	1998	1	70	70	2				

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
3	9076836	1998	1	77	2		dense and leafy	1		2
3	9076836	1998	2	50	44	2				
3	9076836	1998	2	61	2			1		2
1	9076837	1998	1	70	100	2				
1	9076837	1998	1	54	1			2		2
1	9076837	1998	2	70	110	1	wide-leaved			
1	9076837	1998	2	57	1			2		2
1	9076837	1998	3	65	90	2	wide-leaved			
1	9076837	1998	3	78	2		leafy and dense	1		2
2	9076837	1998	1	44	50	2				
2	9076837	1998	1	42	2			2		1
2	9076837	1998	2	65	60	2	wide-leaved			
2	9076837	1998	2	77	2			1		3
2	9076837	1998	3	70	77	2				
2	9076837	1998	3	83	1			1		3
3	9076837	1998	1	74	66	2				
3	9076837	1998	1	74	2			2		2
3	9076837	1998	2	60	70	2				
3	9076837	1998	2	63	1			1		2
3	9076837	1998	3	55	90	2				
3	9076837	1998	3	82	1			1		3
1	9076839	1998	1	62	48	3				
1	9076839	1998	1	65	2			2		2
1	9076839	1998	2	60	70	2				
1	9076839	1998	2	56	2			2		2
2	9076839	1998	1	75	60	2				
2	9076839	1998	1	66	2			2		1
2	9076839	1998	2	out						
2	9076839	1998	2	out						
3	9076839	1998	1	70	50	2				
3	9076839	1998	1	59	2			2		2
3	9076839	1998	2	66	65	2				
3	9076839	1998	2	79	1			2		2
1	9076840	1998	1	90	91	2				
1	9076840	1998	1	56	1			3		3
1	9076840	1998	2	68	83	1	wide-leaved			
1	9076840	1998	2	73	1		leafy	2		2
1	9076840	1998	3	65	80	1				
1	9076840	1998	3	57	1			2		2
2	9076840	1998	1	70	70	2				
2	9076840	1998	1	66	1			2		3
2	9076840	1998	2	75	115	1	large, healthy			
2	9076840	1998	2	84	1		leafy	1		3
2	9076840	1998	3	70	85	1				
2	9076840	1998	3	74	1			2		2
3	9076840	1998	1	75	70	2	coarse-leaved			
3	9076840	1998	1	66	1			2		3
3	9076840	1998	2	55	70	1				
3	9076840	1998	2	78	1			1		2
3	9076840	1998	3	70	65	1				
3	9076840	1998	3	79	1			2		2
1	9076841	1998	1	60	35	3				

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
1	9076841	1998	1	42	3			2		2
1	9076841	1998	2	20	7	3				
1	9076841	1998	2	23	3		small, yellow, diseased	2		2
1	9076841	1998	3	35	22	3	yellow			
1	9076841	1998	3	21	3		yellow, dying	3		2
2	9076841	1998	1	64	80	2				
2	9076841	1998	1	49	2			2		2
2	9076841	1998	2	66	50	2				
2	9076841	1998	2	75	2			2		2
2	9076841	1998	3	65	53	2				
2	9076841	1998	3	67	2			2		2
3	9076841	1998	1	37	6	3				
3	9076841	1998	1	19	3			3		2
3	9076841	1998	2	65	60	1				
3	9076841	1998	2	87	2		leafy	2		2
3	9076841	1998	3	75	86	1				
3	9076841	1998	3	64	1			2		2
1	9076842	1998								
1	9076845	1998	1	20	58	3				
1	9076845	1998	1	18	1		low, flat, dk green, wide leaf	3		2
1	9076845	1998	2	out						
1	9076845	1998	2	out						
2	9076845	1998	1	30	68	2	dense plant			
2	9076845	1998	1	27	1		dense plant	2		2
2	9076845	1998	2	out						
2	9076845	1998	2	out						
3	9076845	1998	1	28	84	2				
3	9076845	1998	1	26	1		dense plant	2		2
3	9076845	1998	2	25	55	1	dark dull green			
3	9076845	1998	2	22	1		prostrate, dark green	3		1
1	9076846	1998	1	20	49	3				
1	9076846	1998	1	28	2		Species? Yellow	3		1
1	9076846	1998	2	30	45	2	wrong species			
1	9076846	1998	2	34	2		dark green, very fine leaf	3		1
1	9076846	1998	3	20	55	2	wrong species			
1	9076846	1998	3	31	2			2		1
2	9076846	1998	1	27	80	3				
2	9076846	1998	1	30	1		wrong species	3		1
2	9076846	1998	2	20	70	2	wrong species			
2	9076846	1998	2	36	2		wrong species	3		1
2	9076846	1998	3	30	80	2	wrong species			
2	9076846	1998	3	41	2			3		1
3	9076846	1998	1	27	48	3				
3	9076846	1998	1	33	2		wrong species	3		1
3	9076846	1998	2	20	50	2	wrong species			
3	9076846	1998	2	37	2		wrong species	3		1
3	9076846	1998	3	30	65	2	wrong species			
3	9076846	1998	3	26	2			2		1
1	9076847	1998	1	20	56	2				
1	9076847	1998	1	26	1		low, prostrate, dark green	2		2
1	9076847	1998	2	25	34	2				
1	9076847	1998	2	33	2		low growing	2		2

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
1	9076847	1998	3	20	40	2				
1	9076847	1998	3	26	2		low growing, dark green	1		2
2	9076847	1998	1	20	5	3				
2	9076847	1998	1	15	3		low growing, dark green	3		2
2	9076847	1998	2	35	65	2				
2	9076847	1998	2	32	1		low growing, dark green	2		2
2	9076847	1998	3	20	55	2				
2	9076847	1998	3	20	1		low growing, dark green	1		2
3	9076847	1998	1	27	70	2				
3	9076847	1998	1	20	1		low growing, dark green	2		2
3	9076847	1998	2	25	67	1				
3	9076847	1998	2	23	1		low growing, dark green	2		2
3	9076847	1998	3	20	55	2				
3	9076847	1998	3	24	2		low growing, dark green	2		2
1	9076848	1998	1	out	out	out				
1	9076848	1998	1	out						
2	9076848	1998	1	30	60	2				
2	9076848	1998	1	24	1		dark green, low	3		2
3	9076848	1998	1	20	70	2				
3	9076848	1998	1	25	2			2		2
1	9076849	1998	1	42	55	2				
1	9076849	1998	1	42	1			2		2
1	9076849	1998	2	42	56	2				
1	9076849	1998	2	64	2			2		2
1	9076849	1998	3	34	62	2				
1	9076849	1998	3	47	2		stressed, yellow	2		2
2	9076849	1998	1	50	55	2				
2	9076849	1998	1	54	2			1		2
2	9076849	1998	2	33	24	3				
2	9076849	1998	2	44	3			2		2
2	9076849	1998	3	45	65	2				
2	9076849	1998	3	58	1		stressed, yellow	3		2
3	9076849	1998	1	37	40	3				
3	9076849	1998	1	37	2			2		2
3	9076849	1998	2	40	55	2				
3	9076849	1998	2	47	1			2		2
3	9076849	1998	3	45	66	2				
3	9076849	1998	3	60	2			2		2
1	9076850	1998	1	out	out	out				
1	9076850	1998	1	out						
1	9076850	1998	2	45	45	2				
1	9076850	1998	2	61	2			1		2
1	9076850	1998	3	45	65	2				
1	9076850	1998	3	53						
2	9076850	1998	1	38	55	2				
2	9076850	1998	1	47	1			2		2
2	9076850	1998	2	44	50	2				
2	9076850	1998	2	46	2			3		2
2	9076850	1998	3	out						
2	9076850	1998	3	out						
3	9076850	1998	1	50	33	2				
3	9076850	1998	1	64	2			1		2

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
3	9076850	1998	2	50	80	1				
3	9076850	1998	2	61	1			2		2
3	9076850	1998	3	out						
3	9076850	1998	3	out						
1	9076851	1998	1	42	58	2				
1	9076851	1998	1	50	1			2		2
1	9076851	1998	2	50	50	2				
1	9076851	1998	2	23	20	3				
1	9076851	1998	2	75	2		upright	1		1
1	9076851	1998	2	45	3			1		2
1	9076851	1998	3	34	55	2				
1	9076851	1998	3	42	2			2		2
2	9076851	1998	1	45	62	2				
2	9076851	1998	1	60	1			2		2
2	9076851	1998	2	40	50	2				
2	9076851	1998	2	50	85	1				
2	9076851	1998	2	59	3			2		1
2	9076851	1998	2	69	1			2		2
2	9076851	1998	3	45	85	2				
2	9076851	1998	3	50	1			2		2
3	9076851	1998	1	42	68	3				
3	9076851	1998	1	36	1			3		2
3	9076851	1998	2	50	60	2				
3	9076851	1998	2	40	50	1				
3	9076851	1998	2	60	2			2		2
3	9076851	1998	2	60	1			1		2
3	9076851	1998	3	45	40	2				
3	9076851	1998	3	53	2			1		2
1	9076852	1998	1	33	46	2				
1	9076852	1998	1	58	2		fine, very leafy	1		1
1	9076852	1998	2	45	70	1				
1	9076852	1998	2	68	2			1		2
1	9076852	1998	3	35	70	1				
1	9076852	1998	3	66	1			2		2
2	9076852	1998	1	37	42	2				
2	9076852	1998	1	56	2		fine, very leafy	1		1
2	9076852	1998	2	40	28	2				
2	9076852	1998	2	56	2			1		2
2	9076852	1998	3	34	55	2				
2	9076852	1998	3	48	2			2		2
3	9076852	1998	1	40	45	2				
3	9076852	1998	1	50	2		fine, very leafy	1		1
3	9076852	1998	2	out						
3	9076852	1998	2	out						
3	9076852	1998	3	30	22	3				
3	9076852	1998	3	35	3		small	2		2
1	9076853	1998	1	47	60	2				
1	9076853	1998	1	66	1			2		2
1	9076853	1998	2	58	85	1				
1	9076853	1998	2	75	1			2		2
1	9076853	1998	3	37	80	1				
1	9076853	1998	3	80	1			2		2

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
2	9076853	1998	1	49	79	2				
2	9076853	1998	1	49	1			2		2
2	9076853	1998	2	55	73	2				
2	9076853	1998	2	88	2			3		2
2	9076853	1998	3	52	90	1				
2	9076853	1998	3	72	2			2		2
3	9076853	1998	1	55	89	2				
3	9076853	1998	1	62	1			2		2
3	9076853	1998	2	55	75	2				
3	9076853	1998	2	67	1			2		2
3	9076853	1998	3	48	63	1				
3	9076853	1998	3	67	2			2		2
1	9076854	1998	1	35	50	2				
1	9076854	1998	1	44	1			2		2
2	9076854	1998	1	out	out	out				
2	9076854	1998	1	out						
3	9076854	1998	1	out	out	out				
3	9076854	1998	1	out						
1	9076855	1998	1	50	70	2				
1	9076855	1998	1	52	1		leafy, good production	1		2
1	9076855	1998	2	56	50	2				
1	9076855	1998	2	70	2			2		2
1	9076855	1998	3	50	90	1				
1	9076855	1998	3	65	1		leafy	2		2
2	9076855	1998	1	65	75	1				
2	9076855	1998	1	62	1		leafy	1		2
2	9076855	1998	2	75	90	2				
2	9076855	1998	2	74	1			2		2
2	9076855	1998	3	70	115	1				
2	9076855	1998	3	69	1		very leafy	1		2
3	9076855	1998	1	55	80	2				
3	9076855	1998	1	58	1		very leafy	1		2
3	9076855	1998	2	54	80	2				
3	9076855	1998	2	64	1			2		2
3	9076855	1998	3	60	80	1				
3	9076855	1998	3	81	1			2		3
1	9076856	1998	1	40	80	2				
1	9076856	1998	1	48	2			1		1
1	9076856	1998	2	49	45	2	fine-leaved			
1	9076856	1998	2	50	2			1		1
1	9076856	1998	3	25	5	3				
1	9076856	1998	3	37	3			1		1
2	9076856	1998	1	40	30	2				
2	9076856	1998	1	49	2			2		1
2	9076856	1998	2	43	87	1				
2	9076856	1998	2	38	1			1		1
2	9076856	1998	3	35	80	2				
2	9076856	1998	3	28	1			2		1
3	9076856	1998	1	30	90	2				
3	9076856	1998	1	34	1			2		1
3	9076856	1998	2	41	76	2				
3	9076856	1998	2	46	1			1		1

**Table SS-4. Evaluation of slough sedge *Carex atherodes*, 1998-1999 data.**

plant #	Accession	Year	Rep	(in.) Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
3	9076856	1998	3	35	80	1				
3	9076856	1998	3	35	2			2		2
1	9076857	1998	1	32	30	3				
1	9076857	1998	1	39	1			2		2
1	9076857	1998	2	40	75	1				
1	9076857	1998	2	61	2		leafy	1		1
1	9076857	1998	3	30	58	2				
1	9076857	1998	3	43	2			1		2
2	9076857	1998	1	43	70	2				
2	9076857	1998	1	31	1			2		2
2	9076857	1998	2	27	72	2				
2	9076857	1998	2	64	2			1		1
2	9076857	1998	3	40	70	1				
2	9076857	1998	3	40	1			2		2
3	9076857	1998	1	40	30	2				
3	9076857	1998	1	55	2			1		2
3	9076857	1998	2	40	50	2				
3	9076857	1998	2	40	2			2		3
3	9076857	1998	3	20	18	3				
3	9076857	1998	3	27	3			1		2
1	9076858	1998	1	out	out	out				
1	9076858	1998	1	out						
1	9076858	1998	2	42	105	1				
1	9076858	1998	2	66	2			2		2
1	9076858	1998	3	50	100	1				
1	9076858	1998	3	46	1			2		1
2	9076858	1998	1	40	40	2				
2	9076858	1998	1	58	2			1		2
2	9076858	1998	2	32	20	3				
2	9076858	1998	2	59	3			1		2
2	9076858	1998	3	40	120	1				
2	9076858	1998	3	61	1			1		1
3	9076858	1998	1	47	50	2				
3	9076858	1998	1	50	2			2		2
3	9076858	1998	2	35	55	3				
3	9076858	1998	2	42	3			2		2
3	9076858	1998	3	45	50	2				
3	9076858	1998	3	73	2		off type	2		2



**Table SS-5. Forage quality analysis of 10 accessions of slough sedge *Carex atherodes*.**

Forage Quality						
Accession	Row	Plant	Stage	%CP*	%ADF**	%NDF***
840	7	1	heading	6.9	33.6	63
822	5	3	heading	9.1	33.0	61
855	9	2	heading	9.0	34.9	63
853	13	2	heading	8.6	33.0	60
840	15	2	heading	8.0	34.1	62
821	19	3	vegetative	8.1	33.2	62
833	20	3	vegetative	6.8	37.3	66
837	21	2	vegetative	8.7	34.8	64
857	14	2	vegetative	9.4	32.5	61
829	6	2	vegetative	8.3	34.6	62

\*CP=Crude Protein

\*\*ADF=Acid Detergent Fiber

\*\*\*NDF=Neutral Detergent Fiber

**Table SS-6. Selected Accessions**

Location in the Initial Block	Characteristic	Accession	State	County	Location	Collector
r1p2	fine	9076790	ND	Eddy	1-66-150	Halko
r12p3	fine	9076799	ND	Emmons	22-136-77	Knudson
r20p2	fine	9076801	ND	Bottineau	8-161-78	Maier,Halko
r17p2	fine	9076820	SD	Deuel	35-116-48	Washachek
r19p1	fine	9076821	SD	Lake	2-106-52	Washachek
r5p1	seed	9076826	MN	Polk	13-148-45	O'Clair
r6p2	seed	9076830	MN	Mahnomen	8-146-42	Kollman
r6p1	seed	9076831	MN	Pope	33-124-36	Oja
r17p1	seed	9076831	MN	Pope	33-124-36	Oja
r7p3	seed	9076835	MN	Blue Earth	25-108-25	Oja
r15p3	fine	9076840	MN	Nicollet	11-110-29	Oja
r19p1	seed	9076851	Can		18-9-22	
r12p3	seed	9076851	Can		18-9-22	
r9p2	fine	9076852	Can		31-12-18(w1)	
r9p3	fine	9076854	Can		1-4-21(w1)	Poole
r9p1	seed	9076855	Can		26-14-7(w1)	Poole
r9p3	seed	9076855	Can		26-14-7(w1)	Poole
r10p1	seed	9076855	Can		26-14-7(w1)	Poole
r24p1	seed	9076858	Can		17-5-14(w1)	Poole

r=replication number

p=plant number

**Table SS-7. Germination of Carex 2000 seed on blotters**

		12/15/00	01/02/01	01/11/01	01/17/01	01/25/01	02/01/01	02/05/01	02/13/01	02/21/01	03/06/01
		25	43	52	58	66	73	77	85	93	106
<b>Accession</b>	<b>Row</b>	<u>Days</u>	<u>Days</u>	<u>Days</u>	<u>Days</u>	<u>Days</u>	<u>Days</u>	<u>Days</u>	<u>Days</u>	<u>Days</u>	<u>Days</u>
790	1	0	4	9	9	9	9	9	9	9	9
799	12	0	10	22	26	34	37	37	40	44	44
801	20	0	2	3	7	9	16	16	21	26	31
820	17	0	1	2	2	2	4	4	4	5	6
821	19	1	1	1	1	1	1	3	3	4	4
826	5	3	4	5	5	5	6	7	8	9	13
830	6	0	1	1	2	5	5	5	10	10	12
831	6	3	7	11	14	14	16	16	25	33	43
831	17	0	0	1	1	1	1	2	2	2	2
835	7	2	9	15	19	24	24	28	31	31	31
840	15	1	5	9	12	18	26	26	29	42	50
851	12	2	11	18	20	20	22	22	22	22	22
851	19	0	1	1	1	1	2	2	4	8	9
852	9	1	1	1	2	3	3	4	7	7	13
854		7	12	13	14	17	23	31	43	49	52
855	10	31	89	91	93	97	97	99	99	99	99
855	9*	1	10	13	20	26	29	29	34	35	35
855	9	1	1	2	2	2	5	5	5	5	5
858	24	0	1	3	5	7	9	9	13	13	16

Seed was harvested from observation Block-Panel A in 2000. Seed was cleaned using a rub board and South Dakota Seed Blower. Once seed was cleaned it was stored in the seed cooler (temperature < 50 degrees F and Humidity < 50 percent). Small plastic germinator boxes with blue blotters soaked with distilled water were used for planting of 100 seeds/box of each accession. No treatment was done to the seed prior to planting. Planted boxes were placed in the germinator on 11/21/2000. Temperature was set at 20/30 C with alternating 12-hour dark and 12-hour light. Germination was counted if there was a root and shoot present. Seedlings were then planted to cone-tainers in the greenhouse as they became large enough.

Table SS-8. Carex atherodes emergence in potting mix								
Stratification /Germination Trial								
		(18 days)	(26 days)	(34 days)	(40 days)	(47 days)		
		02/05/01	02/13/01	02/21/01	02/27/01	03/06/01	03/16/01	03/27/01
Accession	Row	%Germ.	%Germ.	%Germ.	%Germ.	%Germ.	%Germ.	%Germ.
790	1	0	0	0	0	0	3	6
799	12	0	0	0	0	0		6
801	20	0	0	0	0	0		3
820	17	0	0	1	0	0	1	1
821	19	2	0	0	1	1	4	6
826	5	1	0	0	0	1	2	2
830	6	0	1	1	1	1	3	4
831	6	0	1	2	2	2		16
831	17	1	0	0	0	1	2	4
835	7	4	13	23	3	10		20
840	15	0	0	3	4	6		10
851	12	0	2	2	4	8		19
851	19	0	0	0	0	0	0	1
852	9	1	1	13	13	13	13	14
854		8	25	37	39	42		54
855	10	4	17	28	33	41		68
855	9*	0	2	2	4	6		16
855	9	0	0	5	5	6		10
858	24	0	0	1	1	1	2	5

100 seeds of each of the 2000 harvested seed were planted to a potting mix of peat, perlite, and vermiculite. No seed treatment was done prior to planting. Potting mix was wetted with distilled water. Seeds were planted 1/4 to 1/2 inch below the surface of the soil in small plastic germinator boxes. The boxes were placed in the lunchroom refrigerator and kept there from 11/21/00 to 1/18/01 (approximately 2 months cold stratification). On 1/18/01, the germinator boxes were placed in the germinator at 20/30 degrees C and 12 hours dark and 12 hours light.

**Figure SS-2. Map of Panel E-9, seed increase**

Southeast corner of field							Southwest
Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8
9076858r24	9076855r10	9076835r7	9076855r9	9076852r9	9076830r6	9076851r19	9076851r12
9076855r9	9076855r9	9076831r6	9076854	9076840r15	9076801r20	9076831r17	9076820r17
9076855r10	9076851r12	9076851r12	9076826r5	9076799r12	9076831r6	9076840r15	9076840r15
9076831r17	9076840r15	9076858r24	9076851r12	9076855r9	9076799r12	9076855r10	9076855r10
9076835r7	9076831r6	9076840r15	9076801r20	9076851r12	9076855r9	9076855r9	9076840r15
9076840r15	9076855r9	9076855r10	9076851r12	9076830r6	9076854	9076851r12	9076821r19
9076851r19	9076820r17	9076855r9	9076835r7	9076858r24	9076790r1	9076852r9	9076831r6
9076821r19	9076821r19	9076830r6	9076855r10	9076855r9	9076851r12	9076855r9	9076790r1
9076826r5	9076855r10	9076851r19	9076831r6	9076851r19	9076855r9	9076854	9076835r7
9076830r6	9076799r12	9076854	9076854	9076826r5	9076790r1	9076826r5	9076820r17
9076820r17	9076858r24	9076826r5	9076855r9	9076852r9	9076858r24	9076801r20	9076799r12
9076801r20	9076851r12	9076855r9	9076826r5	9076799r12	9076854	9076858r24	9076851r12
9076831r6	9076831r17	9076835r7	9076840r15	9076855r9	9076831r6	9076799r12	9076852r9
9076799r12	9076826r5	9076830r6	9076799r12	9076801r20	9076801r20	9076831r6	9076801r20
9076854	9076790r1	9076801r20	9076801r20	9076790r1	9076855r9	9076790r1	9076858r24
9076852r9	9076830r6	9076799r12	9076854	9076840r15	9076840r15	9076835r7	9076855r9
9076790r1	9076835r7	9076790r1	9076851r12	9076831r6	9076851r12	9076854	9076855r10
9076851r12	9076852r9	9076855r9	9076855r9	9076855r9	9076858r24	9076855r9	9076835r7
9076858r24	9076851r19	9076858r24	9076851r12	9076858r24	9076854	9076830r6	9076840r15
9076855r10	9076854	9076835r7	9076852r9	9076852r9	9076855r9	9076801r20	9076821r19
9076855r9	9076831r6	9076840r15	9076799r12	9076854	9076831r6	9076840r15	9076830r6
9076854	9076840r15	9076820r17	9076801r20	9076855r9	9076855r10	9076801r20	9076820r17
9076851r12	9076801r20	9076790r1	9076830r6	9076855r10	9076801r20	9076851r12	9076831r6
9076835r7	9076831r6	9076855r9	9076855r9	9076831r6	9076855r9	9076835r7	9076799r12
9076840r15	9076826r5	9076831r17	9076821r19	9076851r12	9076835r7	9076831r6	9076854
9076790r1	9076801r20	9076831r6	9076840r15	9076820r17	9076855r10	9076790r1	
9076799r12	9076799r12	9076855r10	9076835r7	9076855r9	9076854	9076831r6	
9076801r20	9076790r1	9076851r12	9076831r17	9076858r24	9076840r15	9076858r24	
9076826r5	9076840r15	9076851r19	9076855r9	9076826r5	9076855r9	9076799r12	
9076830r6	9076858r24	9076830r6	9076858r24	9076855r9	9076855r10	9076826r5	
9076831r6	9076855r9	9076852r9	9076855r9	9076799r12	9076835r7	9076835r7	

9076855r10	9076854	9076801r20	9076855r10	9076858r24	9076801r20	9076821r19	
9076855r9	9076851r12	9076826r5	9076835r7	9076855r9	9076855r9	9076851r12	
9076854	9076840r15	9076854	9076821r19	9076855r10	9076855r10	9076854	
9076851r12	9076855r9	9076799r12	9076831r6	9076831r17	9076830r6	9076790r1	
9076840r15	9076855r10	9076835r7	9076855r9	9076835r7	9076858r24	9076855r10	
9076799r12	9076799r12	9076858r24	9076854	9076840r15	9076826r5	9076854	
9076801r20	9076855r9	9076831r6	9076790r1	9076821r19	9076855r9	9076799r12	
9076826r5	9076826r5	9076855r10	9076855r9	9076855r9	9076821r19	9076801r20	
9076831r6	9076790r1	9076830r6	9076831r17	9076826r5	9076855r10	9076858r24	
Northeast							Northwest

*Carex atherodes* Breeder Block-Field E-9

Planted from seedlings started in the greenhouse

Date of Field Planting: May 29, 2001 Row spacing: 42" between plants, 42" between rows.

Seed used to produce seedlings for this field was collected from the initial selection block. The r number at the end of the 9 million number represents the row of the plant that seed was collected from to start this field.

**Table SS-9.** Forage quality analyses of two samples of slough sedge *Carex atherodes*.

Analyzed at SDSU and reported 02/04/2003.

	As Received <b>Sample 1</b>	100% Dry Matter <b>Sample 1</b>	As Received <b>Sample 2</b>	100% Dry Matter <b>Sample 2</b>
Total Moisture %	4.86	0	5.25	0
Total Dry Matter%	95.1	100	94.8	100
Crude Protein%	8.88	9.33	8.35	8.81
Acid Detergent Fiber%	31.7	33.4	31.8	33.5
Neutral Detergent Fiber %	58.8	61.8	57.1	60.2

## **ACTIVE STUDIES: TECHNICAL REPORT 2004-2006**

### **Study NDPMC-P-0003-OT**

**Study Title:** Evaluation of Culturally Significant Plants  
Initial evaluation of sweetgrass *Hierochloe odorata* from regional collections

**Study Type:** Comparative evaluation

**Locations:** Plant Materials Centers at Bridger, Montana; Meeker, Colorado; Manhattan, Kansas; Bismarck, North Dakota, and Rose Lake, Michigan

**Duration:** 2002 through 2004

**Cooperators:** Northern Plains Plant Materials Centers

**Resources Concerns:** Resource – Human; Consideration/Problem – Culturally significant plant

**Description:** All four Plant Materials Centers in the Northern Plains Region are evaluating sweetgrass as a culturally significant plant. A coordinated evaluation will allow comparisons to be made on the regionally collected plant materials at each PMC. The variety Radora released from South Dakota State University and originating from east central South Dakota will be used as the standard of comparison. Information obtained will be used to evaluate genetic variability and recommend potential areas of adaptation for local collections.

**Status of Knowledge:** Each PMC has obtained information on their most local source of sweetgrass, but comparisons have not been made with different regional sources. Substantial information is available on this species, including a Planting Guide and Fact Sheet through the PLANTS database. Information is also abundant on the cultural use of sweetgrass.

**Experimental Design Materials and Methods:** Initial evaluation in rod rows, 10 plants per row.

**Literature Cited:** PLANTS database

**Keywords:** sweetgrass, vanilla grass, holy grass, culturally significant

### **Methods and Materials**

Participating PMCs propagated their sweetgrass accession from rhizomes in their greenhouse. Plants were then exchanged among the participants in the spring of 2002. The ND accession (9063128) and Radora (SDSU release) were propagated at the Bismarck PMC. Exchanged plants varied in size. Table SW-1 lists the origin and accession number of each entry.

As plants were not received at the same time, plantings took place in Bismarck from June 5-27, 2002. Figure SW-1 indicates planting date, row and plant spacing, and field position of accession. Plants were hand planted into a clean, tilled field. No chemical was applied.

The field was hand rogued.

### **Results and Discussion**

Table SW-2 includes data collected at the Bismarck PMC in 2002 and 2003. Data collected at the other PMCs is not included in this report. The Bismarck collection and Radora were the weakest and smallest

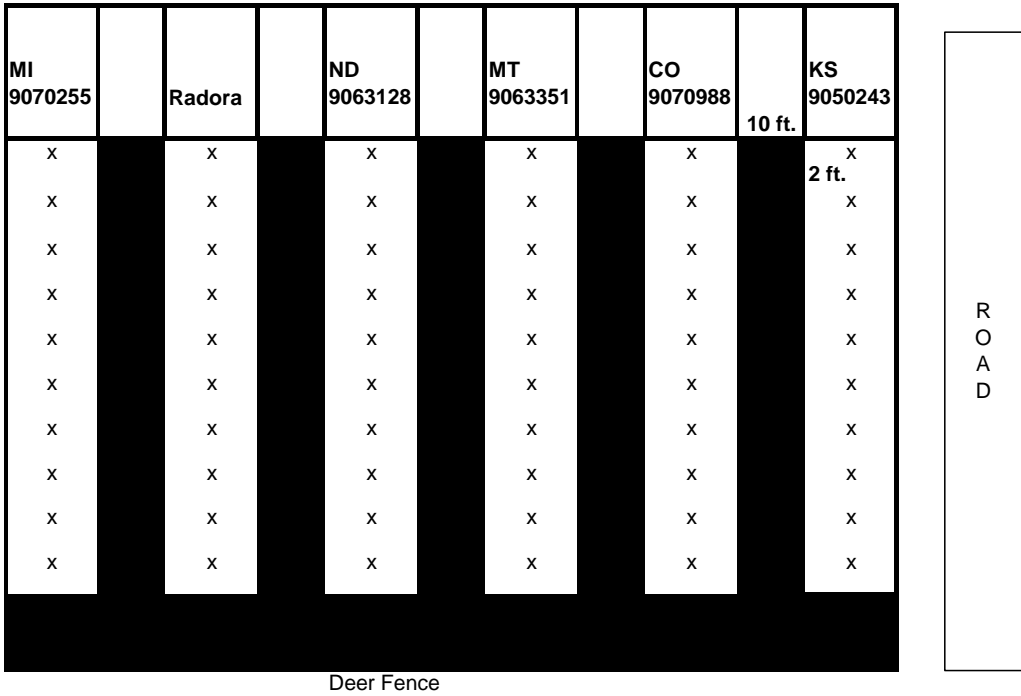
when planted. By the end of the second growing season, differences in plant size were less evident. All accessions had good rhizome spread. Plant rows began growing together by the second year, making individual accession observations more difficult. Wider row spacings would have alleviated this problem. Aroma differences were quite evident among the accessions. Aroma seemed to change from year to year. Data was collected again in 2004. It was difficult to distinguish plots by this time. Aroma again varied by time of year. The length of the leaf appears to be different among the accessions, with material from Kansas and Michigan being the longest. All accessions except Colorado had good/fair stands and vigor overall. As plots have grown together, no additional measurements were taken in 2005 or 2006.

**Table SW-1.**

<b>Study:</b> NDPMC-P-0003-OT	
<b>Evaluation of Culturally Significant Plants</b>	
Sweetgrass Regional Trial ( <i>Hierochloe odorata</i> )	
<b><u>Origin</u></b>	<b><u>Accession</u></b>
Kansas PMC	9050243
Colorado PMC	9070988
Montana PMC	9063351
North Dakota PMC	9063128
South Dakota State University	Radora
Michigan PMC	9070255

**Figure SW-1. Plot layout of sweetgrass evaluation.**

Study: NDPMC-P-0003-OT  
 Evaluation of Culturally Significant Plants  
 Sweetgrass Regional Trial (*Hierochloe odorata*)



<b>Location</b>	Bismarck PMC, Panel D10, adjacent to north side of deer fence	
<b>Feet between Rows</b>	10 feet	
<b>Feet between Plants</b>	2 feet	
<b>Planting Date</b>	06/05/02	KS,CO,MT,ND
	6/19/2002	Radora
	6/27/2002	MI



Table SW-2.

**Study:** NDPMC-P-0003-OT  
**Evaluation of Culturally Significant Plants**  
 Sweetgrass Regional Trial (*Hierochloe odorata*)

**Rating: 1=excellent, 5=fair, 7=poor, 9=none**

<b>Data</b>				
<b>Collection Date</b>	<b>Characteristic</b>	<b>Accession</b>	<b>Origin</b>	<b>Rating</b>
8/21/2002	Aroma	9050243	KS	3
8/21/2002	Aroma	9070988	CO	1
8/21/2002	Aroma	9063351	MT	3
8/21/2002	Aroma	9063128	ND	4
8/21/2002	Aroma	Radora	SDSU	4
8/21/2002	Aroma	9070255	MI	7
8/21/2002	Spread	9050243	KS	3
8/21/2002	Spread	9070988	CO	4
8/21/2002	Spread	9063351	MT	2
8/21/2002	Spread	9063128	ND	6
8/21/2002	Spread	Radora	SDSU	6
8/21/2002	Spread	9070255	MI	8
9/25/2002	Establishment	9050243	KS	1
9/25/2002	Establishment	9070988	CO	1
9/25/2002	Establishment	9063351	MT	1
9/25/2002	Establishment	9063128	ND	5
9/25/2002	Establishment	Radora	SDSU	5
9/25/2002	Establishment	9070255	MI	1
9/25/2002	Rate of Spread	9050243	KS	5
9/25/2002	Rate of Spread	9070988	CO	2
9/25/2002	Rate of Spread	9063351	MT	1
9/25/2002	Rate of Spread	9063128	ND	6
9/25/2002	Rate of Spread	Radora	SDSU	8
9/25/2002	Rate of Spread	9070255	MI	5
9/25/2002	Rhizomes (rating)	9050243	KS	5
9/25/2002	Rhizomes (rating)	9070988	CO	2
9/25/2002	Rhizomes (rating)	9063351	MT	2
9/25/2002	Rhizomes (rating)	9063128	ND	7
9/25/2002	Rhizomes (rating)	Radora	SDSU	8
9/25/2002	Rhizomes (rating)	9070255	MI	7
9/25/2002	Vigor	9050243	KS	4
9/25/2002	Vigor	9070988	CO	1
9/25/2002	Vigor	9063351	MT	1
9/25/2002	Vigor	9063128	ND	7
9/25/2002	Vigor	Radora	SDSU	7
9/25/2002	Vigor	9070255	MI	4
9/25/2002	Survival Percent	9050243	KS	100
9/25/2002	Survival Percent	9070988	CO	100
9/25/2002	Survival Percent	9063351	MT	100

<b>Data</b>				
<b>Collection Date</b>	<b>Characteristic</b>	<b>Accession</b>	<b>Origin</b>	<b>Rating</b>
9/25/2002	Survival Percent	9063128	ND	100
9/25/2002	Survival Percent	Radora	SDSU	90
9/25/2002	Survival Percent	9070255	MI	100
9/25/2002	Seed Culms	9050243	KS	0
9/25/2002	Seed Culms	9070988	CO	0
9/25/2002	Seed Culms	9063351	MT	0
9/25/2002	Seed Culms	9063128	ND	0
9/25/2002	Seed Culms	Radora	SDSU	0
9/25/2002	Seed Culms	9070255	MI	0
9/25/2002	Leaf Height (in)	9050243	KS	9
9/25/2002	Leaf Height (in)	9070988	CO	17
9/25/2002	Leaf Height (in)	9063351	MT	19
9/25/2002	Leaf Height (in)	9063128	ND	chewed 7
9/25/2002	Leaf Height (in)	Radora	SDSU	7
9/25/2002	Leaf Height (in)	9070255	MI	10
9/25/2002	Seed Culm Ht(In)	9050243	KS	0
9/25/2002	Seed Culm Ht(In)	9070988	CO	0
9/25/2002	Seed Culm Ht(In)	9063351	MT	0
9/25/2002	Seed Culm Ht(In)	9063128	ND	0
9/25/2002	Seed Culm Ht(In)	Radora	SDSU	0
9/25/2002	Seed Culm Ht(In)	9070255	MI	0
9/25/2002	Lack of Disease	9050243	KS	2
9/25/2002	Lack of Disease	9070988	CO	rust 3
9/25/2002	Lack of Disease	9063351	MT	rust 3
9/25/2002	Lack of Disease	9063128	ND	2
9/25/2002	Lack of Disease	Radora	SDSU	2
9/25/2002	Lack of Disease	9070255	MI	2
9/25/2002	Lack of Weeds	9050243	KS	2
9/25/2002	Lack of Weeds	9070988	CO	2
9/25/2002	Lack of Weeds	9063351	MT	2
9/25/2002	Lack of Weeds	9063128	ND	2
9/25/2002	Lack of Weeds	Radora	SDSU	2
9/25/2002	Lack of Weeds	9070255	MI	2
9/25/2002	Overall Rating	9050243	KS	6
9/25/2002	Overall Rating	9070988	CO	2
9/25/2002	Overall Rating	9063351	MT	2
9/25/2002	Overall Rating	9063128	ND	7
9/25/2002	Overall Rating	Radora	SDSU	8
9/25/2002	Overall Rating	9070255	MI	4
6/17/2003	Establishment	Radora	SDSU	8
6/17/2003	Establishment	9063128	ND	6
6/17/2003	Establishment	9063351	MT	1
6/17/2003	Establishment	9070988	CO	1
6/17/2003	Establishment	9050243	KS	5
6/17/2003	Establishment	9070255	MI	5
6/17/2003	Rate of Spread	Radora	SDSU	7

<b>Data</b>				
<b>Collection Date</b>	<b>Characteristic</b>	<b>Accession</b>	<b>Origin</b>	<b>Rating</b>
6/17/2003	Rate of Spread	9063128	ND	4
6/17/2003	Rate of Spread	9063351	MT	1
6/17/2003	Rate of Spread	9070988	CO	1
6/17/2003	Rate of Spread	9050243	KS	3
6/17/2003	Rate of Spread	9070255	MI	4
6/17/2003	No. of rhizomes	Radora	SDSU	8
6/17/2003	No. of rhizomes	9063128	ND	6
6/17/2003	No. of rhizomes	9063351	MT	1
6/17/2003	No. of rhizomes	9070988	CO	1
6/17/2003	No. of rhizomes	9050243	KS	5
6/17/2003	No. of rhizomes	9070255	MI	5
6/17/2003	Vigor	Radora	SDSU	8
6/17/2003	Vigor	9063128	ND	5
6/17/2003	Vigor	9063351	MT	1
6/17/2003	Vigor	9070988	CO	1
6/17/2003	Vigor	9050243	KS	4
6/17/2003	Vigor	9070255	MI	4
6/17/2003	Survival Percent	Radora	SDSU	80
6/17/2003	Survival Percent	9063128	ND	100
6/17/2003	Survival Percent	9063351	MT	100
6/17/2003	Survival Percent	9070988	CO	100
6/17/2003	Survival Percent	9050243	KS	100
6/17/2003	Survival Percent	9070255	MI	100
6/17/2003	Seed Culms	Radora	SDSU	9
6/17/2003	Seed Culms	9063128	ND	8
6/17/2003	Seed Culms	9063351	MT	3
6/17/2003	Seed Culms	9070988	CO	5
6/17/2003	Seed Culms	9050243	KS	7
6/17/2003	Seed Culms	9070255	MI	0
6/17/2003	Leaf Height (in)	Radora	SDSU	13
6/17/2003	Leaf Height (in)	9063128	ND	15
6/17/2003	Leaf Height (in)	9063351	MT	29
6/17/2003	Leaf Height (in)	9070988	CO	24
6/17/2003	Leaf Height (in)	9050243	KS	21
6/17/2003	Leaf Height (in)	9070255	MI	25
6/17/2003	Seed Culm Ht(In)	Radora	SDSU	0
6/17/2003	Seed Culm Ht(In)	9063128	ND	13
6/17/2003	Seed Culm Ht(In)	9063351	MT	24
6/17/2003	Seed Culm Ht(In)	9070988	CO	22
6/17/2003	Seed Culm Ht(In)	9050243	KS	17
6/17/2003	Seed Culm Ht(In)	9070255	MI	0
6/17/2003	Lack of Disease	Radora	SDSU	2
6/17/2003	Lack of Disease	9063128	ND	2
6/17/2003	Lack of Disease	9063351	MT	2
6/17/2003	Lack of Disease	9070988	CO	2
6/17/2003	Lack of Disease	9050243	KS	2

<b>Data</b>				
<b>Collection Date</b>	<b>Characteristic</b>	<b>Accession</b>	<b>Origin</b>	<b>Rating</b>
6/17/2003	Lack of Disease	9070255	MI	2
6/17/2003	Lack of Weeds	Radora	SDSU	2
6/17/2003	Lack of Weeds	9063128	ND	2
6/17/2003	Lack of Weeds	9063351	MT	1
6/17/2003	Lack of Weeds	9070988	CO	1
6/17/2003	Lack of Weeds	9050243	KS	1
6/17/2003	Lack of Weeds	9070255	MI	2
6/17/2003	Overall Rating	Radora	SDSU	8
6/17/2003	Overall Rating	9063128	ND	6
6/17/2003	Overall Rating	9063351	MT	1
6/17/2003	Overall Rating	9070988	CO	1
6/17/2003	Overall Rating	9050243	KS	5
6/17/2003	Overall Rating	9070255	MI	4
6/22/2004	Vigor	Radora	SDSU	6
6/22/2004	Vigor	9070255	MI	1
6/22/2004	Vigor	9063128	ND	4
6/22/2004	Vigor	9063351	MT	3
6/22/2004	Vigor	9070988	CO	6
6/22/2004	Vigor	9050243	KS	1
6/22/2004	Ground cover%	Radora	SDSU	50
6/22/2004	Ground cover%	9070255	MI	100
6/22/2004	Ground cover%	9063128	ND	80
6/22/2004	Ground cover%	9063351	MT	70
6/22/2004	Ground cover%	9070988	CO	50
6/22/2004	Ground cover%	9050243	KS	100
6/22/2004	Seed culms rating	Radora	SDSU	3
6/22/2004	Seed culms rating	9070255	MI	5
6/22/2004	Seed culms rating	9063128	ND	2
6/22/2004	Seed culms rating	9063351	MT	8
6/22/2004	Seed culms rating	9070988	CO	9
6/22/2004	Seed culms rating	9050243	KS	5
6/22/2004	Leaf Height (in)	Radora	SDSU	17
6/22/2004	Leaf Height (in)	9070255	MI	26
6/22/2004	Leaf Height (in)	9063128	ND	17
6/22/2004	Leaf Height (in)	9063351	MT	22
6/22/2004	Leaf Height (in)	9070988	CO	17
6/22/2004	Leaf Height (in)	9050243	KS	30
6/22/2004	Seed Culm Ht(In)	Radora	SDSU	17
6/22/2004	Seed Culm Ht(In)	9070255	MI	17
6/22/2004	Seed Culm Ht(In)	9063128	ND	20
6/22/2004	Seed Culm Ht(In)	9063351	MT	18
6/22/2004	Seed Culm Ht(In)	9070988	CO	none
6/22/2004	Seed Culm Ht(In)	9050243	KS	18
6/22/2004	Lack of Disease	Radora	SDSU	2
6/22/2004	Lack of Disease	9070255	MI	2
6/22/2004	Lack of Disease	9063128	ND	3

<b>Data</b>				
<b>Collection Date</b>	<b>Characteristic</b>	<b>Accession</b>	<b>Origin</b>	<b>Rating</b>
6/22/2004	Lack of Disease	9063351	MT	4
6/22/2004	Lack of Disease	9070988	CO	4
6/22/2004	Lack of Disease	9050243	KS	5
6/22/2004	Lack of Weeds	Radora	SDSU	3
6/22/2004	Lack of Weeds	9070255	MI	1
6/22/2004	Lack of Weeds	9063128	ND	3
6/22/2004	Lack of Weeds	9063351	MT	3
6/22/2004	Lack of Weeds	9070988	CO	7
6/22/2004	Lack of Weeds	9050243	KS	1
6/22/2004	Overall Rating	Radora	SDSU	5
6/22/2004	Overall Rating	9070255	MI	1
6/22/2004	Overall Rating	9063128	ND	4
6/22/2004	Overall Rating	9063351	MT	4
6/22/2004	Overall Rating	9070988	CO	7
6/22/2004	Overall Rating	9050243	KS	1

## **ACTIVE STUDIES: TECHNICAL REPORT 2004-2006**

### **Study NDPMC-P-0003-OT**

**Study Title:** Evaluation of Culturally Significant Plants  
White sage *Artemisia ludoviciana*

**Introduction:** Plants of cultural significance are important to preserve and make available for planting. *Artemisia ludoviciana*, also known as white sage, cudweed sagewort, Louisiana sagewort, and “man” sage (Cheyenne Indians) is a varied species with many subspecies. It is not the scope of this study to separate these subspecies. White sage was an important ceremonial plant to the Cheyenne and other Plains Indians. It was believed to drive away evil or bad spirits. It was used in sweat lodges to purify. Medicinal uses included treatment of stomach disorders, nosebleeds, coughs, rheumatism, foot odors, and horse sicknesses. It was also used in making mats and rugs.

**Objective:** The goal of our study is to have northern hardy white sage seed or vegetative material of known origin readily available to the public, particularly the Native Americans of North Dakota, South Dakota, and Minnesota. The material will have a broad genetic base. ‘Summit’ Louisiana sage was released by the Upper Colorado Environmental Plant Center and partners. Its origin is from 6300 feet elevation in Idaho. Its adaptability to lower elevations and more northern latitudes is not known. Plant material originating from local Reservations may be more adapted and culturally desirable.

**Cooperators:** USDA, Natural Resources Conservation Service

**Description:** The species is a rhizomatous, perennial that is sage-scented. It is 12 to 30 inches tall, has a white, woolly appearance and often forms large patches. The leaves are alternate along the stem and range in shape from lanceolate to elliptical and from entire to coarsely toothed. The surface is white, woolly on the underside, and can vary from smooth to woolly on the upper side. The color on the upper side can vary from white to dark green as it ages. The inflorescence is a panicle with many small heads.

**Distribution:** It is a very common species of plains, prairies, roadsides and foothills regions. It is sometimes considered a weedy species because of its common occurrence. It is native from western Ontario to British Columbia and in the United States from Wisconsin west to the Pacific Ocean and south to Mexico. It is generally found on well-drained sites. Its forage value is poor for cattle and fair for sheep. It is grazed by deer, elk, and pronghorn. Overgrazing causes this plant to increase on range sites.

### **Methods and Materials**

**Plot Location:** Bismarck Plant Materials Center, Panel A

**Major Land Resource Area:** MLRA 53B, Central Dark Brown Glaciated Plains. Most of the area is in farms and ranches, and about two-thirds is cropland that is non-irrigated. The more sloping soils are native rangeland. Elevation ranges from 1600 to 2000 feet.

**Soils:** Mandan Silt Loam. Soils of the plot are very low in organic matter and are usually dry and compacted.

**Climate:** The average annual precipitation is 15.47 inches (see page 4), of which three-fourths falls from April to September. The average frost-free period is 134 days with minimum mean temperature of -30 to -40 degrees F.

**Collections:** Refer to Table WS-1 for information on collection origins. Collections were made from sites on or near 5 different Indian Reservations in South Dakota, North Dakota, and Minnesota. Two to three pieces of plant and root material were dug at each site. The bare root pieces were brought back to the Plant Materials Center where they were potted into ½-1 gallon pots. After 1-2 months, the material was planted into the PMC panel A field.

**Planting Plan:** Refer to Figure WS-1 for map of assembly.

**Table WS-1.** White sage *Artemesia ludoviciana* collection information.

<b>Collection</b>				
<b>Date</b>	<b>Accession*</b>	<b>Reservation</b>	<b>Collector</b>	<b>Collection Location</b>
7/11/2002	9082734	Standing Rock	Jensen	Sioux Co., ND 18-132N-79W, 2 mi east of Hwy 1806 along gravel to boat ramp
8/6/2002	9082732	White Earth	Tober	several miles S. of Ponsford, MN
6/26/2002	9082731	Pine Ridge	Tober	approx. 6 mi. S. of Belvidere, SD
6/14/2002	9082730	Sisseton	Tober	several miles NE of Ft. Sisseton, SD
7/8/2002	9082728	Turtle Mountain	Tober, Stange	6 mi. NW of Belcourt, ND

\*2-3 pieces of rhizome for each accession were collected and planted into 1 gallon pots to grow until transplanting.

Soil and plant material was dug and brought to PMC for the Standing Rock Collection

**Figure WS-1.** Plot layout of white sage *Artemesia ludoviciana*.

<b>West</b>
-------------

9082731		9082728
9082732		9082730
9082734		9082731
9082728		9082732
9082730		9082734

<b>East</b>
-------------

<b>Plot location</b>	Panel A
<b>Transplant Date</b>	8/13/2002
<b>Row Spacing</b>	6 feet
<b>Between Plants</b>	4 feet
<b>Row Length</b>	20 feet

**Planting Date:** The planting was made on 8/13/2002, except for the White Earth Collection which was planted in September 2002, because of a recollection of material.

**Maintenance:**

2003: Plot was hand weeded with no chemical weed control.

2004: Plot was hand weeded and dead plant material from previous growing season was clipped in late fall after a hard frost and plants were dormant

2005: Dead plant material was clipped off from 2004 growing season in very early spring.

Planting was hand weeded and edges were roto-tilled.

2006: Dead plant material from 2005 was hand clipped in late winter. Plots were hand weeded and edges were tilled throughout the growing season.

Evaluation:

2002: none

2003: see Table WS-2 for data collected.

2004: Individual plants were not evaluated. Plants have grown together and intertwined in the field. Propagation, using vegetative material was attempted in the greenhouse. A total of 38 plants were distributed in 2004.

2005: Plants were propagated from vegetative material and were shipped out for special plantings and demonstrations. A total of 250 plants were distributed for these plantings.

2006: Plants propagated in the greenhouse from rhizome cuttings were shipped for special plantings and demonstrations. A total of 207 plants were distributed.

**Table WS-2.** White sage *Artemisia ludoviciana* evaluation data.

Data Date	Accession	Location	height (inches)	no. of stems	Spread (inches) (East-West)	Spread (inches) (North-South)
9/24/2003	9082728	south row	17	51	24	13
9/24/2003	9082728	north row	22	30	24	18
9/24/2003	9082730	south row	24	42	14	14
9/24/2003	9082730	north row	30	31	22	20
9/24/2003	9082731	south row	30	31	19	18
9/24/2003	9082731	north row	31	47	30	30
9/24/2003	9082732*	south row	27	20	9	9
9/24/2003	9082732**	north row	29	17	9	8
9/24/2003	9082734	south row	28	25	30	26
9/24/2003	9082734	north row	22	31	16	25

Propagation:

2004-2006: Plantlets with 2-3 true leaves were dug in late April of each year or when they were visible above ground. These plantlets do not appear until later in the spring. They were shoots from rhizomes. Once dug, plant materials was planted into a soilless potting mix in plastic pots (2½”L x 2½”W x 3” deep). The plantlets were allowed to grow in the greenhouse until mid to late May when they were then moved to a shade house to harden off before shipping. The plant material dug in 2006 was smaller than in previous years. New plant shoots were late to emerge from the field plot and were less abundant than in 2004 or 2005. The cool spring temperatures and the lack of soil moisture were contributing factors.

**Results and Conclusions**

2002: All plants were surviving at the time of killing frost in mid October.

2003: Data collected included height, number of stems, and spread of the plants. Variation existed among the accessions in size and spread of plant. The accessions will be allowed to intertwine and rhizomes will be dug from the mixed bed beginning in 2004 for distribution.

2004: The parent plants have intertwined. Propagation was successful using the method described in the propagation section.

2005: Propagation was again successful in the greenhouse. Parent plants continue to thrive. Seed heads were formed on some accessions, but it was not determined if seed was set or viable. Success of demonstration plantings from propagated material was recorded.



2006: Plants were again successfully propagated. The field plot at the PMC was less dense with plants in 2006 than in 2004 or 2005. Plants were shorter and less vigorous, but did survive and produce seed heads. The growing conditions were extremely dry and hot in the growing season of 2006. The plot soils are also very low in organic matter and became very compacted.

Conclusions:

- 1) White sage can be successfully propagated from rhizome cuttings.
- 2) White sage is slow to begin growth in the spring (April-May).
- 3) White sage can survive very dry and hot conditions.

## **ACTIVE STUDIES: TECHNICAL REPORT 2004-2006**

### **Study NDPMC-P-0003-OT**

**Study Title:** Evaluation of culturally significant plants  
Prairie turnip *Pediometum esculentum* (Pursh) Rydb.

**Introduction:** Prairie turnip, also known as breadroot scurfpea, Indian breadroot, and tipsin, was an important food source for Plains Indians in the past. It is native to the Great Plains from Canada to Texas. It is a short, perennial legume that has a tuberous, thickened taproot. Its leaves are palmately compound and the stems and leaves are hairy. Flowers are bluish-purple. The plant matures in early July (in the Northern Great Plains). The plant forms an abscission layer near the ground, and the plant breaks off and tumbles away. Prior to maturity, the roots were dug and eaten raw, cooked, dried or ground to flour. The plant also provided food for sheep and wildlife and diversity on the prairie.

**Objective:** Prairie turnip is no longer widely available for harvest from native prairies. The object of this study is to assemble a population for use in seed increase, and evaluate propagation methods and growth of the species. This would provide a source of seed and planting techniques for food plots or revegetation work.

### **Methods and Materials**

**Collection/Assembly:** The Plant Materials Center, along with other NRCS personnel began collection of seed in July 2003. Very limited amounts of seed were collected in 2003. Many of the plants had matured and tumbled away prior to the beginning of seed collection. Seed was again collected in 2004, 2005, and 2006. Collection amounts were very small, except for a collection made by Terrell Heilman in 2002. See Table PT-1 for collection information. Seed was collected by hand clipping heads or collecting the entire top portion of the plant. Seed was cleaned using a rub board or hand picking seeds from heads.

**Propagation:** In previous years, seed of prairie turnip has been planted to cone-tainers in the greenhouse. Seed was lightly scratched using sandpaper. Seed readily germinated, but it was difficult to maintain plants in the greenhouse environment. Plants either damped off or formed an abscission layer and the top broke off.

In search for other propagation methods, it was decided to seed directly to a field bed instead of planting from the greenhouse.

**Field Propagation:** As collections were very minimal by the end of 2004, the largest seed collection (accession 9082757, collected by Heilman) was used for the first field seeding trial rather than a composite of the collections. The seeding was a late fall dormant seeding so the seed was not scarified or treated prior to planting. The plot, in Panel A at the Bismarck PMC, was prepared by rototilling, packing and hand raking. Seed of prairie turnip was hand broadcast first over the prepared bed. A mix of grass seed including little bluestem, green needlegrass, and sideoats grama was then broadcast over the plot and seed was lightly hand raked. Once seeded, the plot was covered with a netted fiber mulch to prevent seed from blowing or washing in the winter and early spring. Mulch was removed in May. The plot at the PMC was planted on October 29, 2004. A plot using the same seeding rates and seed lots was planted at the Southeast Area SCD Research Farm, Brookings, South Dakota, by the NRCS field office. Table PT-2 lists details of the seeding at the Bismarck PMC.

**Maintenance:** Plots were hand weeded throughout the growing season of 2005 and 2006.

## **Results and Discussion**

Broadleaf weeds and stinkgrass were the prevalent weeds in the plot at Bismarck. They were not allowed to grow to a size to cause shading competition. Plants grew to height of about 3 inches by the end of the growing season. Stand was good for breadroot. Grasses were present, but were not a solid dense stand. Seedlings continued to emerge throughout the growing season of 2005. In 2006, grasses and the prairie turnip stands became more dense. Prairie turnip did not grow very tall and few plants flowered. Severe drought was a contributing factor in its slower growth. Roots were dug on October 4, 2005, and again on October 12, 2006. The tuber portion of the root was ½ inch long and 1/8 inch across in 2005. Roots were 2 inches long by ½ inch across. It appears that roots continue to grow in size with each year. Density of stand and root size will be measured again in 2007.

The plot at Brookings, South Dakota, failed due to excessive weed competition in 2005.

Seed collections from North Dakota, South Dakota, and Minnesota continue. They are placed in cold storage at the PMC. Plans to begin evaluation of each collection are tentatively planned for 2008 or 2009.

<b>Table PT-1. Prairie turnip <i>Pedimelum esculentum</i> seed collection information.</b>					
<b>Accession</b>	<b>State</b>	<b>County</b>	<b>Date</b>	<b>Location</b>	<b>Collector</b>
9082750	ND	Morton	7/21/03	27-T137N-R81W Morton Co. Game Mgt.	N. Jensen, R. Bergsagel
9082751	ND	Sioux	7/21/03	NW1/4 12-T130-R81	K. Hall, A. Harrison
9082752	ND	Morton	7/20/03	NE1/4 31-T140-R83	W. Duckwitz
9082753	SD	Roberts	7/22/03	SE1/4 19-T125-R51	B. Bartelson, G.Thompson, J. TwoStar
9082754	SD	Pennington	7/18/03	16-T1S-R8E 7mi S of Rapid City	T. Warren
9082755	ND	Oliver	7/24/03	14-141-86, 12-141-83, SW31-141-81	L. Voight (on Earl Smith, R. Schwalble)
9082756	ND	Wells	7/24/03	NW1/4 13-147N-73W GMA 7 mi Herdsfield	D. Tober
9082757	SD	Jerauld	00/00/2002	NE1/4 SW1/4 13-107-65 near Wess. Springs	Terrel Heilman
9082758	ND	Benson, Eddy	8/1/03	20-151-65, 16-150-65 Ft. Totten	C. M. Carlson
9082759	ND	Benson	7/25/03	Spirit Lake Sioux Reservation	C. M. Carlson, P. Thompson, P. Halko
9082760	ND	McKenzie	7/26/03	21-148N-99W Horse pasture FR852	Cara Gildar
9082761	MN	Stevens	7/31/03	19-125N-41W along Pommede Terre River	Stan Musielewicz
9082762	SD	Marshall	7/18/03	NW1/4NE1/4 25-126-57	J. Schultz, T. Martin
9082764	SD	Harding	7/14/03	NW1/4 2-T19N R3E	L. Smith, B. Pihl
9082765	SD	Brookings	00/00/2003		D. Granbois
9082766	ND		8/5/03	22-143-82	J. Forman
9082767	ND		8/6/03	SE1/4 8-143-84	J. Forman
9082769	ND	Eddy	8/8/03	SW1/4 8-150-65	C. M. Carlson
9082795	SD	Corson	7/18/03	31-T20N-18E	A. Faulkner
9082796	SD	Sully	9/4/03	5-113N-81W	N. Jensen, D. Tober
9082879	SD		00/00/2003	near Eagle Butte	D. Pesicka
9082880	SD	Meade	7/23/03	south of Ft. Meade	Cheryl Nielsen
9082897	ND	Ft. Totten	7/26/04	NE1/4 8-T150N-65W	M. Carlson
9082898	ND	Morton	7/29/04	S1/2 20-T140N-R81W 5 mi N of Mandan	W. Duckwitz
9082899	MN	Stevens	7/13/04	19-T125N-R41W	J. Hellermann
9082900	MN	Stevens	7/22/04	N1/2SE1/4 19-T125N-R41W	J. Hellermann
9082901	ND	Stutsman	8/6/04	NW1/4 1-T62N-R140W	J. Forman
9082902	MN	Big Stone	8/25/04		K. Leddy
9082903	ND	Rolette	7/26/04	29-T162N-R73W	N. Hanretty

<b>Accession</b>	<b>State</b>	<b>County</b>	<b>Date</b>	<b>Location</b>	<b>Collector</b>
9092027	MN	Stevens	7/18/05	Framnes Township	R. Spiering, J. Hellerman
9092144	ND	Burleigh	8/16/04	Horizon School	N. Jensen
9092145	SD	Harding	7/10/06	North Cave Hills Entrance, picnic area	N. Jensen, Harding Co. 4H
9092146	SD	Hutchinson	7/11/06	Dennis Wurst landowner	B. Woods, R. Rennolet
9092147	SD	Hutchinson	7/11/06	9-T57W-R99N	T. Sommer, B. Woods
9092148	SD	Ziebach	7/13/06	Donald Pesicka Ranch 4 mi NW of Dupree	D. Pesicka
9092149	ND	Barnes	7/25/06	2-T137N-R58W	J. Forman
9092150	ND	Griggs	7/28/06	3-T148N-R61W	J. Forman
9092151	ND	Griggs	7/26/06	2-T148N-R61W	J. Forman
9092152	ND	Dunn	8/16/06	1/2 mi W Little Mo. Park Hdqtr north of Killdeer	D. Tober
9092153	ND	Rolette	7/7/06	SW1/4 NW1/4 11-T161N-R71W	P. Gustafson
9092154	SD	Faulk	8/9/06	8 mi S and 1 mi W of Faulkton	N. Jensen, R. Bergsagel
9092155	MN		7/19/06	2 mi east of Ogema, MN	Dusty Jaskin (farm)
9092156	MN	Kandiyohi	7/18/06	12-T119N-R36W	Steve Smith
9092157	ND		8/14/04	18 mi NE of Carson, 1 plant	W. Duckwitz
9092158	SD	Beadle	6/26/04	4-T109N-R61W near James River	D. Schmidt
9092159	SD	Harding	7/7/04	NW Harding Co.	Mark Rohlving (Belle Fourche)
9092160	ND	Stutsman	7/11/06	2-T141N-R64W	M. Anderson, J. Simonsen
9092161	ND	Mountrail	7/10/06	NW1/4 8-T154N-93W	K. Kallberg

<b>Species</b>	<b>Plot size ft<sup>2</sup></b>	<b>Seeding Rate seeds/ft<sup>2</sup></b>	<b>Full(#/ac) Seeding rate</b>	<b>%of Full Seeding rate</b>	<b>Seeds/lb</b>	<b>PLS # per plot</b>	<b>PLS</b>	<b>Bulk # per plot</b>	<b>X2 broadcast</b>	<b>Bulk gms per plot</b>
<i>Pedimelum esculentum</i>	440	10		100	17,600	0.25	0.85	0.29		133.53
<i>Schizachyrium scoparium</i>	440	30	4.5	20	286,000	0.009231	0.8347	0.01		5.02
<i>Nassella viridula</i>	440	30	7.5	20	180,000	0.014667	0.8311	0.02		8.01
<i>Bouteloua curtipendula</i>	440	30	7	20	180,000	0.014667	0.944	0.02		7.05

## ACTIVE STUDIES: TECHNICAL REPORT 2004-2006

### Study NDPMC-P-0104-RA

Study Title: Native Grasses for Conservation  
Prairie dropseed *Sporobolus heterolepis*

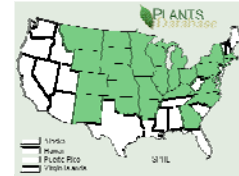
Introduction: Prairie dropseed is a warm-season native that grows in circular tufts. It has been described as quite palatable to livestock, decreasing with grazing pressure. It is desirable to wildlife; birds and rodents eat its large seed and small wildlife can use the plant for cover. It has been identified as a desirable species in landscaping. Native Americans made a poultice from the roots to apply to sores and a decoction of root was taken to remove bile. Although seed is being sold for landscaping, and some local collections are being grown, a northern hardy release of this species for conservation use is not known. Such a release would provide a consistent and larger supply of this species for planting in the Northern Great Plains.

Objective: The purpose of this study is to evaluate adaptability and growth habit of prairie dropseed. If the collections produce seed and prove adaptable and useful as a conservation species, a public release of northern hardy material will be the goal.

Cooperators: USDA, NRCS Plant Materials Center, Bismarck, ND

Description: Prairie dropseed is a warm-season perennial that grows in circular tufts. Plants appear to form colonies in the wild. The seed head is an open pyramid shaped panicle. There are usually only a few seeds produced per plant. When in flower, these plants produce a vanilla-like odor. The seeds are small, round, shiny and hard, and drop when mature in August and September. There are approximately 1,200,000 seeds per pound. The leaves are narrow and 8-20 inches long and are mostly basal and hairless and radiate from the center of the tuft.

Distribution: Prairie dropseed is usually found in lighter textured soils of moist, mixed grass prairie communities. In the tall grass prairies, it often flowers only when stimulated by mowing or burning. It prefers sites where there is little competition from other grasses.



## **Methods and Materials**

Collection/Assembly: Seed collections used in the study are:

- 1) Accession: 9082623. Burleigh County, ND SE ¼ of 3-144N-78W-A few grams (less than 5 gm) of seed was collected each year. Collections were made on 10/98, 9/8/99, 8/18/00 and 8/29/01. This site is the Russell Stuart Wildlife Management Area and is managed by the North Dakota Game and Fish Department. Seed was collected to the north and south of the Prairie Restoration seeding done by the PMC.
- 2) Accession: 9082741. Mahnommen County, MN, Wambuck WMA, 5 ½ miles north of Mahnommen and 1½ miles east. A few grams (less than 5 gm) of seed were collected from several plants on 10/19/01 at this site.
- 3) Accession: 9092028. Seed was collected by Rachel Bergsagel and Nancy Jensen. Collection date: 9/27/2005. Collected in Day County, South Dakota, at the entrance of Pickerel Lake (448<sup>th</sup> Ave.) in a low flat area on the south side of the entrance road, near a large wetland (Sec. 23, T124N, 53W). Seed was collected by hand stripping from numerous plants. Approximately 50 grams of seed were collected.

Planting Plan: Panel A, Plant Materials Center

The field has many small rocks, which appear to have been brought into the site.

Seeds of accession 9082623 (ND) were propagated in the greenhouse in cone-tainers in 2000. Thirty plants from this propagation were planted in panel A at the PMC in June of 2000. The plants were planted in one row and spaced one foot apart. In 2001, 25 additional plants were propagated and transplanted to extend the previous row. At the end of the growing season in 2002, 51 plants remained.

Seed of accession 9082741 was propagated in the greenhouse in 2002 and transplanted to panel A adjacent (south side) to the row of 9082623 (ND). Space between the two rows is approximately 5 feet. Approximately 35 plants were planted at 1½ to 2 feet apart, because of the limited number of plants. At the end of the growing season in 2002, 31 plants remained.

Seed of accession 9092028 was cleaned using hand screens and SD seedblower. The seed was propagated in the greenhouse in 2006 and transplanted in the spring of 2006 to panel A in a row five feet to the south of the Minnesota collection (9082741) row. Approximately 50 plants were transplanted to the field. Spacing between plants was one to two feet.

Planting Date: June 2000, June 2001: accession 9082623 (ND); June 2002: accession 9082741 (MN); June 2006: accession 9092028 (SD)

Maintenance: Plots have been hand weeded and shallow tilled between rows. No chemical has been applied. Vegetative residue was removed by hand clipping either in late fall or early spring the following year. In 2005, the residue was burned in early April.

### **Results and Discussion**

Evaluation:

**9082623(ND)**

2000: Germination was fair in the greenhouse. No seed treatment was done prior to planting. Once transplanted, the plants were slow to grow the first year. Plant height was about 6 inches at the end of the growing season. Survival was greater than 80 percent based on general visual observations. No record was made of plants flowering this year. There were a few token heads.

2001: Plant growth was good this year. No data was recorded other than seed harvest. Seed was produced on plants transplanted in 2000. Seed was harvested on 9/10/2001. Yield was approximately 45 grams. There were approximately 50 plants. Plants appeared free of disease.

2002: Plants were flowering on 8/13/2002. Average height of seed heads was 22 inches. Plant height without heads averaged 7 inches. The leaves averaged 13 inches in total length, measured from the crown. Seed was hand harvested on 9/10/2002. After cleaning, there was approximately 250 grams of clean bulk seed. Most plants in the row set seed. Forty of the 51 plants had seed heads. The plants that did not set seed were very small and did not show much growth in 2002. The many small rocks on the site may have inhibited growth of some plants. Plants with seed heads were very uniform in seed production and height. Leaves showed no sign of disease.

2003: Leaf length and seed culm height were measured on 9/22/2003 (see Table PD-1). The average length of the leaf was 16 inches and the average seed culm height was 30 inches. Plants were vigorous in 2003. Seed harvested was approximately 211 bulk grams. Plants appeared to have shorter seed heads and leaves more abundant and finer than for the MN collection.

2004: Seed was collected by handstripping on 9/30/2004. Approximately 500 grams of seed were harvested. As both the South Dakota and North Dakota sources flowered this year, the seed harvested is probably a cross between the two accessions.

2005: Seed was harvested September 15-21, 2005. The plants were very robust and seed heads abundant and leaves very long. Seed harvested is probably a cross with the Minnesota collection. Approximately 1000 grams of seed were harvested.

2006: Seed was harvested 9/28/2006. Seed harvested was probably a cross with the Minnesota collection. Approximately 245 grams of seed were harvested.

#### **9082741(MN)**

2002: Plants transplanted to the field in 2002 were vigorous. A few seeds produced heads.

2003: Plants were vigorous. Seed was hand harvested on 9/22/03. A total of 119 grams of clean bulk seed was harvested. Plants were very upright and seed stalks were slightly longer than the ND collection. Leaf length and seed culm height were measured on 9/22/2003 for all plants (see Table PD-1). Average length of the leaf was 11 inches and seed culm height was 32 inches. There were fewer seed heads and plants had fewer leaves. These were younger plants than the ND collection, which may have been a contributing factor.

2004: Seed was hand stripped on 9/30/2004. Approximately 350 grams of seed were harvested, which is probably a cross with the North Dakota collection.

2005: Seed was harvested Sept 15-21, 2005. Plants were very robust, heads large, and leaves long. The seed of the Minnesota accession appeared to be slightly larger than the North Dakota accession. Seed ripened slightly later. Approximately 780 grams of seed were harvested.

2006: Seed has harvested 9/28/2006. Seed was probably a cross with North Dakota accession. Approximately 250 grams of seed were harvested.

#### **9092028(SD)**

2006: Seedlings of the South Dakota collection were very slow to grow in the greenhouse. At transplanting time in late June/July the plants were very small. Plants were hand watered due to drought conditions. Plants of the South Dakota collection remained very small and a few had to be replaced.

Plants of the North Dakota and Minnesota collections were stressed in 2006 due to drought but still grew and produced seed.

#### **Results/Conclusions:**

There are subtle phenological differences among plants, but most are of similar size and shape. Plants appear to be much larger and robust in a tilled, spaced plant row setting compared to a native prairie. Lack of competition for light, moisture, and space may be some reasons for the differences. Buildup of thatch in native stands may also hinder growth.

Managing residue with fire appeared to stimulate and enhance growth of prairie dropseed. The optimum frequency of burning, however, needs additional evaluation.

Seed size differences were found in harvested seed. When selecting a population for release, seed size will be considered, as larger seed usually is more vigorous. Seed set and flowering time will also be important factors to evaluate. Longevity of seed viability in storage has also been questioned and will be investigated in future years.



In upcoming years, seed set and flowering time will be important factors to evaluate. Longevity of seed storage has also been questioned and will be evaluated. The goal of the project is to produce a genetically diverse source of prairie dropseed.

**Table PD-1.** 2003 Data, Prairie dropseed (*Sporobolus heterolepis*). Eleven randomly selected plants of the North Dakota accession were measured for leaf length and 11 different plants were measured for seed height. All plants of Minnesota origin were measured.

Accession	Origin	Leaf length (inches)	Head Height (inches)
9082741	MN	12	34
9082741	MN	16	43
9082741	MN	13	27
9082741	MN	12	33
9082741	MN	M	M
9082741	MN	7	25
9082741	MN	8	20
9082741	MN	M	M
9082741	MN	M	M
9082741	MN	14	36
9082741	MN	12	36
9082741	MN	12	32
9082741	MN	12	41
9082741	MN	12	33
9082741	MN	12	36
9082741	MN	10	32
9082741	MN	10	32
9082741	MN	9	25
9082741	MN	13	31
9082741	MN	12	33
9082741	MN	9	34
9082741	MN	7	21
9082741	MN	10	27
9082741	MN	12	34
9082741	MN	12	36
9082741	MN	11	39
9082741	MN	12	38
9082741	MN	14	39
9082741	MN	12	34
9082741	MN	11	39
9082741	MN	10	34
9082741	MN	12	38
9082741	MN	10	24
9082741	MN	10	32
9082741	MN	5	24
9082741	MN	12	32
9082741	MN	12	30
9082741	MN	8	16

Accession	Origin	Leaf length (inches)	Head Height (inches)
9082623	ND	15	35
9082623	ND	16	30
9082623	ND	14	26
9082623	ND	15	32
9082623	ND	18	32
9082623	ND	18	36
9082623	ND	15	32
9082623	ND	16	30
9082623	ND	14	26
9082623	ND	16	28
9082623	ND	15	22

## **ACTIVE STUDIES: TECHNICAL REPORT 2004-2006**

### **Study NDPMC-P-0401-RA**

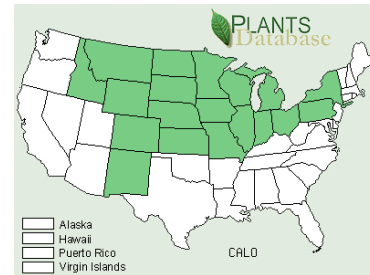
**Study Title:** Native Grasses for Conservation  
Prairie sandreed *Calamovilfa longifolia*

**Introduction:** Prairie sandreed is a warm-season native perennial grass of well-drained soils. It is very rhizomatous, making it a good soil stabilizer. It occurs naturally in the mid grass prairies. It is fair for forage and hay, even with its coarse, tough textured leaves and stem. Species for stabilizing sandy soils are limited. Release of an adapted prairie sandreed would offer an additional species for these sites.

**Objective:** The purpose of the study is to develop a named release of prairie sandreed that has a broad genetic parentage, and is adapted to the Northern Great Plains, particularly eastern North Dakota and South Dakota and western Minnesota. Selection criteria will include, but not limited to leaf and stem disease tolerance, seed production, winter hardiness, and forage production. Releases currently available are Goshen and Pronghorn. At Bismarck, North Dakota, Goshen, originating from drier conditions in Wyoming is susceptible to foliar diseases. ND-95, a germplasm from North Dakota was also found susceptible to leaf rust. Pronghorn originated from Kansas and Nebraska sources, making its winter hardiness questionable in the more northern portions of the Northern Great Plains.

**Cooperators:** USDA, NRCS Plant Materials Center, Bismarck, North Dakota

**Species Description/Distribution:** Prairie sandreed is a warm-season perennial grass. It is native from portions of Canada, south to Kansas and Colorado, east to Illinois and Iowa, and west to Idaho. It is strongly rhizomatous and leaves are smooth, course and tough. The seed head is an open panicle. It grows naturally on dry, well-drained soils in sandy, gravelly, or rocky soils.



## **Materials and Methods**

**Collections:** Seed collection began in the fall of 2003. Targeted locations included sites in Minnesota, and central and eastern South Dakota, and North Dakota. Table PS-1 is a list of collections for 2003. Seed was collected from more than 10 plants at a site. Seed quality of the collections was poor.

**Assembly:** Seed were propagated in the greenhouse in March 2004. The late greenhouse planting was due to heating problems. Seed was planted to flats and then seedlings were planted to cone-tainers. Seedlings were then hand transplanted to the field (Panel A) in July 2004. Seedlings were small at the time of transplanting. Seedlings were planted in a randomized complete block with three replications. Goshen and ND-95 were used as checks in the assembly.

**Planting Date:** Seedlings were transplanted to the field (Panel A) on 7/6/2004.

**Site Location:** Panel A. The site was tilled and free of growing weeds at the time of planting.

**Field Map:** See Figure PS-1 for plot layout.

### **Maintenance:**

**2004:** Plot was hoed and shallow tilled with garden tiller throughout the growing season. No chemicals were applied. Plants were watered by hand in 2004 to keep new seedlings alive.

2005: Plot was hoed and shallow tilled with garden till throughout growing season. No chemicals were applied. Plants were irrigated once in the summer of 2005. Residue was removed in the fall of 2005 by hand clipping, leaving 3 to 4-inch stubble.

2006: Plot was hoed and shallow tilled with garden tiller throughout the growing season. No chemicals were applied. Plants were irrigated once (July) in the growing season to sustain the plants in drought conditions. An attempt to burn residue from the individual plants in early November was not successful. Plant residue resisted burning. Plots were hand clipped to 3 to 4-inch stubble height to remove residue.

Evaluations:

2004: Plants got off to a slow start in 2004. Survival was noted in September 2004. No other data was collected.

2005: In 2005, data was collected on 8/26/2005, for various growth characteristics including spread, height, vigor, disease, and number of seed culms.

2006: In 2006, data on various growth characteristics was collected on 8/4/2006. Disease and lodging were noted on 9/20/2006.

### **Results and Discussion**

Plants were very slow to establish and mortality was high in 2004. Plants that survived and grew in 2005 were vigorous and began spreading by rhizomes. Plants varied in spreadability. There was variation in leaf width and coarseness of the plant as well. In 2005, foliar and leaf diseases manifested in certain plants. Disease was not as noticeable in 2006 compared to 2005, but some plants did exhibit severe infestations by the end of the growing season. The dry climatic conditions of 2006 were likely contributing factors. Rhizome growth and vegetative growth were strong for both years. Disease in 2005 was noted, with some accessions severely affected with stem and leaf diseases.

Plants within an accession did not always perform in a similar manner. This was expected as plants were propagated from seed, making genetics different. Due to these differences, each plant was evaluated individually.

Data will be collected again in 2007. Depending on results, evaluations from 2004-2007 will be analyzed and superior performing plants will be selected for further evaluation. Plans are to propagate new plants from pieces of the selected assembly plants. The new plantlets will be planted to a crossing block for further selection or seed increase.

**Table PS-1.** Prairie sandreed *Calamovilfa longifolia* collection information.

<b>Accession</b>	<b>State</b>	<b>County</b>	<b>Section-Township-Range</b>	<b>Collector</b>	<b>Date</b>
9082770	SD	Lyman	35-107N-72W	Tober, Jensen	9/4/2003
9082771	SD	Corson	29-20N-18E	Evenson	9/23/2003
9082772	ND	McHenry	13-153N-76W	Knudson	9/24/2003
9082773	SD	Sanborn	31-108N-61W	Jensen	9/9/2003
9082774	SD	Roberts	19-122N-52W	Jensen	9/8/2003
9082775	SD	Ransom	14-135N-53W	Jensen	9/8/2003
9082776	SD	Pennington	13-1S-8E	Bradbury, Warren	8/29/2003
9082777	ND	Morton	5 mi NW of Mandan, ND	Duckwitz	9/13/2003
9082778	SD	Kingsbury	30-112N-56W	Jensen	9/10/2003
9082779	SD	Faulk	33-117N-69W	Jensen	9/11/2003
9082780	SD	Campbell	5-125N-76W	Jensen	9/11/2003
9082781	ND	Adams	11-129-92	Klein, Timm	9/2/2003
9082782	SD	Brookings	12-112N-48W	Jensen, Tober	9/3/2003
9082783	SD	Marshall	30-127N-59W	Jensen	9/9/2003
9082784	SD	Brown	26-128N-60W	Jensen	9/9/2003
9082785	SD	Stanley	36-6N-30E	Tober, Jensen	9/4/2003
9082786	SD	Sully	5-113N-81W	Tober, Jensen	9/5/2003
9082787	SD	Tripp	9-99N-78W	Tober, Jensen	9/4/2003
9082788	MN	Sherburne	24-34N-29W	Gullickson	9/4/2003
9082789	MN	Sherburne	16-34N-29W	Hugo	9/4/2003
9082790	MN	Sherburne	31-34N-28W	Hugo	9/4/2003
9082791	MN	Sherburne	34-34N-27W	Hugo	9/4/2003
9082792	SD	Mellette	15-40N-29W	Schoon	9/19/2003
9082793	SD	Todd	2-39N-30W	Schoon	9/19/2003
9082794	SD	Todd	26-36N-31W	Schoon	9/19/2003
9082813	MN	Kittson	Lake Bronson	Tober	9/8/2003
9082814	MN	Polk	Agassiz Dunes	Tober	9/10/2003
9082815	MN	Norman	Prairie Smoke Dunes	Tober	9/10/2003
9082816	MN	Clay	Bluestem Prairie	Tober	9/10/2003
9082817	MN	Otter Tail	Inspiration Peak Wayside Park	Tober	9/8/2003
9082818	MN	Douglas	Lake Christina-north shore	Tober	9/8/2003
9082819	MN	Wabasha	7-109-9	Oja	9/22/2003
9082820	MN	Chisago	8-33N-21W	Oja	9/9/2003
9082821	MN	Anoka	2-33N-23W	Oja	9/9/2003
9082822	MN	Chisago	8-33N-21W	Oja	9/9/2003
9082823	MN	Anoka	1-33N-23W	Oja	9/9/2003
9082825	ND	Oliver	½ mile north of Cross Ranch State Park	Tober	10/22/2003
9082826	ND	McHenry	2-75-154	Duckwitz	9/9/2003

**Figure PS-1.**  
**Prairie Sandreed (*Calamovilfa longifolia*)**

West

Rep 1				Rep 2				Rep 3		
Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11
ND95	2817	2818	Goshen	ND95	2789	2784	Goshen	2818	2788	2820
2820	2778	2815	2816	2825	2813	2826	2773	2817	2783	ND95
2825	2776	2813	2782	2783	2818	2774	2774	2814	2784	2816(2)
2780	2771	2793	2823	2792	2775	2776	2771	2815	2781	2787(1)
2783	2774	2789	2822	2814	2773	2817	2772	2813	2780	2786(2)
2788	2773	2784	2779(2)	2778	2772	2794	2775	2794	2825	2823(2)
2792	2772	2781	2790	2771	2777	2788	2776	2792	2826	2822(3)
2794	2775	2826	2787	2821	2815	2780	2778	2793	2821	2786(1)
2814	2777	2821	2786	2781	2793	2820	2777	2789	Goshen	2790(1)
										2816(2)
										2787(1)

Location: Panel A

Planted: 7/6/2004

Seedlings were grown in the greenhouse. Seedlings were in very poor condition when field was planted.

Row spacing: 3 1/2 feet between plants and 3 1/2 feet between rows

The prefix for each accession is 908

Accessions are in 3-plant plots unless designated in ( ).

<b>Table PS-2. Prairie Sandreed Evaluation, 2005 data</b>													
<b>Ratings:</b>													
leaf width:	1=narrow 3=wide			vigor: 1=vigorous 9=poor vigor									
leafiness:	1=leafy 9=few leaves			dead/alive: +=alive X=dead									
disease:	1=none 9=very diseased			*plants are numbered from west to east and rows are numbered from south to north									
				<b>9/8/2004</b>									
				<b>dead/</b>	<b>(in.)</b>	<b>(in.)</b>	<b>(in.)</b>	<b>(in.)</b>	<b>leaf</b>	<b>(1-9)</b>	<b>(1-9)</b>	<b>no.</b>	<b>(1-9)</b>
<b>Date</b>	<b>*row</b>	<b>accession</b>	<b>*plant</b>	<b>alive</b>	<b>culm ht.</b>	<b>veg. ht.</b>	<b>EW spread</b>	<b>NS spread</b>	<b>width</b>	<b>leafiness</b>	<b>disease</b>	<b>culms</b>	<b>vigor</b>
8/26/2005	1	ND95	1	+	60	12	23	18	1	4	3	15	3
8/26/2005	1	ND95	2	+	20	12	5	4	3	6	2	1	5
8/26/2005	1	ND95	3	+	25	12	10	9	2	4	3	1	4
8/26/2005	1	2820	1	+	26	7	8	5	2	7	2	1	7
8/26/2005	1	2820	2	+	48	26	7	11	2	3	2	4	3
8/26/2005	1	2820	3	+	x								
8/26/2005	1	2825	1	+	25	15	3	6	2	4	1	1	4
8/26/2005	1	2825	2	+	0	9	1	7	2	7	1	0	8
8/26/2005	1	2825	3	+	70	12	8	11	1	5	1	5	4
8/26/2005	1	2780	1	X	x								
8/26/2005	1	2780	2	+	0	10	5	3	2	5	2	0	6
8/26/2005	1	2780	3	+	x								
8/26/2005	1	2783	1	+	0	3	7	5	3	8	1	0	8
8/26/2005	1	2783	2	+	56	15	14	8	2	2	1	9	2
8/26/2005	1	2783	3	+	57	14	13	11	2	1	2	21	1
8/26/2005	1	2788	1	+	0	10	6	7	2	6	1	0	5
8/26/2005	1	2788	2	+	0	10	1	8	2	8	7	0	7
8/26/2005	1	2788	3	+	0	6	1	1	3	8	2	0	7
8/26/2005	1	2792	1	+	70	18	14	6	1	4	3	8	3
8/26/2005	1	2792	2	+	0	30	7	13	2	5	3	0	4
8/26/2005	1	2792	3	+	59	16	7	6	2	2	6	9	2
8/26/2005	1	2794	1	+	59	15	13	11	2	1	6	27	1
8/26/2005	1	2794	2	+	65	20	2	4	2	6	7	5	6
8/26/2005	1	2794	3	+	76	22	10	8	1	3	7	12	3
8/26/2005	1	2814	1	+	72	20	10	9	3	2	4	16	3
8/26/2005	1	2814	2	+	84	26	21	14	3	2	2	9	2

Table PS-2. Prairie Sandreed Evaluation, 2005 data (continued)													
				9/8/2004						(1-3)			
Date	*row	accession	*plant	dead/ alive	(in.) culm ht.	(in.) veg. ht.	(in.) EW spread	(in.) NS spread	(1-3) leaf width	(1-9) leafiness	(1-9) disease	no. culms	(1-9) vigor
8/26/2005	1	2814	3	+	38	12	6	6	3	4	1	2	4
8/26/2005	2	2817	1	X	X	X	X	X	X	X	X	X	X
8/26/2005	2	2817	2	X	X	X	X	X	X	X	X	X	X
8/26/2005	2	2817	3	X	X	X	X	X	X	X	X	X	X
8/26/2005	2	2778	1	+	0	14	7	7	2	5	4	0	6
8/26/2005	2	2778	2	+	0	12	10	8	1	4	4	0	4
8/26/2005	2	2778	3	+	0	4	2	3	3	8	4	0	7
8/26/2005	2	2776	1	+	56	8	8	5	2	5	3	4	4
8/26/2005	2	2776	2	+	0	8	5	3	2	8	6	0	7
8/26/2005	2	2776	3	+	45	15	8	8	1	4	7	10	5
8/26/2005	2	2771	1	+	48	18	4	4	1	3	3	6	3
8/26/2005	2	2771	2	+	42	13	8	6	2	4	3	2	4
8/26/2005	2	2771	3	+	58	11	3	3	2	5	3	4	4
8/26/2005	2	2774	1	+	0	11	4	4	3	5	2	0	6
8/26/2005	2	2774	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	2	2774	3	+	36	7	10	3	3	6	2	3	5
8/26/2005	2	2773	1	+	0	17	4	4	2	5	2	0	4
8/26/2005	2	2773	2	+	0	13	7	5	3	6	3	0	6
8/26/2005	2	2773	3	+	55	15	14	8	2	4	5	4	3
8/26/2005	2	2772	1	+	0	12	3	3	2	6	4	0	5
8/26/2005	2	2772	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	2	2772	3	+	0	6	0	0	3	8	1	0	9
8/26/2005	2	2775	1	X	X	X	X	X	X	X	X	X	X
8/26/2005	2	2775	2	+	37	10	8	10	1	2	2	3	3
8/26/2005	2	2775	3	+	0	17	3	3	1	3	2	0	4
8/26/2005	2	2777	1	+	26	10	17	13	2	3	4	1	4
8/26/2005	2	2777	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	2	2777	3	+	21	5	3	10	1	4	2	0	6
8/26/2005	3	2818	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	3	2818	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	3	2818	3	+	X	X	X	X	X	X	X	X	X
8/26/2005	3	2815	1	X	X	X	X	X	X	X	X	X	X
8/26/2005	3	2815	2	+	X	X	X	X	X	X	X	X	X



Table PS-2. Prairie Sandreed Evaluation, 2005 data (continued)													
				9/8/2004					(1-3)				
Date	*row	accession	*plant	dead/ alive	(in.) culm ht.	(in.) veg. ht.	(in.) EW spread	(in.) NS spread	leaf width	(1-9) leafiness	(1-9) disease	no. culms	(1-9) vigor
8/26/2005	3	2815	3	+	42	5	3	3	3	6	2	3	5
8/26/2005	3	2813	1	+	68	15	8	5	1	4	6	8	3
8/26/2005	3	2813	2	+	54	9	7	6	3	3	6	6	4
8/26/2005	3	2813	3	+	X	X	X	X	X	X	X	X	X
8/26/2005	3	2793	1	+	68	15	12	5	2	2	2	5	2
8/26/2005	3	2793	2	+	37	10	4	5	3	4	3	1	5
8/26/2005	3	2793	3	+	37	12	3	6	2	5	2	3	5
8/26/2005	3	2789	1	+	56	12	4	6	3	4	7	12	5
8/26/2005	3	2789	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	3	2789	3	+	31	9	8	6	3	5	6	2	5
8/26/2005	3	2784	1	+	69	14	7	6	2	12	2	13	3
8/26/2005	3	2784	2	+	38	11	9	13	1	2	2	3	3
8/26/2005	3	2784	3	+	46	12	16	10	3	1	2	17	3
8/26/2005	3	2781	1	+	0	14	2	3	3	5	2	0	6
8/26/2005	3	2781	2	X	X	X	X	X	X	X	X	X	X
8/26/2005	3	2781	3	+	31	6	5	10	2	6	2	1	6
8/26/2005	3	2826	1	+	52	8	6	6	2	5	2	1	4
8/26/2005	3	2826	2	+	67	11	12	15	1	3	4	5	3
8/26/2005	3	2826	3	+	47	11	16	17	3	4	1	7	4
8/26/2005	3	2821	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	3	2821	2	X	X	X	X	X	X	X	X	X	X
8/26/2005	3	2821	3	X	X	X	X	X	X	X	X	X	X
8/26/2005	4	Goshen	1	X	X	X	X	X	X	X	X	X	X
8/26/2005	4	Goshen	2	+	0	20	4	6	1	3	4	0	4
8/26/2005	4	Goshen	3	+	57	14	9	9	1	3	4	7	3
8/26/2005	4	2816	1	X	X	X	X	X	X	X	X	X	X
8/26/2005	4	2816	2	X	X	X	X	X	X	X	X	X	X
8/26/2005	4	2816	3	+	48	10	12	10	1	4	3	7	3
8/26/2005	4	2782	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	4	2782	2	+	0	8	1	1	3	8	2	0	8
8/26/2005	4	2782	3	+	X	X	X	X	X	X	X	X	X
8/26/2005	4	2823	1	+	0	29	6	4	2	5	3	0	5
8/26/2005	4	2823	2	+	0	17	2	2	3	5	3	0	6

Table PS-2. Prairie Sandreed Evaluation, 2005 data (continued)													
				9/8/2004					(1-3)				
Date	*row	accession	*plant	dead/ alive	(in.) culm ht.	(in.) veg. ht.	(in.) EW spread	(in.) NS spread	leaf width	(1-9) leafiness	(1-9) disease	no. culms	(1-9) vigor
8/26/2005	4	2823	3	+	X	X	X	X	X	X	X	X	X
8/26/2005	4	2822	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	4	2822	2	+	0	15	2	2	2	5	2	0	5
8/26/2005	4	2822	3	+	0	10	4	4	2	5	2	0	5
8/26/2005	4	2779	1	+	0	17	6	5	3	4	2	0	5
8/26/2005	4	2779	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	4	2779	3	X	X	X	X	X	X	X	X	X	X
8/26/2005	4	2790	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	4	2790	2	+	0	6	1	1	2	8	2	0	8
8/26/2005	4	2790	3	+	36	8	2	2	3	6	2	1	6
8/26/2005	4	2787	1	+	57	11	8	7	2	3	3	8	3
8/26/2005	4	2787	2	+	59	19	9	9	2	5	3	6	4
8/26/2005	4	2787	3	X	X	X	X	X	X	X	X	X	X
8/26/2005	4	2786	1	+	67	12	5	4	1	4	3	8	4
8/26/2005	4	2786	2	+	60	14	5	6	2	3	3	4	4
8/26/2005	4	2786	3	+	92	18	12	6	1	2	2	22	2
8/26/2005	5	ND95	1	+	36	10	10	11	2	3	5	1	4
8/26/2005	5	ND95	2	+	29	11	6	5	3	3	8	4	4
8/26/2005	5	ND95	3	+	54	9	7	6	3	3	6	19	3
8/26/2005	5	2825	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	5	2825	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	5	2825	3	+	48	10	18	13	1	6	4	2	5
8/26/2005	5	2783	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	5	2783	2	+	68	8	9	6	1	6	4	7	5
8/26/2005	5	2783	3	+	60	12	7	8	3	2	2	4	3
8/26/2005	5	2792	1	+	0	23	2	2	2	6	2	0	5
8/26/2005	5	2792	2	+	54	9	9	6	3	3	2	2	4
8/26/2005	5	2792	3	+	40	12	4	5	3	2	2	2	3
8/26/2005	5	2814	1	+	51	11	5	8	2	3	7	7	5
8/26/2005	5	2814	2	+	68	14	2	4	2	5	6	2	5
8/26/2005	5	2814	3	+	73	13	5	9	3	2	2	17	3
8/26/2005	5	2778	1	+	0	18	2	2	2	7	3	0	7
8/26/2005	5	2778	2	+	0	20	5	3	2	6	4	0	6

Table PS-2. Prairie Sandreed Evaluation, 2005 data (continued)													
				9/8/2004					(1-3)				
				dead/	(in.)	(in.)	(in.)	(in.)	leaf	(1-9)	(1-9)	no.	(1-9)
Date	*row	accession	*plant	alive	culm ht.	veg. ht.	EW spread	NS spread	width	leafiness	disease	culms	vigor
8/26/2005	5	2778	3	+	33	10	6	4	3	3	2	2	5
8/26/2005	5	2771	1	+	52	10	12	22	1	3	2	7	3
8/26/2005	5	2771	2	+	66	12	13	9	2	2	2	19	2
8/26/2005	5	2771	3	+	56	11	6	7	1	3	7	6	3
8/26/2005	5	2821	1	+	0	18	7	3	3	5	2	0	6
8/26/2005	5	2821	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	5	2821	3	+	X	X	X	X	X	X	X	X	X
8/26/2005	5	2781	1	+	57	10	6	6	3	3	2	15	3
8/26/2005	5	2781	2	+	0	5	5	5	3	6	2	0	8
8/26/2005	5	2781	3	+	X	X	X	X	X	X	X	X	X
8/26/2005	6	2789	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	6	2789	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	6	2789	3	X	X	X	X	X	X	X	X	X	X
8/26/2005	6	2813	1	+	0	13	6	4	3	3	2	0	4
8/26/2005	6	2813	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	6	2813	3	+	X	X	X	X	X	X	X	X	X
8/26/2005	6	2818	1	+	29	6	3	4	3	6	2	1	7
8/26/2005	6	2818	2	+	46	9	10	7	2	4	5	8	4
8/26/2005	6	2818	3	+	0	18	1	2	3	6	6	0	8
8/26/2005	6	2775	1	+	58	11	11	8	2	2	5	11	3
8/26/2005	6	2775	2	+	55	11	10	7	1	2	2	1	3
8/26/2005	6	2775	3	+	75	11	5	6	2	2	2	12	2
8/26/2005	6	2773	1	+	61	11	8	11	2	4	2	5	3
8/26/2005	6	2773	2	+	64	10	17	12	3	3	2	11	3
8/26/2005	6	2773	3	+	57	12	11	4	3	2	6	3	3
8/26/2005	6	2772	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	6	2772	2	+	22	8	6	5	1	4	4	2	5
8/26/2005	6	2772	3	+	X	X	X	X	X	X	X	X	X
8/26/2005	6	2777	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	6	2777	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	6	2777	3	+	55	12	8	9	2	2	7	14	3
8/26/2005	6	2815	1	+	0	20	9	3	3	5	4	0	5
8/26/2005	6	2815	2	+	X	X	X	X	X	X	X	X	X

Table PS-2. Prairie Sandreed Evaluation, 2005 data (continued)													
				9/8/2004					(1-3)				
				dead/	(in.)	(in.)	(in.)	(in.)	leaf	(1-9)	(1-9)	no.	(1-9)
Date	*row	accession	*plant	alive	culm ht.	veg. ht.	EW spread	NS spread	width	leafiness	disease	culms	vigor
8/26/2005	6	2815	3	+	86	9	4	4	2	4	2	5	3
8/26/2005	6	2793	1	+	0	20	9	9	2	2	3	0	3
8/26/2005	6	2793	2	+	0	12	6	2	2	6	2	0	6
8/26/2005	6	2793	3	+	63	12	25	18	3	2	2	6	3
8/26/2005	7	2784	1	+	67	12	7	6	2	3	4	11	3
8/26/2005	7	2784	2	+	62	12	10	20	3	4	6	7	3
8/26/2005	7	2784	3	+	67	12	18	11	2	3	6	5	3
8/26/2005	7	2826	1	+	57	12	7	13	3	3	2	9	3
8/26/2005	7	2826	2	+	34	8	6	20	3	5	4	2	5
8/26/2005	7	2826	3	+	61	12	9	7	3	3	2	4	3
8/26/2005	7	2774	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	7	2774	2	+	0	12	10	4	3	6	2	0	6
8/26/2005	7	2774	3	+	22	6	7	5	3	5	2	1	5
8/26/2005	7	2776	1	+	52	12	5	5	2	3	5	6	3
8/26/2005	7	2776	2	+	62	8	5	6	1	4	3	5	4
8/26/2005	7	2776	3	+	37	7	4	6	2	6	3	2	6
8/26/2005	7	2817	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	7	2817	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	7	2817	3	+	0	10	3	3	3	7	4	0	7
8/26/2005	7	2794	1	+	65	12	14	14	2	3	3	14	3
8/26/2005	7	2794	2	+	76	11	4	5	1	4	2	7	4
8/26/2005	7	2794	3	+	67	12	14	8	2	2	2	20	2
8/26/2005	7	2788	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	7	2788	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	7	2788	3	+	38	8	6	19	2	5	4	1	5
8/26/2005	7	2780	1	+	0	20	4	4	3	5	2	0	6
8/26/2005	7	2780	2	+	0	16	1	2	3	6	7	0	7
8/26/2005	7	2780	3	+	0	20	2	2	3	6	3	0	6
8/26/2005	7	2820	1	+	0	20	2	3	3	7	3	0	8
8/26/2005	7	2820	2	+	0	10	1	1	3	8	2	0	8
8/26/2005	7	2820	3	X	X	X	X	X	X	X	X	X	X
8/26/2005	8	Goshen	1	+	54	7	6	4	2	5	7	5	5
8/26/2005	8	Goshen	2	+	56	8	13	5	2	3	7	8	3

Table PS-2. Prairie Sandreed Evaluation, 2005 data (continued)													
				9/8/2004					(1-3)				
Date	*row	accession	*plant	dead/ alive	(in.) culm ht.	(in.) veg. ht.	(in.) EW spread	(in.) NS spread	leaf width	(1-9) leafiness	(1-9) disease	no. culms	(1-9) vigor
8/26/2005	8	Goshen	3	+	55	6	12	17	2	5	7	3	6
8/26/2005	8	2773	1	X	X	X	X	X	X	X	X	X	X
8/26/2005	8	2773	2	+	30	10	22	17	2	3	4	1	4
8/26/2005	8	2773	3	+	0	24	11	9	2	5	2	0	5
8/26/2005	8	2774	1	+	0	10	4	5	3	6	4	0	6
8/26/2005	8	2774	2	+	36	7	10	7	3	3	2	5	4
8/26/2005	8	2774	3	+	0	10	7	4	3	6	2	0	6
8/26/2005	8	2771	1	+	58	16	9	5	1	2	3	9	2
8/26/2005	8	2771	2	+	72	8	13	13	1	5	3	6	4
8/26/2005	8	2771	3	+	63	8	15	12	3	3	2	12	4
8/26/2005	8	2772	1	+	64	8	6	11	2	4	2	16	3
8/26/2005	8	2772	2	+	32	7	9	8	2	5	2	1	5
8/26/2005	8	2772	3	+	28	9	6	10	3	3	2	1	4
8/26/2005	8	2775	1	+	79	12	15	6	2	3	2	11	2
8/26/2005	8	2775	2	+	61	9	16	11	2	2	2	12	2
8/26/2005	8	2775	3	+	34	10	19	9	2	5	4	1	5
8/26/2005	8	2776	1	+	57	8	6	6	3	4	5	14	4
8/26/2005	8	2776	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	8	2776	3	+	47	10	8	4	2	5	6	6	5
8/26/2005	8	2778	1	+	29	10	5	4	3	4	5	1	5
8/26/2005	8	2778	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	8	2778	3	+	0	11	7	5	3	7	8	0	8
8/26/2005	8	2777	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	8	2777	2	+	13	7	4	3	3	5	2	1	6
8/26/2005	8	2777	3	+	0	12	1	1	3	7	2	0	7
8/26/2005	9	2818	1	+	0	12	7	4	2	6	4	0	6
8/26/2005	9	2818	2	+	16	12	6	3	2	6	5	2	6
8/26/2005	9	2818	3	X	X	X	X	X	X	X	X	X	X
8/26/2005	9	2817	1	X	X	X	X	X	X	X	X	X	X
8/26/2005	9	2817	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	9	2817	3	X	X	X	X	X	X	X	X	X	X
8/26/2005	9	2814	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	9	2814	2	+	47	16	12	8	2	4	3	2	4

Table PS-2. Prairie Sandreed Evaluation, 2005 data (continued)														
				9/8/2004						(1-3)				
				dead/	(in.)	(in.)	(in.)	(in.)	(in.)	leaf	(1-9)	(1-9)	no.	(1-9)
Date	*row	accession	*plant	alive	culm ht.	veg. ht.	EW spread	NS spread	width	leafiness	disease	culms	vigor	
8/26/2005	9	2814	3	+	10	12	6	2	3	6	4	0	7	
8/26/2005	9	2815	1	+	X	X	X	X	X	X	X	X	X	
8/26/2005	9	2815	2	+	54	16	5	9	3	5	3	3	5	
8/26/2005	9	2815	3	+	48	15	9	7	2	2	2	3	3	
8/26/2005	9	2813	1	+	38	16	6	4	3	3	2	10	3	
8/26/2005	9	2813	2	+	X	X	X	X	X	X	X	X	X	
8/26/2005	9	2813	3	X	X	X	X	X	X	X	X	X	X	
8/26/2005	9	2794	1	+	X	X	X	X	X	X	X	X	X	
8/26/2005	9	2794	2	+	59	17	11	9	3	2	3	14	2	
8/26/2005	9	2794	3	+	X	X	X	X	X	X	X	X	X	
8/26/2005	9	2792	1	+	56	15	4	7	2	4	2	6	4	
8/26/2005	9	2792	2	+	35	19	4	3	3	4	2	7	4	
8/26/2005	9	2792	3	+	60	16	9	4	1	4	2	6	3	
8/26/2005	9	2793	1	+	X	X	X	X	X	X	X	X	X	
8/26/2005	9	2793	2	+	X	X	X	X	X	X	X	X	X	
8/26/2005	9	2793	3	+	57	14	10	10	3	2	2	15	2	
8/26/2005	9	2789	1	+	30	10	4	3	3	6	2	3	6	
8/26/2005	9	2789	2	+	X	X	X	X	X	X	X	X	X	
8/26/2005	9	2789	3	+	48	13	6	4	2	5	7	4	5	
8/26/2005	10	2788	1		X	X	X	X	X	X	X	X	X	
8/26/2005	10	2788	2	+	34	18	7	8	2	3	2	3	4	
8/26/2005	10	2788	3	+	X	X	X	X	X	X	X	X	X	
8/26/2005	10	2783	1	+	42	13	8	6	3	3	4	14	3	
8/26/2005	10	2783	2	+	X	X	X	X	X	X	X	X	X	
8/26/2005	10	2783	3	+	X	X	X	X	X	X	X	X	X	
8/26/2005	10	2784	1	+	X	X	X	X	X	X	X	X	X	
8/26/2005	10	2784	2	X	X	X	X	X	X	X	X	X	X	
8/26/2005	10	2784	3	+	42	18	6	12	2	2	2	6	2	
8/26/2005	10	2781	1	X	X	X	X	X	X	X	X	X	X	
8/26/2005	10	2781	2	+	15	8	4	3	2	5	2	2	5	
8/26/2005	10	2781	3	+	X	X	X	X	X	X	X	X	X	
8/26/2005	10	2780	1	+	X	X	X	X	X	X	X	X	X	
8/26/2005	10	2780	2	+	X	X	X	X	X	X	X	X	X	

Table PS-2. Prairie Sandreed Evaluation, 2005 data (continued)													
				9/8/2004						(1-3)			
Date	*row	accession	*plant	dead/ alive	(in.) culm ht.	(in.) veg. ht.	(in.) EW spread	(in.) NS spread	(in.) leaf width	(1-9) leafiness	(1-9) disease	no. culms	(1-9) vigor
8/26/2005	10	2780	3	+	X	X	X	X	X	X	X	X	X
8/26/2005	10	2825	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	10	2825	2	+	0	10	4	4	3	5	2	0	5
8/26/2005	10	2825	3	+	X	X	X	X	X	X	X	X	X
8/26/2005	10	2826	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	10	2826	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	10	2826	3	+	48	13	11	11	3	3	2	12	4
8/26/2005	10	2821	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	10	2821	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	10	2821	3	+	X	X	X	X	X	X	X	X	X
8/26/2005	10	Goshen	1	+	35	10	6	5	2	5	2	7	4
8/26/2005	10	Goshen	2	+	50	13	17	11	2	2	3	16	2
8/26/2005	10	Goshen	3	+	67	16	13	4	1	4	3	8	4
8/26/2005	11	2820	1	+	0	10	3	4	2	5	3	0	7
8/26/2005	11	2820	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	11	2820	3	X	X	X	X	X	X	X	X	X	X
8/26/2005	11	ND95	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	11	ND95	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	11	ND95	3	+	X	X	X	X	X	X	X	X	X
8/26/2005	11	2816	1	+	36	13	9	9	1	4	9	3	6
8/26/2005	11	2816	2	X	X	X	X	X	X	X	X	X	X
8/26/2005	11	2787	1	X	X	X	X	X	X	X	X	X	X
8/26/2005	11	2786	1	+	71	17	12	9	1	2	5	11	2
8/26/2005	11	2786	2	+	32	18	4	4	2	4	3	2	4
8/26/2005	11	2823	1	+	0	10	2	2	3	8	2	0	8
8/26/2005	11	2823	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	11	2822	1	+	X	X	X	X	X	X	X	X	X
8/26/2005	11	2822	2	+	X	X	X	X	X	X	X	X	X
8/26/2005	11	2822	3	+	0	20	4	8	1	4	2	0	5
8/26/2005	11	2786	1	+	64	15	7	10	1	3	4	13	2
8/26/2005	11	2790	1	+	37	9	7	5	2	6	3	4	6
8/26/2005	11	2816	1	+	32	9	6	4	2	5	3	1	5
8/26/2005	11	2816	2	X	X	X	X	X	X	X	X	X	X

<b>Table PS-2. Prairie Sandreed Evaluation, 2005 data (continued)</b>													
				<b>9/8/2004</b>					<b>(1-3)</b>				
				<b>dead/</b>	<b>(in.)</b>	<b>(in.)</b>	<b>(in.)</b>	<b>(in.)</b>	<b>leaf</b>	<b>(1-9)</b>	<b>(1-9)</b>	<b>no.</b>	<b>(1-9)</b>
<b>Date</b>	<b>*row</b>	<b>accession</b>	<b>*plant</b>	<b>alive</b>	<b>culm ht.</b>	<b>veg. ht.</b>	<b>EW spread</b>	<b>NS spread</b>	<b>width</b>	<b>leafiness</b>	<b>disease</b>	<b>culms</b>	<b>vigor</b>
8/26/2005	11	2787	1	+	X	X	X	X	X	X	X	X	X



Table PS-3. Prairie Sandreed Evaluation, 2006 data												
Ratings:		Leaf width	1=fine 3=wide									
		leafiness	1=very leafy 3=few leaves									
		flower culms	1=none 3=many									
Date	*Row	Accession	*Plant	Dead/ Alive	(in.) culm ht.	veg. ht.	(in.) EW spread	(in.) NS spread	leaf width	leafi- ness	no. culms	Disease/Notes (9/20/2006)
8/4/2006	1	ND95	1	+	73		36	39	3	2	1	
8/4/2006	1	ND95	2	+	66		9	15	2	3	3	some
8/4/2006	1	ND95	3	+	69		15	18	2	2	2	rust on leaves
8/4/2006	1	2820	1	+	51		12	15	2	3	3	stressed
8/4/2006	1	2820	2	+	60		15	20	2	2	3	stressed, lodged
8/4/2006	1	2820	3	X	dead							
8/4/2006	1	2825	1	+	69		15	12	2	3	2	
8/4/2006	1	2825	2	+	41		7	12	2	3	3	
8/4/2006	1	2825	3	+	69		15	24	3	3	3	not leafy, sprawling
8/4/2006	1	2780	1	X	dead							
8/4/2006	1	2780	2	+	0	21	12	9	2	3	3	leaf spot, yellow, no culms
8/4/2006	1	2780	3	X	dead							
8/4/2006	1	2783	1	+	0	9	12	11	1	3	3	tiny, wrong species
8/4/2006	1	2783	2	+	70		24	22	2	1	2	lodged
8/4/2006	1	2783	3	+	78		38	30	2	1	1	upright
8/4/2006	1	2788	1	+	41		15	15	2	3	3	disease, lodged
8/4/2006	1	2788	2	+	14		9	12	2	3	3	small, stressed, yellow, diseased
8/4/2006	1	2788	3	+	18		3	6	2	3	3	very small, stressed
8/4/2006	1	2792	1	+	75		2	17	2	2	1	very upright
8/4/2006	1	2792	2	+	52		17	19	2	3	3	lodged, boot stage
8/4/2006	1	2792	3	+	60		24	27	2	2	2	late boot
8/4/2006	1	2794	1	+	68		28	29	2	1	1	very leafy
8/4/2006	1	2794	2	+	87		18	18	2	3	3	disease, dead center
8/4/2006	1	2794	3	+	84		24	21	2	2	2	disease, lodged
8/4/2006	1	2814	1	+	79		22	36	1	2	2	stressed
8/4/2006	1	2814	2	+	92		21	30	2	2	2	yellowed
8/4/2006	1	2814	3	+	66		14	18	1	2	2	dead center

Table PS-3. Prairie Sandreed Evaluation, 2006 data (continued)												
				Dead/ Alive	(in.) culm ht.	veg. ht.	(in.) EW spread	(in.) NS spread	leaf width	leafi- ness	no. culms	Disease/Notes (9/20/2006)
8/4/2006	2	2817	1	X	X		X	X	X	X	X	
8/4/2006	2	2817	2	X	X		X	X	X	X	X	
8/4/2006	2	2817	3	X	X		X	X	X	X	X	
8/4/2006	2	2778	1	+	45		13	17	1	2	2	
8/4/2006	2	2778	2	+	55		14	11	2	2	2	lodged
8/4/2006	2	2778	3	+	34		6	6	2	2	3	diseased
8/4/2006	2	2776	1	+	81		21	13	2	2	1	diseased, fine leaves
8/4/2006	2	2776	2	+	33		9	9	1	3	3	small
8/4/2006	2	2776	3	+	47		17	13	1	2	2	diseased, fine culms
8/4/2006	2	2771	1	+	67		22	19	2	1	2	
8/4/2006	2	2771	2	+	64		12	9	1	2	1	fine, small
8/4/2006	2	2771	3	+	87		13	12	2	3	1	
8/4/2006	2	2774	1	+	45		18	16	1	2	2	fine, blue, small
8/4/2006	2	2774	2	X	X		X	X	X	X	X	
8/4/2006	2	2774	3	+	49		17	9	1	2	1	fine leaf and heads, boot
8/4/2006	2	2773	1	+	44		10	10	1	2	3	diseased, boot
8/4/2006	2	2773	2	+	50		22	11	2	3	2	disease
8/4/2006	2	2773	3	+	79		17	24	1	2	1	disease, lodge
8/4/2006	2	2772	1	+	41		16	17	2	3	3	heads compressed
8/4/2006	2	2772	2	X	X		X	X	X	X	X	
8/4/2006	2	2772	3	X	X		X	x				
8/4/2006	2	2775	1	X	X		X	X	X	X	X	
8/4/2006	2	2775	2	+	78		22	17	2	2	2	fine center leaves
8/4/2006	2	2775	3	+	55		9	10	2	2	2	boot
8/4/2006	2	2777	1	+	57		16	16	2	2	2	disease outer leaves
8/4/2006	2	2777	2	X	X		X	X	X	X	X	
8/4/2006	2	2777	3	+	40		10	8	3	3	2	diseased
8/4/2006	3	2818	1	X	X		X	X	X	X	X	
8/4/2006	3	2818	2	X	X		X	X	X	X	X	
8/4/2006	3	2818	3	X	X		X	X	X	X	X	
8/4/2006	3	2815	1	X	X		X	X	X	X	X	
8/4/2006	3	2815	2	X	X		X	X	X	X	X	

Table PS-3. Prairie Sandreed Evaluation, 2006 data (continued)												
				Dead/	(in.)	veg.	(in.)	(in.)				
Date	*Row	Accession	*Plant	Alive	culm	ht.	EW	NS	leaf	leafi-	no.	Disease/Notes (9/20/2006)
					ht.	ht.	spread	spread	width	ness	culms	
8/4/2006	3	2815	3	+	49		15	13	1	2	2	clean
8/4/2006	3	2813	1	+	69		32	22	3	3	2	disease
8/4/2006	3	2813	2	+	73		21	22	1	2	2	disease, lodging
8/4/2006	3	2813	3	X	X		X	X	X	X	X	
8/4/2006	3	2793	1	+	85		22	17	3	1	1	disease, lodging, coarse
8/4/2006	3	2793	2	+	76		18	12	1	2	2	
8/4/2006	3	2793	3	+	57		18	22	2	2	1	blue, upright, clean
8/4/2006	3	2789	1	+	69		12	17	2	3	3	diseased, lodged
8/4/2006	3	2789	2	X	X		X	X	X	X	X	
8/4/2006	3	2789	3	+	54		21	23	2	3	2	diseased
8/4/2006	3	2784	1	+	91		22	25	2	1	1	disease severe
8/4/2006	3	2784	2	+	72		28	28	3	1	1	clean, large
8/4/2006	3	2784	3	+	68		29	26	1	1	1	fine, upright
8/4/2006	3	2781	1	+	50		6	9	2	3	2	disease bottom leaf
8/4/2006	3	2781	2	X	X		X	X	X	X	X	
8/4/2006	3	2781	3	+	47		13	18	2	3	1	small, dwarf heads, bugs, stressed
8/4/2006	3	2826	1	+	78		19	17	2	2	1	
8/4/2006	3	2826	2	+	70		21	33	2	1	1	leafy, clean
8/4/2006	3	2826	3	+	63		19	23	1	1	1	fine leaf, yellow, disease
8/4/2006	3	2821	1	X	X		X	X	X	X	X	
8/4/2006	3	2821	2	X	X		X	X	X	X	X	
8/4/2006	3	2821	3	X	X		X	X	X	X	X	
8/4/2006	4	Goshen	1	X	X		X	X	X	X	X	
8/4/2006	4	Goshen	2	+	67		21	21	2	2	2	leafy
8/4/2006	4	Goshen	3	+	82		22	23	2	1	1	some disease, leafy
8/4/2006	4	2816	1	X	X		X	X	X	X	X	
8/4/2006	4	2816	2	X	X		X	X	X	X	X	
8/4/2006	4	2816	3	+	63		26	23	2	1	1	very leafy, some disease, blue, short
8/4/2006	4	2782	1	X	X		X	X	X	X	X	
8/4/2006	4	2782	2	+	30		6	6	2	2	2	
8/4/2006	4	2782	3	X	X		X	X	X	X	X	
8/4/2006	4	2823	1	+	48		9	5	2	3	3	small plant

<b>Table PS-3. Prairie Sandreed Evaluation, 2006 data (continued)</b>												
				Dead/	(in.)		(in.)	(in.)				
Date	*Row	Accession	*Plant	Alive	culm	veg.	EW	NS	leaf	leafi-	no.	Disease/Notes (9/20/2006)
					ht.	ht.	spread	spread	width	ness	culms	
8/4/2006	4	2823	2	+	40		6	4	2	2	3	small, stressed, disease
8/4/2006	4	2823	3	X	X		X	X	X	X	X	
8/4/2006	4	2822	1	X	X		X	X	X	X	X	
8/4/2006	4	2822	2	+	48		11	9	2	2	3	lodged, stress, no disease
8/4/2006	4	2822	3	+	67		9	8	3	2	3	lodged, stressed
8/4/2006	4	2779	1	+	41		8	10	1	2	3	fine, little disease, upright
8/4/2006	4	2779	2	X	X		X	X	X	X	X	
8/4/2006	4	2779	3	X	X		X	X	X	X	X	
8/4/2006	4	2790	1	X	X		X	X	X	X	X	
8/4/2006	4	2790	2	+	27		4	3	2	3	3	almost dead, lodged
8/4/2006	4	2790	3	+	37		11	14	1	3	3	
8/4/2006	4	2787	1	+	68		24	24	2	2	1	
8/4/2006	4	2787	2	+	57		30	27	2	2	2	center dead
8/4/2006	4	2787	3	X	X		X	X	X	X	X	
8/4/2006	4	2786	1	+	86		20	21	3	2	1	large plant
8/4/2006	4	2786	2	+	67		21	17	1	2	2	diseased, lodged
8/4/2006	4	2786	3	+	91		29	31	3	1	1	large, coarse
8/4/2006	5	ND95	1	+	78		17	20	2	2	2	disease severe
8/4/2006	5	ND95	2	+	55		24	25	1	1	2	disease severe
8/4/2006	5	ND95	3	+	71		19	20	2	2	2	disease severe
8/4/2006	5	2825	1	X	X		X	X	X	X	X	
8/4/2006	5	2825	2	X	X		X	X	X	X	X	
8/4/2006	5	2825	3	+	79		25	23	3	3	2	disease not severe
8/4/2006	5	2783	1	X	X		X	X	X	X	X	
8/4/2006	5	2783	2	+	66		32	22	3	3	2	disease, lodged
8/4/2006	5	2783	3	+	72		21	19	2	1	2	
8/4/2006	5	2792	1	+	43		13	6	2	3	3	small
8/4/2006	5	2792	2	+	45		26	27	2	2	3	open, not leafy
8/4/2006	5	2792	3	+	61		26	26	2	2	3	
8/4/2006	5	2814	1	+	58		21	18	2	3	2	stressed, yellow
8/4/2006	5	2814	2	+	72		24	24	2	3	2	lodged, disease
8/4/2006	5	2814	3	+	77		29	23	1	2	1	fine leaves

Table PS-3. Prairie Sandreed Evaluation, 2006 data (continued)												
				Dead/	(in.)	veg.	(in.)	(in.)				
Date	*Row	Accession	*Plant	Alive	culm	ht.	EW	NS	leaf	leafi-	no.	Disease/Notes (9/20/2006)
					ht.	ht.	spread	spread	width	ness	culms	
8/4/2006	5	2778	1	+	48		11	8	3	3	2	disease
8/4/2006	5	2778	2	+	57		11	8	2	3	3	disease severe
8/4/2006	5	2778	3	+	56		11	20	1	2	1	
8/4/2006	5	2771	1	+	75		22	30	3	1	1	disease
8/4/2006	5	2771	2	+	91		31	30	3	1	1	disease not severe
8/4/2006	5	2771	3	+	62		22	23	2	1	1	leafy, slight disease
8/4/2006	5	2821	1	+	29		15	9	2	2	3	no heads, stress
8/4/2006	5	2821	2	X	X		X	X	X	X	X	
8/4/2006	5	2821	3	X	X		X	X	X	X	X	
8/4/2006	5	2781	1	+	72		23	18	2	2	2	disease, very small
8/4/2006	5	2781	2	+	18		5	5	1	3	3	
8/4/2006	5	2781	3	X	X		X	X	X	X	X	
8/4/2006	6	2789	1	X	X		X	X	X	X	X	
8/4/2006	6	2789	2	X	X		X	X	X	X	X	
8/4/2006	6	2789	3	X	X		X	X	X	X	X	
8/4/2006	6	2813	1	+	36		12	10	1	1	2	disease, yellow, stress
8/4/2006	6	2813	2	X	X		X	X	X	X	X	
8/4/2006	6	2813	3	X	X		X	X	X	X	X	
8/4/2006	6	2818	1	+	54		9	6	2	3	3	disease
8/4/2006	6	2818	2	+	52		23	17	2	2	1	leafy
8/4/2006	6	2818	3	+	29		5	7	2	3	3	disease, almost dead
8/4/2006	6	2775	1	+	55		19	26	2	2	1	disease on lower Leaves
8/4/2006	6	2775	2	+	65		23	23	1	1	2	
8/4/2006	6	2775	3	+	81		18	20	2	2	1	
8/4/2006	6	2773	1	+	70		24	18	2	2	2	blue, leafy
8/4/2006	6	2773	2	+	66		25	24	2	3	2	lodged
8/4/2006	6	2773	3	+	79		21	19	2	1	1	leafy
8/4/2006	6	2772	1	X	X		X	X	X	X	X	
8/4/2006	6	2772	2	+	40		13	15	2	1	2	
8/4/2006	6	2772	3	X	X		X	X	X	X	X	
8/4/2006	6	2777	1	X	X		X	X	X	X	X	
8/4/2006	6	2777	2	X	X		X	X	X	X	X	

Table PS-3. Prairie Sandreed Evaluation, 2006 data (continued)												
				Dead/ Alive	(in.) culm ht.	veg. ht.	(in.) EW spread	(in.) NS spread	leaf width	leafi- ness	no. culms	Disease/Notes (9/20/2006)
8/4/2006	6	2777	3	+	75		31	20	3	2	1	disease severe
8/4/2006	6	2815	1	+	45		15	13	2	1	3	blue, leafy
8/4/2006	6	2815	2	X	X		X	X	X	X	X	
8/4/2006	6	2815	3	+	80		21	19	2	2	2	leafy
8/4/2006	6	2793	1	+	60		20	25	2	1	1	disease
8/4/2006	6	2793	2	+	52		9	15	2	2	3	
8/4/2006	6	2793	3	+	68		31	22	1	1	1	leafy, yellow
8/4/2006	7	2784	1	+	69		27	21	3	1	1	
8/4/2006	7	2784	2	+	72		19	24	2	2	1	
8/4/2006	7	2784	3	+	88		25	20	2	1	2	stressed, yellow
8/4/2006	7	2826	1	+	67		14	19	2	2	2	
8/4/2006	7	2826	2	+	60		14	19	2	1	1	fine leafed
8/4/2006	7	2826	3	+	66		18	16	2	1	1	fine leafed, slight disease
8/4/2006	7	2774	1	X	X		X	X		X	X	
8/4/2006	7	2774	2	+	47		19	12	2	3	2	small
8/4/2006	7	2774	3	+	39		13	13	2	3	2	disease severe
8/4/2006	7	2776	1	+	64		15	14	2	2	2	disease severe
8/4/2006	7	2776	2	+	62		24	20	2	3	2	disease severe
8/4/2006	7	2776	3	+	39		10	15	2	3	3	disease, small, stressed
8/4/2006	7	2817	1	X	X		X	X	X	X	X	
8/4/2006	7	2817	2	X	X		X	X	X	X	X	
8/4/2006	7	2817	3	+	0	23	7	12	2	3	3	disease, small plant
8/4/2006	7	2794	1	+	82		36	36	2	1	1	leafy, coarse
8/4/2006	7	2794	2	+	76		36	24	2	1	1	
8/4/2006	7	2794	3	+	80		24	25	2	1	1	disease, lodged
8/4/2006	7	2788	1	X	X		X	X	X	X	X	
8/4/2006	7	2788	2	X	X		X		X	X	X	
8/4/2006	7	2788	3	+	56		20	21	2	3	3	disease, short, sprawling
8/4/2006	7	2780	1	+	0	35	9	9	2	3	3	disease, small
8/4/2006	7	2780	2	+	0	32	9	8	2	3	3	disease, small
8/4/2006	7	2780	3	+	0	25	6	5	2	3	3	disease, small
8/4/2006	7	2820	1	+	0	24	4	8	1	3	3	disease, small

Table PS-3. Prairie Sandreed Evaluation, 2006 data (continued)												
				Dead/ Alive	(in.) culm ht.	veg. ht.	(in.) EW spread	(in.) NS spread	leaf width	leafi- ness	no. culms	Disease/Notes (9/20/2006)
8/4/2006	7	2820	2	X			X	x				
8/4/2006	7	2820	3	X	X		X	X	X	X	X	
8/4/2006	8	Goshen	1	+	60		22	22	2	2	2	disease no center
8/4/2006	8	Goshen	2	+	56		24	19	3	2	2	disease severe
8/4/2006	8	Goshen	3	+	63		29	28	2	1	1	disease severe
8/4/2006	8	2773	1	X	X		X	X	X	X	X	
8/4/2006	8	2773	2	+	54		20	20	2	1	1	leafy, blue, upright
8/4/2006	8	2773	3	+	48		13	10	2	1	3	leafy, blue, slight disease
8/4/2006	8	2774	1	+	31		10	9	2	2	2	small upright, slight disease
8/4/2006	8	2774	2	+	36		18	12	2	3	1	disease
8/4/2006	8	2774	3	+	30		12	10	1	2	2	disease, small plant
8/4/2006	8	2771	1	+	57		35	35	2	1	1	disease, leafy
8/4/2006	8	2771	2	+	75		23	25	3	3	2	disease
8/4/2006	8	2771	3	+	70		34	25	2	2	2	disease slight
8/4/2006	8	2772	1	+	61		24	23	3	2	2	disease slight
8/4/2006	8	2772	2	+	61		24	25	3	2	2	
8/4/2006	8	2772	3	+	53		18	22	2	2	2	stressed
8/4/2006	8	2775	1	+	84		29	30	3	2	1	leafy, clean
8/4/2006	8	2775	2	+	60		23	25	2	1	2	leafy
8/4/2006	8	2775	3	+	34		24	19	2	2	3	disease
8/4/2006	8	2776	1	+	68		25	27	2	2	1	disease not severe
8/4/2006	8	2776	2	X	X		X	X	X	X	X	
8/4/2006	8	2776	3	+	54		24	21	1	1	1	disease, yellow
8/4/2006	8	2778	1	+	64		11	13	2	2	2	disease, severe
8/4/2006	8	2778	2	X	X		X	X	X	X	X	
8/4/2006	8	2778	3	+	0	28	9	10	2	3	3	disease severe
8/4/2006	8	2777	1	X	X		X	X	X	X	X	
8/4/2006	8	2777	2	+	57		18	11	2	2	2	disease
8/4/2006	8	2777	3	+	0	32	3	6	2	3	3	disease
8/4/2006	9	2818	1	+	0	24	12	11	2	3	3	disease
8/4/2006	9	2818	2	+	34		10	17	2	3	3	disease
8/4/2006	9	2818	3	X	X		X	X	X	X	X	

<b>Table PS-3. Prairie Sandreed Evaluation, 2006 data (continued)</b>												
				Dead/ Alive	(in.) culm ht.	veg. ht.	(in.) EW spread	(in.) NS spread	leaf width	leafi- ness	no. culms	Disease/Notes (9/20/2006)
8/4/2006	9	2817	1	X	X		X	X	X	X	X	
8/4/2006	9	2817	2	X	X		X	X	X	X	X	
8/4/2006	9	2817	3	X	X		X	X	X	X	X	
8/4/2006	9	2814	1	X	X		X	X	X	X	X	
8/4/2006	9	2814	2	+	54		19	13	2	2	2	
8/4/2006	9	2814	3	+	42		12	8	1	3	3	very fine leaf small
8/4/2006	9	2815	1	X	X		X	X	X	X	X	
8/4/2006	9	2815	2	+	83		20	17	2	3	2	blue, disease
8/4/2006	9	2815	3	+	51		22	20	2	1	2	blue, leafy
8/4/2006	9	2813	1	+	64		18	21	2	3	1	lodged
8/4/2006	9	2813	2	X	X		X	X	X	X	X	
8/4/2006	9	2813	3	X	X		X	X	X	X	X	
8/4/2006	9	2794	1	X	X		X	X	X	X	X	
8/4/2006	9	2794	2	+	78		30	36	2	1	1	leafy, robust, slight disease
8/4/2006	9	2794	3	X	X		X	X	X	X	X	
8/4/2006	9	2792	1	+	73		27	29	3	2	1	blue, no center
8/4/2006	9	2792	2	+	65		24	25	2	3	2	blue, no center
8/4/2006	9	2792	3	+	77		26	24	3	3	2	blue, no center
8/4/2006	9	2793	1	X	X		X	X	X	X	X	
8/4/2006	9	2793	2	X	X		X	X	X	X	X	
8/4/2006	9	2793	3	+	73		28	14	2	1	1	leafy
8/4/2006	9	2789	1	+	48		10	12	2	3	3	diseased
8/4/2006	9	2789	2	X	X		X	X	X	X	X	
8/4/2006	9	2789	3	+	57		17	14	2	3	2	stressed
8/4/2006	10	2788	1	X	X		X	X	X	X	X	
8/4/2006	10	2788	2	+	69		24	27	3	2	1	short, wide
8/4/2006	10	2788	3	X	X		X	X	X	X	X	
8/4/2006	10	2783	1	+	76		31	30	2	1	1	diseased
8/4/2006	10	2783	2	X	X		X	X	X	X	X	
8/4/2006	10	2783	3	X	X		X	X	X	X	X	
8/4/2006	10	2784	1	X	X		X	X	X	X	X	
8/4/2006	10	2784	2	X	X		X	X	X	X	X	



Table PS-3. Prairie Sandreed Evaluation, 2006 data (continued)												
				Dead/	(in.)		(in.)	(in.)				
Date	*Row	Accession	*Plant	Alive	culm	veg.	EW	NS	leaf	leafi-	no.	Disease/Notes (9/20/2006)
					ht.	ht.	spread	spread	width	ness	culms	
8/4/2006	10	2784	3	+	77		21	28	2	1	1	disease severe
8/4/2006	10	2781	1	X	X		X	X	X	X	X	
8/4/2006	10	2781	2	+	52		14	18	1	1	1	disease, upright
8/4/2006	10	2781	3	X	X		X	X	X	X	X	
8/4/2006	10	2780	1	X	X		X	X	X	X	X	
8/4/2006	10	2780	2	X	X		X	X	X	X	X	
8/4/2006	10	2780	3	X	X		X	X	X	X	X	
8/4/2006	10	2825	1	X	X		X	X	X	X	X	
8/4/2006	10	2825	2	+	42		16	14	2	2	1	
8/4/2006	10	2825	3	X	X		X	X	X	X	X	
8/4/2006	10	2826	1	X	X		X	X	X	X	X	
8/4/2006	10	2826	2	X	X		X	X	X	X	X	
8/4/2006	10	2826	3	+	77		30	30	1	1	1	disease, leafy
8/4/2006	10	2821	1	X	X		X	X	X	X	X	
8/4/2006	10	2821	2	X	X		X	X	X	X	X	
8/4/2006	10	2821	3	X	X		x	X	X	X	X	
8/4/2006	10	Goshen	1	+	81		30	30	2	2	1	
8/4/2006	10	Goshen	2	+	52		24	33	2	1	1	leafy
8/4/2006	10	Goshen	3	+	89		31	36	3	2	1	
8/4/2006	11	2820	1	+	44		13	15	2	3	3	disease, stressed
8/4/2006	11	2820	2	X	X		X	X	X	X	X	
8/4/2006	11	2820	3	X	X		X	X	X	X	X	
8/4/2006	11	ND95	1	X	X		X	X	X	X	X	
8/4/2006	11	ND95	2	X	X		X	X	X	X	X	
8/4/2006	11	ND95	3	X	X		X	X	X	X	X	
8/4/2006	11	2816	1	+	45		22	24	2	1	2	leafy, some disease
8/4/2006	11	2816	2	X	X		X	X	X	X	X	
8/4/2006	11	2787	1	X	X		x	X	X	X	X	
8/4/2006	11	2786	1	+	97		30	39	3	2	1	diseased, lodged, large plants
8/4/2006	11	2786	2	+	76		14	16	3	2	2	diseased, lodged
8/4/2006	11	2823	1	+	0	15	3	4	2	3	3	small
8/4/2006	11	2823	2	X	X		X	X	X	X	X	

<b>Table PS-3. Prairie Sandreed Evaluation, 2006 data (continued)</b>												
					(in.)		(in.)	(in.)				
				Dead/	culm	veg.	EW	NS	leaf	leafi-	no.	
<b>Date</b>	<b>*Row</b>	<b>Accession</b>	<b>*Plant</b>	<b>Alive</b>	<b>ht.</b>	<b>ht.</b>	<b>spread</b>	<b>spread</b>	<b>width</b>	<b>ness</b>	<b>culms</b>	<b>Disease/Notes (9/20/2006)</b>
8/4/2006	11	2822	1	X	X		X	X	X	X	X	
8/4/2006	11	2822	2	X	X		X	X	X	X	X	
8/4/2006	11	2822	3	+	88		14	17	3	2	2	slight lodging
8/4/2006	11	2786	1	+	81		39	28	2	1	1	leafy upright nice plant
8/4/2006	11	2790	1	+	45		16	17	2	3	3	diseased, stressed
8/4/2006	11	2816	1	+	45		18	20	2	2	1	leafy, not tall
8/4/2006	11	2816	2	X	X		X	X	X	X	X	
8/4/2006	11	2787	1	X	X		X	X	X	X	X	

**ACTIVE STUDIES: TECHNICAL REPORT 2004-2006**

Study: NDPMC-P-0402-RA

Study Title: Sand Bluestem Seed Increase (*Andropogon hallii*)

Introduction: Plant species available for stabilizing sandy soils are limited. Sand bluestem is a tall, warm-season, perennial grass, native on sandy sites in the Great Plains. Its growth habit and forage quality are important attributes when used in conservation plantings.

Objective: The purpose of this study is to develop a sand bluestem release from native collections from SD, ND, and MN . Superior plants will be selected and the release would be for various conservation plantings on sandy sites in South Dakota, North Dakota, and Minnesota.

Cooperators: USDA, NRCS, Bismarck Plant Materials Center

Description: Sand bluestem is a tall, perennial, warm season grass that can grow to a height of 7 feet. It has short rhizomes. The culms are solid. The seed heads are racemes forming the "turkey foot" shape and closely resembling big bluestem. It is distinguished from big bluestem by its lack of hairs on the leaves and the dense yellow hairs on the seed heads. The stems tend to be straw-colored. It is not as palatable as big bluestem but does provide excellent grazing and decreases with grazing pressure.

Distribution: Sandy soils of the Great Plains

**Methods and Materials**

Collection: Seed was hand harvested from various sites throughout North Dakota, South Dakota, and Minnesota in the fall of 2004. Each collection was accessioned (assigned an ID number). See Table SB-1 for a list of collection information.

Assembly: Seed was planted to cone-tainers in the greenhouse in February of 2005. Seedlings were hardened off in the lath house and planted to a field in Panel A at the PMC in May 2005.

Planting Plan: See Figure SB-1 for a planting plan. The planting was made on 5/24/2005. Accessions were planted in three-plant plots, with accessions random within a replication. Three replications were planted. The third replication does not have all three plants for all accessions, due to limited germination of seed in the greenhouse. Plants were spaced 42 inches apart within the row and rows were 42 inches apart.

Site Preparation: The site was prepared by tilling and slightly packing prior to planting. The site was black fallowed at least 2 years before planting.

Planting Method: The plants were hand-planted. Holes were dug using specially made dibble bars that produced holes approximately the length of the long roots growing in the cone-tainers.

Planting Date: 5/24/2005

Maintenance:

2005	Fertilizer-none
2005	Weed control-frequent shallow tilling using walk behind front tine garden tiller
2005	Irrigation-once right after planting to establish plants
2005	Residue removal-hand clipped to 3 inch stubble in November
2006	Fertilizer-none

2006	Weed control-shallow tilling, hand hoeing
2006	Irrigation-once in July during severe drought
2006	Residue removal-attempted to burn,hand clipped in November

Data Collection: Data was collected for each plant in the field in 2005 and 2006. See Table SB-2 and SB-3 for data.

### **Results and Discussion**

Survival of transplants was good. Plant vigor overall was good in 2005 and 2006 despite the droughty conditions. Color ranges from blue green to green. Plants within some accessions have different growth habits. This is expected for seed collected accessions as parentage could be different. Data will again be gathered in 2007. Some of the accessions appear to be big bluestem rather than sand bluestem. All plants that are not *Andropogon hallii* will be removed in 2007.

<b>Table SB-1. Sand bluestem collection information</b>					
<b>Accession</b>	<b>State</b>	<b>County</b>	<b>Date</b>	<b>Legal Description</b>	<b>Collector</b>
9082894	SD	Harding	09/14/03	Sec.30, T15N, R5E SE of N Crow Butte	L.Smith
9082803	ND	Adams	09/02/03	SW1/4 Sec.11 and NE1/4 of Sec.14, T129N, R92W Roadway	J.Klein, J.Timm
9082804	ND	Ransom	09/08/03	Sec. 14 and Sec.23, T135N, R53W Sheyenne Grasslands	
9082805	ND	McHenry	09/24/03	Sec.20, T158N, R75W, Mouse River State Forest	M.Knudson
9082806	ND	McHenry	09/24/03	Sec.13, T153N, R76W road ditch SE of George Lake	M.Knudson
9082807	SD	Corson	09/23/03	Sec.29, T20N, R18E flat area	D.Evenson
9082808	ND	Ransom	09/09/03	Sec.27,34 T135N, R53W 2mi N of Hwy 27 along 147 Ave. N	
9082809	SD	Brown	09/09/03	NE1/4 26, SW1/4 25, T128N, R60W 1mi from Brown/Marshall Co. line	
9082810	SD	Todd	09/19/03	SW1/4 19, T36N, R29W N of county road	L.Schoon
9082811	SD	Todd	09/19/03	NW1/4 Sec.25, T36N, R31W, 3/4mi W Hwy S of St. Francis	L.Schoon
9082812	SD	Todd	09/19/03	SE1/4 Sec.9, T36N, R28W 1/2 mi W of Hwy 83, N edge of county road	L.Schoon
9082824	ND	Billings	10/01/03	SW1/4 Sec.22, T139N, R103W along Little Missouri River	M.Humann
9082827	ND	McHenry	09/15/03	NW1/4 Sec.2, T75N, R154W east of farm	W.Duckwitz
9082881	MT		2003	Sec.25, T11N, R48E	T.Haughain, Kilian
9082904	ND	Burleigh	09/09/03	Sec.7, T137N, R77W Moffit Rd west of curve	Jensen, Bergsagel
9082905	ND	Emmons	09/23/04	4 mi S. of Glencoe Church, Hwy 1804, east side of road	D.Tober
Garden	KS			Received from Manhattan, KS PMC	
sher1	MN	Sherburne	09/04/03	Sec.27, T34N, R27W Sand Dunes State Forest, east exposure	G.Hugo
sher2	MN	Sherburne	09/04/03	Sec.4, T133N, R28W non-cropped pivot corner	B.Gullickson
sher3	MN	Sherburne	09/04/03	SESE Sec.15, T34N, R27W old Christmas tree plantation	G.Hugo
sher4	MN	Sherburne	09/04/03	Sec.24, T34N, R29W Oak Savannah Land preserve (county park)	B.Gullickson
sher5	MN	Sherburne	09/04/03	Sec.16, T34N, R29W & Sec.31, T34, R28 along railroad tracks	B.Gullickson

**Figure SB-1. Plot Layout of Sand Bluestem Assembly.**

Location: Panel A

Planting Date: 5/24/2005

(Plants were started in containers in the greenhouse from collected seed)

Plant spacing: 42 inches (3.5 ft.)

Row spacing: 42 inches (3.5 ft.)



Garden	9082811	9082809	9082806	sher5	9082881
Garden	9082811	9082809	9082806	sher5	9082881
Garden	9082811	9082809	9082806	sher5	9082881
9082827	9082905	9082881	9082807	9082806	sher3
9082827	9082905	9082881	9082807	9082806	sher3
9082827	9082905	9082881	9082807	9082806	sher3
9082810	sher5	9082811	sher3	9082812	9082810
9082810	sher5	9082811	sher3	9082812	9082810
9082810	sher5	9082811	sher3	9082812	9082810
9082809	9082807	sher5	9082810	9082804	Garden
9082809	9082807	sher5	9082810	9082804	Garden
9082809	9082807	sher5	9082810	9082804	Garden
9082806	9082904	9082804	9082812	9082809	9082803
9082806	9082904	9082804	9082812	9082809	9082803
9082806	9082904	9082804	9082812	9082809	9082803
9082803	sher3	Garden	sher2	9082811	9082905
9082803	sher3	Garden	sher2	9082811	9082905
9082803	sher3	Garden	sher2	9082811	9082905
9082808	sher2	9082803	9082904	sher2	9082904
9082808	sher2	9082803	9082904	sher2	9082904
9082808	sher2	9082803	9082904	sher2	9082904
9082881	9082804	9082905	9082808	9082808	9082807
9082881	9082804	9082905	9082808	9082808	9082807
9082881	9082804	9082905	9082808	9082808	9082807
9082812	9082802	9082827	blank	9082827	9082824
9082812	9082802	9082827	blank	9082827	sher4
9082812	9082802	9082827	blank	9082827	sher1

**Table SB-2. Sand bluestem evaluation data, 9/13/2005.**

<u>Accession</u>	<u>Rep</u>	<u>Row</u>	<u>alive/ Dead</u>	<u>Species</u>	<u>Seed heads</u>	<u>notes</u>
Garden	1	1	alive		y	
Garden	1	1	alive		y	
Garden	1	1	alive		y	
9082827	1	1	alive		no	
9082827	1	1	alive		y	
9082827	1	1	alive		y	
9082810	1	1	alive	?big bluestem	y	
9082810	1	1	alive	?	y	
9082810	1	1	alive		y	
9082809	1	1	alive	?	y	
9082809	1	1	alive	?	y	
9082809	1	1	alive		y	
9082806	1	1	alive		y	
9082806	1	1	alive		y	small
9082806	1	1	alive		y	leafy
9082803	1	1	Dead			
9082803	1	1	alive		y	
9082803	1	1	alive		y	
9082808	1	1	alive		y	
9082808	1	1	alive		no	
9082808	1	1	alive		y	
9082881	1	1	alive		y	small
9082881	1	1	alive		y	
9082881	1	1	alive		y	
9082812	1	1	alive		y	
9082812	1	1	alive		y	
9082812	1	1	alive		y	
9082811	1	2	alive		y	
9082811	1	2	alive		y	
9082811	1	2	alive		y	
9082905	1	2	alive		y	
9082905	1	2	alive		no	very small
9082905	1	2	alive		no	
Sher5	1	2	alive	big bluestem	y	
Sher5	1	2	alive	big bluestem	y	
Sher5	1	2	alive	big bluestem	y	
9082807	1	2	alive		no	very small
9082807	1	2	alive		y	
9082807	1	2	alive		y	
9082904	1	2	a-barely		no	
9082904	1	2	alive		y	sheath
9082904	1	2	alive		y	
sher3	1	2	alive	big bluestem	y	
sher3	1	2	alive	big bluestem	y	
sher3	1	2	alive	big bluestem	y	
sher2	1	2	alive	big bluestem	y	
sher2	1	2	alive	big bluestem	y	

**Table SB-2. Sand bluestem evaluation data, 9/13/2005 (continued).**

<u>Accession</u>	<u>Rep</u>	<u>Row</u>	<u>alive/ Dead</u>	<u>Species</u>	<u>Seed heads</u>	<u>notes</u>
sher2	1	2	alive	big bluestem	no	
9082804	1	2	alive		y	
9082804	1	2	alive		y	
9082804	1	2	alive		y	
9082802	1	2	alive		y	
9082802	1	2	alive		y	
9082802	1	2	alive	?	y	
9082809	2	3	alive	?	y	
9082809	2	3	alive		y	
9082809	2	3	alive		y	
9082881	2	3	a-barely		no	
9082881	2	3	alive		y	very small
9082881	2	3	alive		no	
9082811	2	3	alive	?	no	
9082811	2	3	alive	?	y	
9082811	2	3	alive	?	y	in sheath
sher5	2	3	alive	big bluestem	y	
sher5	2	3	alive	big bluestem	y	
sher5	2	3	alive	big bluestem	y	
9082804	2	3	alive		y	
9082804	2	3	alive		y	
9082804	2	3	alive		y	
Garden	2	3	alive		y	
Garden	2	3	alive		y	
Garden	2	3	alive		y	
9082803	2	3	alive		y	
9082803	2	3	alive		y	
9082803	2	3	alive	?	y	
9082905	2	3	alive		no	small
9082905	2	3	alive		y	
9082905	2	3	alive		y	in sheath
9082827	2	3	alive	?	y	
9082827	2	3	alive		y	1 head
9082827	2	3	alive		no	
9082806	2	4	alive		no	small
9082806	2	4	alive		y	few hds
9082806	2	4	alive		no	
9082807	2	4	alive		y	flowering
9082807	2	4	alive		y	flowering
9082807	2	4	alive		y	flowering
sher3	2	4	alive	big bluestem	y	
sher3	2	4	alive	big bluestem	y	
sher3	2	4	alive	big bluestem	y	
9082810	2	4	alive		y	in sheath
9082810	2	4	alive		y	
9082810	2	4	alive		y	
9082812	2	4	alive		no	small
9082812	2	4	alive		y	sml, shea



**Table SB-2. Sand bluestem evaluation data, 9/13/2005 (continued).**

<u>Accession</u>	<u>Rep</u>	<u>Row</u>	<u>alive/ Dead</u>	<u>Species</u>	<u>Seed heads</u>	<u>notes</u>
9082812	2	4	alive		y	
sher2	2	4	alive	big bluestem	y	
sher2	2	4	alive	big bluestem	y	
sher2	2	4	alive	big bluestem	y	
9082904	2	4	alive		y	
9082904	2	4	alive		no	
9082904	2	4	alive		y	2 culms
9082808	2	4	alive		y	
9082808	2	4	alive		y	
9082808	2	4	alive		y	
blank	2	4	---			
blank	2	4	---			
blank	2	4	---			
sher5	3	5	alive	big bluestem	y	
sher5	3	5	alive	big bluestem	y	
sher5	3	5	alive	big bluestem	y	
9082806	3	5	alive		y	2 sm culms
9082806	3	5	alive		y	
9082806	3	5	alive		y	
9082812	3	5	alive		y	
9082812	3	5	alive		y	
9082812	3	5	alive		y	in sheath
9082804	3	5	Dead			
9082804	3	5	alive		y	in sheath
9082804	3	5	alive		no	
9082809	3	5	alive	?	y	
9082809	3	5	alive		y	2 culms
9082809	3	5	alive		y	
9082811	3	5	alive		y	
9082811	3	5	alive	big bluestem	y	
9082811	3	5	alive	big bluestem	y	
sher2	3	5	alive	big bluestem	y	
sher2	3	5	alive	big bluestem	no	
sher2	3	5	alive	big bluestem	y	
9082808	3	5	alive		y	1 in sheath
9082808	3	5	alive		y	
9082808	3	5	alive		no	
9082827	3	5	alive		no	
9082827	3	5	alive		y	
9082827	3	5	alive		y	1 in sheath
9082881	3	6	alive		no	
9082881	3	6	alive		no	
9082881	3	6	alive		y	
sher3	3	6	alive	big bluestem	y	
sher3	3	6	alive	big bluestem	y	
sher3	3	6	alive	big bluestem	y	
9082810	3	6	alive	big bluestem	y	
9082810	3	6	alive	?	y	

<b>Table SB-2. Sand bluestem evaluation data, 9/13/2005 (continued).</b>						
<b>Accession</b>	<b>Rep</b>	<b>Row</b>	<b>alive/ Dead</b>	<b>Species</b>	<b>Seed heads</b>	<b>notes</b>
9082810	3	6	alive	?	y	
Garden	3	6	alive		y	
Garden	3	6	alive		y	
Garden	3	6	alive		y	
9082803	3	6	alive		y	
9082803	3	6	alive		y	
9082803	3	6	alive		y	
9082905	3	6	Dead			
9082905	3	6	alive	?	y	
9082905	3	6	alive	?	y	
9082904	3	6	alive		y	
9082904	3	6	alive		y	
9082904	3	6	alive		no	
9082807	3	6	Dead			
9082807	3	6	alive		y	
9082807	3	6	alive		y	
9082824	3	6	alive	big bluestem	y	
sher4	3	6	alive		y	
sher1	3	6	alive	big bluestem	y	

Table SB-3. Sand bluestem evaluation data, 8/4/2006.								
Leaf width: 1=fine,narrow 2=medium 3=wide								
Leafiness: 1=very leafy 2=medium 3= few leaves								
No. of Culms: 1=many 2=medium 3=few								
Accession	Rep	Row	canopy spread (inches)	culm height (inches)	leaf width	leafiness	no. of culms	Notes
Garden	1	1	20	63	2	2	2	
Garden	1	1	20	72	2	2	1	
Garden	1	1	36	66	2	2	2	boot, no heads
9082827	1	1	13	51	1	3	2	powder blue
9082827	1	1	20	57	2	2	2	
9082827	1	1	26	42	2	3	2	
9082810	1	1	10	41	1	3	2	
9082810	1	1	17	45	2	3	2	
9082810	1	1	17	63	2	2	1	red stemmed
9082809	1	1	35	45	2	1	1	
9082809	1	1	21	45	2	3	2	lodged, very basal leaves
9082809	1	1	25	24	1	2	2	very blue, boot
9082806	1	1	29	48	2	1	1	
9082806	1	1	12	39	2	1	1	
9082806	1	1	21	51	2	1	1	very upright
9082803	1	1						
9082803	1	1	25	54	2	2	2	
9082803	1	1	23	42	2	2	1	
9082808	1	1	21	36	1	1	2	boot
9082808	1	1	17	45	2	2	2	powder blue, boot
9082808	1	1	26	48	2	2	1	very hairy heads
9082881	1	1	20	45	2	2	2	
9082881	1	1	24	54	2	2	1	
9082881	1	1	18	36	2	3	2	
9082812	1	1	21	51	2	1	2	upright
9082812	1	1	12	39	2	2	2	
9082812	1	1	18	42	2	1	1	
9082811	1	2	23	45	2	1	2	
9082811	1	2	18	54	2	2	1	
9082811	1	2	19	57	3	2	1	
9082905	1	2	26	51	2	2	1	
9082905	1	2	5	48	2	3	3	
9082905	1	2	11	54	2	3	2	
Sher5	1	2	22	54	2	2	1	big bluestem?
Sher5	1	2	32	45	2	2	2	big bluestem?
Sher5	1	2	27	51	2	2	1	big bluestem?
9082807	1	2	2	5	2	3	3	
9082807	1	2	30	48	2	1	1	
9082807	1	2	30	54	2	2	2	
9082904	1	2	dead	--				
9082904	1	2	27	54	2	1	1	
9082904	1	2	28	48	3	3	2	

**Table SB-3. Sand bluestem evaluation data, 8/4/2006 (continued).**

			canopy	culm				
			spread	height	leaf	leafi-	no. of	
<b>Accession</b>	<b>Rep</b>	<b>Row</b>	<b>(inches)</b>	<b>(inches)</b>	<b>width</b>	<b>ness</b>	<b>culms</b>	<b>Notes</b>
sher3	1	2	19	66	2	2	2	big bluestem?
sher3	1	2	17	66	2	2	2	big bluestem?
sher3	1	2	15	72	2	2	1	big bluestem?
sher2	1	2	4	12	2	3	3	big bluestem?
sher2	1	2	18	63	2	2	1	big bluestem?
sher2	1	2	9	15	2	3	3	big bluestem?
9082804	1	2	23	36	2	3	3	
9082804	1	2	20	36	2	3	3	
9082804	1	2	12	18	3	3	3	
9082802	1	2	18	48	3	1	1	lime green
9082802	1	2	7	21	2	3	2	yellow green
9082802	1	2	13	51	2	2	1	
9082809	2	3	36	42	2	2	1	
9082809	2	3	23	36	3	3	3	lodged
9082809	2	3	20	51	2	3	2	
9082881	2	3	dead					
9082881	2	3	16	26	1	2	2	
9082881	2	3	14	36	2	2	1	
9082811	2	3	14	18	2	2	3	no heads
9082811	2	3	34	42	2	1	1	
9082811	2	3	26	48	3	2	2	boot
sher5	2	3	21	57	2	2	2	big bluestem?
sher5	2	3	28	57	2	2	2	big bluestem?
sher5	2	3	30	57	2	2	1	big bluestem?
9082804	2	3	35	54	2	3	2	lodged, boot
9082804	2	3	26	63	3	1	1	
9082804	2	3	36	48	2	1	2	boot
Garden	2	3	17	72	2	2	1	
Garden	2	3	23	66	3	1	1	
Garden	2	3	17	81	3	2	1	
9082803	2	3	18	51	2	1	1	
9082803	2	3	36	51	2	1	1	
9082803	2	3	22	42	2	2	1	
9082905	2	3	9	42	2	2	2	
9082905	2	3	16	45	1	2	2	
9082905	2	3	8	39	2	2	3	
9082827	2	3	31	57	2	2	2	
9082827	2	3	22	45	2	2	1	
9082827	2	3	18	54	1	2	2	
9082806	2	4	4	6	2	3	3	very small, no heads
9082806	2	4	26	48	2	2	2	
9082806	2	4	11	39	3	2	2	
9082807	2	4	22	57	2	2	1	
9082807	2	4	17	36	1	2	2	
9082807	2	4	26	51	2	3	1	
sher3	2	4	17	75	2	2	1	big bluestem?
sher3	2	4	21	72	3	2	1	big bluestem?

**Table SB-3. Sand bluestem evaluation data, 8/4/2006 (continued).**

			canopy	culm				
			spread	height	leaf	leafi-	no. of	
<b>Accession</b>	<b>Rep</b>	<b>Row</b>	<b>(inches)</b>	<b>(inches)</b>	<b>width</b>	<b>ness</b>	<b>culms</b>	<b>Notes</b>
sher3	2	4	23	66	3	2	2	big bluestem?
9082810	2	4	13	63	2	2	2	
9082810	2	4	30	63	2	2	2	
9082810	2	4	22	54	2	2	1	
9082812	2	4	8	72	2	3	3	
9082812	2	4	10	30	2	2	3	
9082812	2	4	16	57	2	2	1	
sher2	2	4	23	45	2	2	1	big bluestem?
sher2	2	4	12	69	2	3	2	big bluestem?
sher2	2	4	16	72	2	1	1	big bluestem?
9082904	2	4	36	51	1	2	2	
9082904	2	4	15	24	1	2	3	boot
9082904	2	4	24	36	1	2	3	boot
9082808	2	4	22	45	2	2	1	
9082808	2	4	26	54	2	1	2	
9082808	2	4	23	54	2	2	1	
blank	2	4						
blank	2	4						
blank	2	4						
sher5	3	5	16	51	2	2	2	big bluestem?
sher5	3	5	15	66	2	2	1	big bluestem?
sher5	3	5	25	54	2	1	2	big bluestem?
9082806	3	5	8	48	2	3	1	
9082806	3	5	19	48	2	2	2	
9082806	3	5	17	48	2	2	2	
9082812	3	5	18	54	3	2	2	
9082812	3	5	15	54	3	2	2	
9082812	3	5	14	48	2	1	2	
9082804	3	5						
9082804	3	5	24	54	3	1	2	
9082804	3	5	8	6	2	3	3	boot
9082809	3	5	26	48	3	2	1	
9082809	3	5	26	36	3	3	2	
9082809	3	5	31	60	3	1	1	
9082811	3	5	25	54	3	1	1	
9082811	3	5	16	48	2	1	1	big bluestem?
9082811	3	5	18	51	2	1	1	big bluestem?
sher2	3	5	10	66	2	2	1	big bluestem?
sher2	3	5	6	42	2	3	3	big bluestem?
sher2	3	5	7	54	2	3	2	big bluestem?
9082808	3	5	32	57	3	2	2	
9082808	3	5	19	48	2	1	1	
9082808	3	5	11	33	3	2	3	
9082827	3	5	13	36	1	2	2	
9082827	3	5	25	48	2	1	1	
9082827	3	5	20	48	2	2	1	
9082881	3	6	21	45	2	2	2	

**Table SB-3. Sand bluestem evaluation data, 8/4/2006 (continued).**

			canopy	culm				
			spread	height	leaf	leafi-	no. of	
<b>Accession</b>	<b>Rep</b>	<b>Row</b>	<b>(inches)</b>	<b>(inches)</b>	<b>width</b>	<b>ness</b>	<b>culms</b>	<b>Notes</b>
9082881	3	6	9	45	2	2	3	
9082881	3	6	19	45	2	2	2	
sher3	3	6	12	69	3	1	2	big bluestem?
sher3	3	6	21	69	3	2	1	big bluestem?
sher3	3	6	15	66	3	2	2	big bluestem?
9082810	3	6	36	54	1	2	1	
9082810	3	6	34	51	1	1	1	big bluestem?
9082810	3	6	21	42	2	3	2	
Garden	3	6	28	84	3	1	1	
Garden	3	6	23	81	3	1	1	
Garden	3	6	24	60	2	1	1	
9082803	3	6	27	57	2	1	1	
9082803	3	6	27	42	1	1	1	
9082803	3	6	18	48	2	2	1	
9082905	3	6						
9082905	3	6	23	69	3	1	1	big bluestem?
9082905	3	6	20	60	3	1	1	big bluestem?
9082904	3	6	24	51	1	2	2	
9082904	3	6	26	51	1	2	2	
9082904	3	6	8	18	3	3	3	boot
9082807	3	6						
9082807	3	6	22	48	1	1	1	
9082807	3	6	12	42	1	1	1	
9082824	3	6	4	54	3	3	3	lodged, poor big bluestem
sher4	3	6	26	42	2	1	1	
sher1	3	6	7	24	2	3	1	

## **ACTIVE STUDIES: TECHNICAL REPORT 2004-2006**

### **Study NDPMC-P-0404-RA**

**Study Title:** Evaluation and Increase of Indiangrass *Sorghastrum nutans*

**Objective:** The purpose of this study is to identify and release an Indiangrass for use in urban and rural landscaping. A second objective is to identify and release another population of Indiangrass that is a good forage producer for use in livestock production

**Cooperators:** USDA, NRCS, Bismarck Plant Materials Center; University of Minnesota; South Dakota State University, Brookings, South Dakota

**Description:** Indiangrass is a tall, native, warm-season grass that is bunchy, but has short, stout rhizomes. It grows 2-6 tall. The leaves are often a gray-green color and are somewhat stiff and straight. The attractive seedheads are panicles that are reddish gold and softly hairy.

**Distribution:** Indiangrass is most commonly associated with big bluestem and switchgrass in tallgrass prairies. It is found in southeast Canada, through much of the central and eastern United States, and into Mexico. It is not generally found west of the Great Plains. It prefers deep, well-drained floodplain soils and moister conditions than big bluestem.

### **Methods and Materials**

**Collection:** Portions of plants were dug from an existing Indiangrass nursery at the north corner of the Agronomy Farm, South Dakota State University. The nursery had been planted in the 1970's-1980's from seedlings started from two seed collections, one from Aurora, east of Brookings, South Dakota, and one from an area around Yankton, South Dakota. Plants from the two sources could be distinguished by their leaf width and texture. The Yankton source, which is a more southern source had wider, coarser leaves than the Aurora source plants. Plants that were colorful or had unusual growth favorable for landscaping were flagged in the fall of 2004 by Dwight Tober and Nancy Jensen, PMC personnel; Mary Meyer, University of Minnesota; and Arvid Boe, South Dakota State University. Portions of the selected plants were dug the following spring on April 12, 2005, from the Brookings nursery. One portion of each selection was delivered to Mary Meyer at the University of Minnesota Arboretum and the remaining portion was taken to the Plant Materials Center. Additional Indiangrass plants were collected at native sites in Minnesota. These were grown only at the PMC.

The plant/root were kept dormant prior to greenhouse planting. They were kept in a tree cooler which was dark, damp and cool. Plantlets were split off from root chunks that had been collected at SDSU and native locations. Each individual plantlet was planted into Miracle Grow Potting Mix in cone-tainers and placed in the greenhouse to grow from April 25, 2005, to June 7, 2005, when they were planted into the field in panel A. The plants in the greenhouse were very slow to grow in size. Plants were hardened off in the lath house for two weeks prior to planting in the field.

**Assembly:** See Table IG-1 for accession information.

**Planting Plan:** Plantlets were planted to a field north of the sand bluestem in Panel A at the PMC. Each accession was planted in a three-plant plot. The accessions were randomized within the three replications. Plants were spaced 42 inches apart and rows were 42 inches apart. See Figure IG-1 for field plot map.

**Site Preparation:** The field was black fallowed prior to planting. Previous plant material in the field was *Carex atherodes*. The site was tilled and packed prior to planting.

Planting Method: Plants were hand planted using a specially made dibble bar that produces holes the size and length of roots within the cone-tainers.

Planting Date: 4/12/2005

Maintenance:

2005	2006
Plants were shallow tilled with small front-tine, walk-behind tiller	Plants were shallow tilled with small, front-tine, walk-behind tiller
Weed were hoed throughout season	Weeds were hoed throughout season
Irrigated-once in July, and once on 9/23/2005	Irrigated once in July due to severe drought conditions
No fertilizer	No fertilizer
Spot sprayed small thistle patch between row with Curtail	Spot sprayed small thistle patch between row with Curtail and Roundup

Data Collection: Notes on survival and a few comments on color were noted in 2005. As this was the transplant year, no extensive data was collected. Data collected in 2006 included plant height, leafiness, and culms produced. See Table IG-2 for data.

### **Results and Discussion**

Plant survival in the greenhouse was greater than 90 percent. Plant survival in the field in 2005 was greater than 90 percent. Some color differences were seen. In 2006, the plants had excellent plant growth despite drought conditions. Differences in phenology and growth characteristics were exhibited in 2006. Some accessions produced viable seed before freeze-up. Phenology was not recorded in 2006, but this will be noted in 2007.

Some plants displayed an upright stature and showed some color variation, making them desirable for landscaping. Some plants were also fine leaved, and leafy making them desirable for forage production. In 2007, plants will be rated for landscaping or forage and superior plants will be selected in 2008.

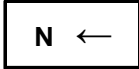


**Table IG-1. Indiangrass collection information.**

No.	Accession	State	County	Location
A1	9091979	A1 - A12 Vegetative material dug 4/12/2005 from Dr. Arvid Boe's assembly at SDSU Agronomy Farm east of campus, just west of I-29 and at SDSU Research Farm near Aurora, east of I-29. Original material had been collected by Dr. Ross of SDSU in the 1970's from the Aurora Prairie east of Brookings.		
A2	9091980			
A3	9091981			
A4	9091982			
A5	9091983			
A6	9091984			
A7	9091985			
A8	9091986			
A9	9091987			
A10	9091988			
A11	9091989			
A12	9091990			
Y1	9091991	Y1 - Y14 Vegetative material dug 4/12/2005 from Dr. Arvid Boe's assembly at SDSU Agronomy Farm east of campus, just west of I-29 and at SDSU Research farm near Aurora, east of I-29. Original material had been collected by Dr. Ross of SDSU in the 1970's from a site near Yankton, South Dakota.		
Y2	9091992			
Y3	9091993			
Y4	9091994			
Y5	9091995			
Y6	9091996			
Y7	9091997			
Y8	9091998			
Y9	9091999			
Y10	9092000			
Y11	9092001			
Y12	9092002			
Y13	9092003			
Y14	9092004			
L1	9092005	MN	Redwood	U of M SW Outreach and Research Center, Lamberton, near Cottonwood River in native prairie
L2	9092006	MN	Redwood	U of M SW Outreach and Research Center, Lamberton, near Cottonwood River in native prairie
L3	9092007	MN	Redwood	U of M SW Outreach and Research Center, Lamberton, near Cottonwood River in native prairie
K1	9092008	MN	Douglas	near Kensington, MN between road and railroad
P1	9092009	MN	Redwood	coll. 4/13/2005 Lamberton Twp, Sec.29, 2 miles from Revere along Pell Cr., Brian Pfarr landowner
P2	9092010	MN	Redwood	coll. 4/13/2005 Lamberton Twp, Sec.29, 2 miles from Revere along Pell Cr., Brian Pfarr landowner
E1	9092011	MN	Sherburne	coll. 4/13/2005 Elk River FO, Gina Hugo, T33N. R27 NW1/4of SW1/2 sec14
E2	9092012	MN	Sherburne	coll. 4/13/2005 Elk River FO, Gina Hugo, T33N. R27 NW1/4of SW1/2 sec14
E3	9092013	MN	Sherburne	coll. 4/13/2005 Elk River FO, Gina Hugo, T33N. R27 NW1/4of SW1/2 sec14
KN10	9092017	MN	Kittson	SW1/4 SE1/4 Sec.10 T160N R 46W(Norway Township) fine and medium sands, Al Gustafson
KN15	9092018	MN	Kittson	NW1/4 NE1/4 Sec.15 T160N. R46W(Norway Township) loamy fine sand, Al Gustafson
KN30	9092019	MN	Kittson	NE1/4 SE1/4 Sec.30 T160N. R46W(Norway Township) Arveson fine sandy loam, Al Gustafson
Tom1	9092014	ND		PMC field
Tom2	9092015	ND		PMC field
Tom3	9092016	ND		PMC field
Holt		NE		seed from KS PMC, started in the Greenhouse
H1	NONE	MN	Pine	Hinkley FO, Julie Lindner, SCT, Pine Co., MN SE1/4 of NE1/4 Sec.20 T39N R21W - poor root sample

**Figure IG-1. Plot Layout of Indiangrass assembly.**

Species: **Indiangrass** *Sorghastrum nutans*  
 Location: **Panel A**  
 Planting Date: 6/7/2005  
 Spacing between rows = 42 inches (3.5 feet)  
 Spacing between plants = 42 inches (3.5 feet)



East													S a n d B l u e s t e m		
		TOM3	Y3	A6	Y14	Y2	A3	A4		KN10	L1	Y6			A9
		TOM3	Y3	A6	Y14	Y2	A3	A4		KN10	L1	Y6			A9
		TOM3	Y3	A6	Y14	Y2	A3	A4		KN10	L1	Y6			A9
		E2	A4	Y14	A6	HOLT	Y9	L2		E3	Y14	Y5			A8
		E2	A4	Y14	A6	HOLT	Y9	L2		E3	Y14	Y5			A8
		E2	A4	Y14	A6	HOLT	Y9	L2		E3	Y14	Y5			A8
		L3	HOLT	A1	L1	P1	KN30	E3		E2	Y13	Y4			A7
Y8		L3	HOLT	A1	L1	P1	KN30	E3		E2	Y13	Y4			A7
L1		L3	HOLT	A1	L1	P1	KN30	E3		E2	Y13	Y4			A7
K1		E3	A12	Y2	Y5	A1	A5	Y3	HOLT	E1		Y3			A6
Y9		E3	A12	Y2	Y5	A1	A5	Y3	HOLT	E1	Y12	Y3			A6
E1		E3	A12	Y2	Y5	A1	A5	Y3	HOLT	E1	Y12	Y3			A6
Y4		A5	Y5	Y7	Y4	Y6	L3	TOM2	TOM3	P2		Y2	A5		
Y6		A5	Y5	Y7	Y4	Y6	L3	TOM2	TOM3	P2	Y11	Y2	A5		
Y6		A5	Y5	Y7	Y4	Y6	L3	TOM2	TOM3	P2	Y11	Y2	A5		
Y1		A8	A2	A9	KN10	E2	A2	E1	TOM2	P1	Y10	Y1	A4		
Y1		A8	A2	A9	KN10	E2	A2	E1	TOM2	P1	Y10	Y1	A4		
A10		A8	A2	A9	KN10	E2	A2	E1	TOM2	P1	Y10	Y1	A4		
A10		A8	A2	A9	KN10	E2	A2	E1	TOM2	P1	Y10	Y1	A4		
L2		TOM1	A7	A3	A11	Y8	Y7	K1	TOM1	K1	Y9	A12	A3		
L2		TOM1	A7	A3	A11	Y8	Y7	K1	TOM1	K1	Y9	A12	A3		
L2		TOM1	A7	A3	A11	Y8	Y7	K1	TOM1	K1	Y9	A12	A3		
KN10		A11	P1	Rep 3	A7	A12	A9	Y1	KN30	L3	Y8	A11	A2		
KN10		A11	P1		A7	A12	A9	Y1	KN30	L3	Y8	A11	A2		
KN10		A11	P1	P2	A7	A12	A9	Y1	KN30	L3	Y8	A11	A2		
KN30		TOM2	KN15	KN15	TOM1	A10	TOM3	A8	KN15	L2	Y7	A10	A1		
KN30		TOM2	KN15	KN15	TOM1	A10	TOM3	A8	KN15	L2	Y7	A10	A1		
KN30		TOM2	KN15	KN15	TOM1	A10	TOM3	A8	KN15	L2	Y7	A10	A1		
<b>Row13</b>	<b>Row12</b>	<b>Row11</b>	<b>Row10</b>	<b>Row9</b>	<b>Row8</b>	<b>Row7</b>	<b>Row6</b>	<b>Row5</b>	<b>Row4</b>	<b>Row3</b>	<b>Row2</b>	<b>Row1</b>			

Hard Fescue Alley

<b>Table IG-2. Indiangrass evaluation data, 9/09/2005.</b>				
<b>Accession</b>	<b>Row</b>	<b>Rep</b>	<b>Dead(-)/Alive(+)</b>	<b>Observations</b>
A1	1	1	+	
A1	1	1	+	
A1	1	1	+	
A2	1	1	+	
A2	1	1	+	
A2	1	1	+	
A3	1	1	—	
A3	1	1	+	red leaves, small
A3	1	1	+	red leaves, small
A4	1	1	+	
A4	1	1	+	
A4	1	1	+	
A5	1	1	+	blue
A5	1	1	+	blue
A5	1	1	+	blue
A6	1	1	+	
A6	1	1	+	
A6	1	1	+	
A7	1	1	+	
A7	1	1	+	
A7	1	1	+	
A8	1	1	+	
A8	1	1	+	
A8	1	1	+	
A9	1	1	+	
A9	1	1	+	
A9	1	1	+	
A10	2	1	+	
A10	2	1	+	
A10	2	1	+	
A11	2	1	+	upright, thick stalk
A11	2	1	+	upright, thick stalk
A11	2	1	+	upright, thick stalk
A12	2	1	+	small, red leaves
A12	2	1	+	
A12	2	1	+	
Y1	2	1	+	red variegated leaves
Y1	2	1	+	red variegated leaves
Y1	2	1	+	red variegated leaves
Y2	2	1	+	
Y2	2	1	+	
Y2	2	1	+	
Y3	2	1	+	

<b>Table IG-2. Indiangrass evaluation data, 9/09/2005 (continued).</b>				
<b>Accession</b>	<b>Row</b>	<b>Rep</b>	<b>Dead(-)/Alive(+)</b>	<b>Observations</b>
Y3	2	1	+	
Y3	2	1	+	
Y4	2	1	+	blue
Y4	2	1	+	blue
Y4	2	1	+	blue
Y5	2	1	+	
Y5	2	1	+	
Y5	2	1	+	
Y6	2	1	+	
Y6	2	1	+	
Y6	2	1	+	
Y7	3	1	+	
Y7	3	1	+	
Y7	3	1	+	
Y8	3	1	+	blue
Y8	3	1	+	very tiny 1-2"
Y8	3	1	+	blue
Y9	3	1	+	blue
Y9	3	1	+	blue
Y9	3	1	+	blue
Y10	3	1	+	
Y10	3	1	+	
Y10	3	1	+	
Y11	3	1	+	light gold seed, small, red
Y11	3	1	+	light gold seed
Blank				
Y12	3	1	+	
Y12	3	1	+	
Blank				
Y13	3	1	+	prostrate, small, stemmy
Y13	3	1	+	prostrate, small, stemmy
Y13	3	1	+	open crown
Y14	3	1	+	yellow-green leaves
Y14	3	1	+	yellow-green leaves
Y14	3	1	+	yellow-green leaves
L1	3	1	+	
L1	3	1	+	
L1	3	1	+	
L2	4	1	+	light colored heads
L2	4	1	+	light colored heads
L2	4	1	+	light colored heads
L3	4	1	+	
L3	4	1	+	
L3	4	1	+	

<b>Table IG-2. Indiangrass evaluation data, 9/09/2005 (continued).</b>				
<b>Accession</b>	<b>Row</b>	<b>Rep</b>	<b>Dead(-)/Alive(+)</b>	<b>Observations</b>
K1	4	1	+	
K1	4	1	+	
K1	4	1	+	
P1	4	1	+	
P1	4	1	+	
P1	4	1	+	
P2	4	1	+	
P2	4	1	+	
P2	4	1	X	little bluestem-wrong
E1	4	1	+	
E1	4	1	+	
E1	4	1	+	
E2	4	1	+	
E2	4	1	+	
E2	4	1	+	
E3	4	1	+	
E3	4	1	+	
E3	4	1	+	small plant
KN10	4	1	+	fineleaf, short, blue-green
KN10	4	1	+	fineleaf, short, blue-green
KN10	4	1	+	fineleaf, short, blue-green
KN15	5	1	+	
KN15	5	1	+	
KN15	5	1	+	
KN30	5	1	+	
KN30	5	1	+	
KN30	5	1	X	wrong species
Tom1	5	1	+	slight blue-green
Tom1	5	1	+	
Tom1	5	1	+	
Tom2	5	1	+	
Tom2	5	1	+	blue-green
Tom2	5	1	+	
Tom3	5	1	+	
Tom3	5	1	+	
Tom3	5	1	+	slight blue-green
Holt	5	1	+	blue-green
Holt	5	1	+	blue-green
Holt	5	1	+	yellow-green, leafy
A8	6	2	+	
A8	6	2	+	
A8	6	2	+	
Y1	6	2	+	small, red, no heads
Y1	6	2	+	small, red, no heads

<b>Table IG-2. Indiangrass evaluation data, 9/09/2005 (continued).</b>				
<b>Accession</b>	<b>Row</b>	<b>Rep</b>	<b>Dead(-)/Alive(+)</b>	<b>Observations</b>
Y1	6	2	+	small, red, no heads
K1	6	2	+	
K1	6	2	+	
K1	6	2	+	
E1	6	2	+	
E1	6	2	+	
E1	6	2	+	
Tom2	6	2	+	
Tom2	6	2	+	
TOM2	6	2	+	
Y3	6	2	+	
Y3	6	2	+	
Y3	6	2	+	
E3	6	2	+	small, not leafy
E3	6	2	+	small, not leafy
E3	6	2	+	small, not leafy
L2	6	2	+	slight blue-green
L2	6	2	+	slight blue-green
L2	6	2	+	slight blue-green
A4	6	2	+	slight blue-green
A4	6	2	+	slight blue-green
A4	6	2	+	slight blue-green
TOM3	7	2	+	
TOM3	7	2	+	
TOM3	7	2	+	
A9	7	2	+	fine leaf, few, small
A9	7	2	+	fine leaf, few, small
A9	7	2	+	fine leaf, few, small
Y7	7	2	+	upright, leafy
Y7	7	2	+	upright, leafy
Y7	7	2	+	upright, leafy
A2	7	2	+	short
A2	7	2	+	short
A2	7	2	+	short
L3	7	2	+	very fine leaf, leafy
L3	7	2	+	very fine leaf, leafy
L3	7	2	+	very fine leaf, leafy
A5	7	2	+	blue, short, leafy basal
A5	7	2	+	blue, short, leafy basal
A5	7	2	+	blue, short, leafy basal
KN30	7	2	+	
KN30	7	2	+	
KN30	7	2	+	

<b>Table IG-2. Indiangrass evaluation data, 9/09/2005 (continued).</b>				
<b>Accession</b>	<b>Row</b>	<b>Rep</b>	<b>Dead(-)/Alive(+)</b>	<b>Observations</b>
Y9	7	2	—	
Y9	7	2	+	blue upright
Y9	7	2	—	
A3	7	2	+	very small, red, few heads
A3	7	2	+	very small, red, few heads
A3	7	2	+	very small, red, few heads
A10	8	2	+	
A10	8	2	+	
A10	8	2	+	
A12	8	2	+	red leaves, very short
A12	8	2	+	
A12	8	2	+	
Y8	8	2	+	blue
Y8	8	2	+	blue
Y8	8	2	—	
E2	8	2	+	
E2	8	2	+	
E2	8	2	+	
Y6	8	2	+	blue-green
Y6	8	2	+	blue-green
Y6	8	2	+	blue-green
A1	8	2	+	fine leaves
A1	8	2	+	fine leaves
A1	8	2	+	fine leaves
P1	8	2	+	
P1	8	2	+	slight blue-green
P1	8	2	+	
HOLT	8	2	+	
HOLT	8	2	+	blue-green
HOLT	8	2	+	
Y2	8	2	+	
Y2	8	2	+	
Y2	8	2	+	
TOM1	9	2	—	
TOM1	9	2	+	prostrate, short, blue-green
TOM1	9	2	+	prostrate, short, blue-green
A7	9	2	+	small, fine leaf and stem
A7	9	2	+	small, fine leaf and stem
A7	9	2	+	small, fine leaf and stem
A11	9	2	+	
A11	9	2	+	
A11	9	2	+	
KN10	9	2	+	blue-green, fine leaf, short

<b>Table IG-2. Indiangrass evaluation data, 9/09/2005 (continued).</b>				
<b>Accession</b>	<b>Row</b>	<b>Rep</b>	<b>Dead(-)/Alive(+)</b>	<b>Observations</b>
KN10	9	2	+	blue-green, fine leaf, short
KN10	9	2	+	blue-green, fine leaf, short
Y4	9	2	+	blue
Y4	9	2	—	
Y4	9	2	+	blue
Y5	9	2	+	
Y5	9	2	+	
Y5	9	2	+	
L1	9	2	+	
L1	9	2	+	
L1	9	2	+	
A6	9	2	+	prostrate, short
A6	9	2	+	prostrate, short
A6	9	2	+	prostrate, short
Y14	9	2	+	
Y14	9	2	+	
Y14	9	2	+	
KN15	10	2	+	
KN15	10	2	+	short, basal leaves
KN15	10	2	+	
P2	10	2	+	
Blank	X	X	X	
Blank	X	X	X	
A3	10	3	+	red, small plant
A3	10	3	—	
A3	10	3	+	red, small plant
A9	10	3	+	
A9	10	3	+	very small plant
A9	10	3	+	very small plant
Y7	10	3	+	upright
Y7	10	3	+	upright
Y7	10	3	+	upright
Y2	10	3	+	
Y2	10	3	+	
Y2	10	3	—	
A1	10	3	+	
A1	10	3	+	
A1	10	3	+	
Y14	10	3	+	
Y14	10	3	+	
Y14	10	3	+	
A6	10	3	+	
A6	10	3	+	a few red leaves
A6	10	3	+	a few red leaves, small



<b>Table IG-2. Indiangrass evaluation data, 9/09/2005 (continued).</b>				
<b>Accession</b>	<b>Row</b>	<b>Rep</b>	<b>Dead(-)/Alive(+)</b>	<b>Observations</b>
KN15	11	3	+	leaves basal
KN15	11	3	+	leaves basal
KN15	11	3	+	leaves basal
P1	11	3	+	
P1	11	3	+	
P1	11	3	—	
A7	11	3	+	small, stressed
A7	11	3	+	
A7	11	3	+	small, no seed heads
A2	11	3	+	
A2	11	3	+	
A2	11	3	+	
Y5	11	3	+	slight blue-green
Y5	11	3	+	slight blue-green
Y5	11	3	+	slight blue-green
A12	11	3	+	
A12	11	3	+	
A12	11	3	+	leaves basal
HOLT	11	3	+	
HOLT	11	3	+	slight blue-green
HOLT	11	3	+	slight blue-green
A4	11	3	+	
A4	11	3	+	
A4	11	3	+	basal leaves
Y3	11	3	+	upright
Y3	11	3	+	upright
Y3	11	3	+	upright
TOM2	12	3	+	
TOM2	12	3	+	
TOM2	12	3	+	
A11	12	3	+	red on a few leaves
A11	12	3	+	
A11	12	3	+	
TOM1	12	3	+	blue-green, fine leaves
TOM1	12	3	+	blue-green, fine leaves
TOM1	12	3	+	blue-green, fine leaves
A8	12	3	+	some red leaves
A8	12	3	+	some red leaves
A8	12	3	+	fine leaves
A5	12	3	+	blue, leafy at base
A5	12	3	+	blue, leafy at base
A5	12	3	+	blue, leafy at base
E3	12	3	+	few leaves

<b>Table IG-2. Indiangrass evaluation data, 9/09/2005 (continued).</b>				
<b>Accession</b>	<b>Row</b>	<b>Rep</b>	<b>Dead(-)/Alive(+)</b>	<b>Observations</b>
E3	12	3	+	few leaves
E3	12	3	+	few leaves
L3	12	3	+	upright, leafy, not tall
L3	12	3	+	upright, leafy, not tall
L3	12	3	+	upright, leafy, not tall
E2	12	3	+	
E2	12	3	+	
E2	12	3	+	
TOM3	12	3	+	few leaves
TOM3	12	3	+	few leaves
TOM3	12	3	+	few leaves
KN30	13	3	+	
KN30	13	3	+	
KN30	13	3	+	
KN10	13	3	+	fine leaf, basal, blue-green
KN10	13	3	+	fine leaf, basal, blue-green
KN10	13	3	+	fine leaf, basal, blue-green
L2	13	3	+	blue-green, leafy
L2	13	3	+	blue-green, leafy
A10	13	3	+	red leaves, chlorotic
A10	13	3	+	
Y1	13	3	+	red leaves
Y1	13	3	—	
Y6	13	3	+	blue, red leaves
Y6	13	3	—	
Y4	13	3	+	blue
E1	13	3	+	
Y9	13	3	+	blue
K1	13	3	+	
L1	13	3	+	
Y8	13	3	+	blue

<b>Table IG-3. Indiangrass evaluation data, 8/04/2006.</b>									
Ratings:	leaf width: 1=fine 2=medium 3=wide								
	leafiness: 1=very leafy 2=medium 3=few leaves								
	culms: 1=many culms 2=medium 3=few or no culms								
	Map			Leaf	Leafi-	Seed	Culm Ht.	Spread	
Accession	name	Row	Rep	Width	ness	Culms	(inches)	(inches)	Notes
9091979	A1	1	1	1	2	1	45	15	
9091979	A1	1	1	1	2	2	42	24	
9091979	A1	1	1	2	2	2	54	18	
9091980	A2	1	1	2	2	2	54	15	
9091980	A2	1	1	2	2	2	54	19	
9091980	A2	1	1	2	2	2	54	21	
9091981	A3	1	1	dead					
9091981	A3	1	1	1	2	3	42	17	
9091981	A3	1	1	1	2	2	45	15	
9091982	A4	1	1	1	2	2	51	18	
9091982	A4	1	1	2	2	2	48	21	disease
9091982	A4	1	1	2	1	2	51	24	
9091983	A5	1	1	2	1	1	45	31	blue
9091983	A5	1	1	2	1	1	42	36	blue
9091983	A5	1	1	2	1	1	45	36	blue
9091984	A6	1	1	2	2	2	48	36	
9091984	A6	1	1	2	2	2	51	37	
9091984	A6	1	1	2	2	2	51	33	
9091985	A7	1	1	2	1	2	39	23	
9091985	A7	1	1	2	1	2	45	17	
9091985	A7	1	1	2	1	2	45	20	
9091986	A8	1	1	2	2	2	51	27	
9091986	A8	1	1	2	2	2	45	22	
9091986	A8	1	1	2	2	2	45	20	
9091987	A9	1	1	2	1	1	39	27	
9091987	A9	1	1	2	1	1	42	25	
9091987	A9	1	1	2	1	1	39	21	
9091988	A10	2	1	1	2	2	42	16	
9091988	A10	2	1	1	2	1	48	25	
9091988	A10	2	1	1	2	1	54	22	
9091989	A11	2	1	2	2	1	54	25	
9091989	A11	2	1	2	2	1	57	23	
9091989	A11	2	1	2	2	1	57	22	
9091990	A12	2	1	2	3	3	2	2	
9091990	A12	2	1	2	2	2	57	22	
9091990	A12	2	1	2	2	2	51	25	
9091991	Y1	2	1	3	2	3	42	20	boot, red
9091991	Y1	2	1	3	2	3	36	26	boot, red
9091991	Y1	2	1	3	2	3	39	25	boot
9091992	Y2	2	1	2	1	3	42	27	boot
9091992	Y2	2	1	2	1	3	42	22	boot
9091992	Y2	2	1	2	1	3	48	23	boot

<b>Table IG-3. Indiangrass evaluation data, 8/04/2006 (continued).</b>									
	Map			Leaf	Leafi-	Seed	Culm Ht.	Spread	
<u>Accession</u>	<u>name</u>	<u>Row</u>	<u>Rep</u>	<u>Width</u>	<u>ness</u>	<u>Culms</u>	<u>(inches)</u>	<u>(inches)</u>	<u>Notes</u>
9091993	Y3	2	1	3	1	3	42	16	boot
9091993	Y3	2	1	3	1	3	42	19	boot
9091993	Y3	2	1	3	1	3	42	22	
9091994	Y4	2	1	3	1	3	42	25	boot
9091994	Y4	2	1	3	1	3	42	22	boot
9091994	Y4	2	1	3	1	3	42	22	boot
9091995	Y5	2	1	2	2	2	45	18	
9091995	Y5	2	1	2	2	2	51	21	
9091995	Y5	2	1	2	2	2	54	22	
9091996	Y6	2	1	3	1	3	36	22	boot
9091996	Y6	2	1	3	1	3	33	25	boot
9091996	Y6	2	1	3	1	3	36	25	boot
9091997	Y7	3	1	3	1	3	54	27	boot
9091997	Y7	3	1	3	1	3	51	30	boot
9091997	Y7	3	1	3	1	3	51	34	boot
9091998	Y8	3	1	3	1	3	48	33	boot
9091998	Y8	3	1	dead					
9091998	Y8	3	1	3	1	3	51	37	boot
9091999	Y9	3	1	3	1	3	48	28	boot
9091999	Y9	3	1	3	1	3	51	33	boot
9091999	Y9	3	1	3	1	3	45	28	boot
9092000	Y10	3	1	3	1	3	39	36	boot
9092000	Y10	3	1	3	1	3	36	33	boot
9092000	Y10	3	1	3	1	3	33	28	boot
9092001	Y11	3	1	2	3	3	12	15	
9092001	Y11	3	1	3	1	1	45	23	boot
Blank	Blank								
9092002	Y12	3	1	3	2	2	45	25	
9092002	Y12	3	1	3	2	2	48	25	
Blank	Blank								
9092003	Y13	3	1	3	2	3	30	31	boot
9092003	Y13	3	1	x					
9092003	Y13	3	1	3	1	2	45	38	boot
9092004	Y14	3	1	3	1	3	51	29	boot
9092004	Y14	3	1	3	1	3	45	25	boot
9092004	Y14	3	1	3	1	3	45	27	boot
9092005	L1	3	1	3	1	3	39	28	boot
9092005	L1	3	1	3	1	3	45	24	boot
9092005	L1	3	1	3	1	3	45	24	boot
9092006	L2	4	1	2	1	2	36	32	boot
9092006	L2	4	1	2	1	2	39	34	boot
9092006	L2	4	1	2	1	2	39	32	boot
9092007	L3	4	1	2	1	2	39	33	boot
9092007	L3	4	1	2	1	2	39	33	boot
9092007	L3	4	1	2	1	2	45	38	boot
9092008	K1	4	1	2	2	2	54	35	
9092008	K1	4	1	2	2	2	54	28	

**Table IG-3. Indiangrass evaluation data, 8/04/2006 (continued).**

	Map	Row	Rep	Leaf Width	Leafi- ness	Seed Culms	Culm Ht. (inches)	Spread (inches)	Notes
9092008	K1	4	1	2	2	2	51	34	
9092009	P1	4	1	3	1	3	33	37	boot
9092009	P1	4	1	3	1	3	39	39	boot
9092009	P1	4	1	3	1	3	30	37	boot
9092010	P2	4	1	3	2	3	39	33	boot
9092010	P2	4	1	3	2	3	39	26	boot
9092010	P2	4	1	littleblue					
9092011	E1	4	1	2	2	1	63	18	
9092011	E1	4	1	2	2	1	60	19	
9092011	E1	4	1	2	2	1	57	21	
9092012	E2	4	1	3	2	2	66	25	
9092012	E2	4	1	3	2	2	66	18	
9092012	E2	4	1	3	2	2	66	20	
9092013	E3	4	1	2	2	2	63	32	
9092013	E3	4	1	2	2	2	60	21	
9092013	E3	4	1	2	2	2	54	18	
9092017	KN10	4	1	1	2	1	48	33	
9092017	KN10	4	1	1	2	1	48	26	
9092017	KN10	4	1	1	2	1	48	30	
9092018	KN15	5	1	2	3	2	48	32	
9092018	KN15	5	1	2	3	3	45	23	
9092018	KN15	5	1	2	2	2	51	24	
9092019	KN30	5	1	2	2	3	48	32	
9092019	KN30	5	1	2	2	2	42	29	red
9092019	KN30	5	1	dead					
9092014	Tom1	5	1	1	2	1	42	24	
9092014	Tom1	5	1	1	2	1	45	34	
9092014	Tom1	5	1	1	2	1	45	33	
9092015	Tom2	5	1	2	2	1	48	29	
9092015	Tom2	5	1	2	2	1	48	30	
9092015	Tom2	5	1	3	1	1	60	36	very upright
9092016	Tom3	5	1	3	1	1	66	36	
9092016	Tom3	5	1	2	2	2	57	26	
9092016	Tom3	5	1	2	2	2	57	31	
Holt	Holt	5	1	3	1	2	45	22	boot, upright
Holt	Holt	5	1	3	1	3	36	31	boot
Holt	Holt	5	1	3	1	3	42	35	boot
9091986	A8	6	2	1	2	2	42	28	
9091986	A8	6	2	1	2	2	42	30	
9091986	A8	6	2	1	2	2	48	33	
9091991	Y1	6	2	3	3	3	24	15	boot, red
9091991	Y1	6	2	3	2	3	27	24	boot, red
9091991	Y1	6	2	3	2	3	36	24	boot, red
9092008	K1	6	2	2	1	2	57	36	
9092008	K1	6	2	2	1	2	54	34	
9092008	K1	6	2	2	1	2	54	31	
9092011	E1	6	2	1	1	2	60	26	

**Table IG-3. Indiangrass evaluation data, 8/04/2006 (continued).**

Accession	Map name	Row	Rep	Leaf Width	Leafiness	Seed Culms	Culm Ht. (inches)	Spread (inches)	Notes
9092011	E1	6	2	1	1	2	60	22	
9092011	E1	6	2	1	1	2	57	21	
9092015	Tom2	6	2	2	2	1	48	34	
9092015	Tom2	6	2	2	2	1	45	26	
9092015	TOM2	6	2	2	2	1	51	27	
9091993	Y3	6	2	3	1	2	45	30	boot
9091993	Y3	6	2	3	1	2	36	24	boot
9091993	Y3	6	2	3	1	2	42	28	boot, very wide leaf
9092013	E3	6	2	2	2	2	63	29	
9092013	E3	6	2	2	2	2	63	23	
9092013	E3	6	2	2	2	2	60	20	
9092006	L2	6	2	3	1	2	42	34	boot
9092006	L2	6	2	3	1	2	39	30	boot
9092006	L2	6	2	3	1	2	36	33	boot
9091982	A4	6	2	2	2	2	51	26	
9091982	A4	6	2	2	2	2	48	24	
9091982	A4	6	2	2	2	2	48	18	
9092016	TOM3	7	2	2	1	1	63	25	good plant
9092016	TOM3	7	2	2	1	1	51	33	good plant
9092016	TOM3	7	2	2	1	1	54	35	good plant
9091987	A9	7	2	2	2	1	42	30	
9091987	A9	7	2	2	3	2	42	21	
9091987	A9	7	2	2	2	1	45	35	
9091997	Y7	7	2	3	1	1	54	32	boot
9091997	Y7	7	2	3	1	1	54	33	boot
9091997	Y7	7	2	3	1	1	54	29	boot
9091980	A2	7	2	2	2	2	48	28	
9091980	A2	7	2	2	2	2	45	28	lime green
9091980	A2	7	2	2	2	2	51	24	
9092007	L3	7	2	2	1	2	30	29	boot
9092007	L3	7	2	2	1	2	33	27	boot
9092007	L3	7	2	2	1	2	27	29	boot
9091983	A5	7	2	2	1	2	36	24	blue, short leaves
9091983	A5	7	2	2	1	2	42	29	blue, short leaves
9091983	A5	7	2	2	1	2	42	31	blue, short leaves
9092019	KN30	7	2	1	2	2	42	30	
9092019	KN30	7	2	1	2	2	42	29	
9092019	KN30	7	2	1	2	2	42	26	
9091999	Y9	7	2	dead					
9091999	Y9	7	2	3	1	2	48	29	boot, blue
9091999	Y9	7	2	dead					
9091981	A3	7	2	1	3	3	15	11	red
9091981	A3	7	2	1	3	2	42	22	red
9091981	A3	7	2	1	3	2	42	18	red
9091988	A10	8	2	2	1	2	51	24	
9091988	A10	8	2	2	1	2	48	22	
9091988	A10	8	2	2	1	2	54	23	

**Table IG-3. Indiangrass evaluation data, 8/04/2006 (continued).**

<u>Accession</u>	<u>Map name</u>	<u>Row</u>	<u>Rep</u>	<u>Leaf Width</u>	<u>Leafiness</u>	<u>Seed Culms</u>	<u>Culm Ht. (inches)</u>	<u>Spread (inches)</u>	<u>Notes</u>
9091990	A12	8	2	dead					
9091990	A12	8	2	2	1	1	54	21	
9091990	A12	8	2	2	1	1	54	27	
9091998	Y8	8	2	3	1	2	45	26	boot, blue
9091998	Y8	8	2	3	1	2	45	29	boot, blue
9091998	Y8	8	2	dead					
9092012	E2	8	2	2	1	1	63	29	
9092012	E2	8	2	2	1	1	66	23	
9092012	E2	8	2	2	1	1	63	24	
9091996	Y6	8	2	3	1	3	33	37	boot
9091996	Y6	8	2	3	1	3	30	32	boot
9091996	Y6	8	2	3	1	3	33	33	boot
9091979	A1	8	2	2	1	1	42	34	
9091979	A1	8	2	2	1	1	48	32	
9091979	A1	8	2	2	1	1	51	28	
9092009	P1	8	2	3	1	2	30	39	boot
9092009	P1	8	2	3	1	2	30	28	boot
9092009	P1	8	2	3	1	2	30	32	boot
Holt	HOLT	8	2	3	1	2	33	37	boot
Holt	HOLT	8	2	3	1	2	33	42	boot, blue
Holt	HOLT	8	2	3	1	2	33	33	boot
9091992	Y2	8	2	2	1	3	39	28	early boot
9091992	Y2	8	2	2	1	3	39	22	early boot
9091992	Y2	8	2	2	1	3	42	21	early boot
9092014	TOM1	9	2	dead					
9092014	TOM1	9	2	2	2	1	45	31	
9092014	TOM1	9	2	2	2	1	42	29	
9091985	A7	9	2	2	2	2	33	24	boot
9091985	A7	9	2	2	2	2	39	27	boot
9091985	A7	9	2	2	2	2	39	31	
9091989	A11	9	2	2	1	1	48	26	
9091989	A11	9	2	2	1	1	54	30	red
9091989	A11	9	2	2	1	1	51	27	red
9092017	KN10	9	2	2	2	2	45	25	upright, dk green
9092017	KN10	9	2	2	2	2	48	28	
9092017	KN10	9	2	2	2	2	45	27	
9091994	Y4	9	2	3	2	2	42	36	boot, blue
9091994	Y4	9	2	dead					
9091994	Y4	9	2	3	2	2	42	37	boot, blue
9091995	Y5	9	2	3	2	2	45	25	late boot
9091995	Y5	9	2	3	2	2	45	28	
9091995	Y5	9	2	3	2	2	48	27	
9092005	L1	9	2	3	1	2	48	30	boot
9092005	L1	9	2	3	1	2	42	32	boot
9092005	L1	9	2	3	1	2	42	33	boot
9091984	A6	9	2	2	2	2	45	33	
9091984	A6	9	2	2	2	2	42	32	

<b>Table IG-3. Indiangrass evaluation data, 8/04/2006 (continued).</b>									
	Map			Leaf	Leafi-	Seed	Culm Ht.	Spread	
<u>Accession</u>	<u>name</u>	<u>Row</u>	<u>Rep</u>	<u>Width</u>	<u>ness</u>	<u>Culms</u>	<u>(inches)</u>	<u>(inches)</u>	<u>Notes</u>
9091984	A6	9	2	2	2	2	42	38	
9092004	Y14	9	2	3	1	2	45	29	
9092004	Y14	9	2	3	1	2	45	26	boot
9092004	Y14	9	2	3	1	2	45	22	boot
9092018	KN15	10	2	2	2	2	48	24	
9092018	KN15	10	2	2	2	2	51	28	
9092018	KN15	10	2	2	2	2	48	27	
9092010	P2	10	2	3	2	2	36	29	boot
Blank	Blank	X	X	x					
Blank	Blank	X	X	x					
9091981	A3	10	3	2	2	3	30	19	red
9091981	A3	10	3	dead					
9091981	A3	10	3	2	2	3	39	18	
9091987	A9	10	3	2	2	2	45	27	
9091987	A9	10	3	1	3	3	39	18	
9091987	A9	10	3	dead					
9091997	Y7	10	3	3	1	2	51	20	boot
9091997	Y7	10	3	3	1	2	51	18	boot
9091997	Y7	10	3	3	1	2	51	24	boot
9091992	Y2	10	3	3	1	2	39	22	boot
9091992	Y2	10	3	3	1	2	39	23	boot
9091992	Y2	10	3	dead					
9091979	A1	10	3	2	1	1	42	29	
9091979	A1	10	3	2	1	1	45	28	
9091979	A1	10	3	2	1	1	42	28	
9092004	Y14	10	3	3	1	2	48	24	boot
9092004	Y14	10	3	3	1	2	48	26	boot
9092004	Y14	10	3	3	1	2	48	26	boot
9091984	A6	10	3	2	2	3	45	35	
9091984	A6	10	3	2	2	3	48	34	
9091984	A6	10	3	2	3	3	36	21	boot
9092018	KN15	11	3	2	3	2	48	21	
9092018	KN15	11	3	2	3	2	48	23	
9092018	KN15	11	3	2	3	2	48	23	
9092009	P1	11	3	3	1	2	42	27	boot
9092009	P1	11	3	3	1	2	39	30	boot
9092009	P1	11	3	1	3	3			seedling
9091985	A7	11	3	dead					
9091985	A7	11	3	2	1	2	45	25	
9091985	A7	11	3	2	3	3	36	14	
9091980	A2	11	3	2	2	2	45	16	
9091980	A2	11	3	2	1	1	48	27	
9091980	A2	11	3	2	2	2	51	27	
9091995	Y5	11	3	2	1	2	48	25	
9091995	Y5	11	3	2	1	2	51	22	
9091995	Y5	11	3	2	1	2	48	28	
9091990	A12	11	3	2	1	2	51	26	dk gray head



**Table IG-3. Indiangrass evaluation data, 8/04/2006 (continued).**

	Map	Row	Rep	Leaf Width	Leafi- ness	Seed Culms	Culm Ht. (inches)	Spread (inches)	Notes
9091990	A12	11	3	2	1	2	51	23	dk gray head
9091990	A12	11	3	2	1	2	51	22	dk gray head
Holt	HOLT	11	3	3	1	2	42	27	
Holt	HOLT	11	3	3	1	2	51	38	
Holt	HOLT	11	3	3	1	2	45	40	
9091982	A4	11	3	2	2	2	51	26	
9091982	A4	11	3	2	2	2	48	27	
9091982	A4	11	3	2	2	2	45	28	
9091993	Y3	11	3	3	1	2	42	20	
9091993	Y3	11	3	3	1	2	39	18	
9091993	Y3	11	3	3	1	2	39	16	
9092015	TOM2	12	3	3	2	1	45	23	
9092015	TOM2	12	3	3	2	1	48	30	
9092015	TOM2	12	3	3	2	1	48	35	
9091989	A11	12	3	2	1	1	51	27	upright
9091989	A11	12	3	2	1	1	48	27	upright
9091989	A11	12	3	2	1	1	48	29	upright
9092014	TOM1	12	3	1	2	1	45	36	
9092014	TOM1	12	3	1	2	1	42	36	
9092014	TOM1	12	3	1	2	1	42	34	
9091986	A8	12	3	2	2	2	42	36	
9091986	A8	12	3	2	2	2	42	36	
9091986	A8	12	3	2	2	2	45	36	
9091983	A5	12	3	3	1	1	39	37	
9091983	A5	12	3	3	1	1	39	38	
9091983	A5	12	3	3	1	1	39	40	
9092013	E3	12	3	3	2	2	60	25	
9092013	E3	12	3	3	2	2	60	24	
9092013	E3	12	3	3	2	2	63	22	
9092007	L3	12	3	3	1	2	39	30	
9092007	L3	12	3	3	1	2	42	28	
9092007	L3	12	3	3	1	2	42	26	
9092012	E2	12	3	2	1	1	63	17	upright
9092012	E2	12	3	2	1	1	63	19	
9092012	E2	12	3	2	1	1	63	18	
9092016	TOM3	12	3	2	1	2	57	23	
9092016	TOM3	12	3	2	1	2	54	27	
9092016	TOM3	12	3	2	1	2	63	24	
9092019	KN30	13	3	2	3	2	39	25	red
9092019	KN30	13	3	2	1	2	42	31	
9092019	KN30	13	3	2	1	2	45	31	
9092017	KN10	13	3	3	2	2	42	30	
9092017	KN10	13	3	3	2	2	42	29	
9092017	KN10	13	3	3	2	2	45	30	
9092006	L2	13	3	2	1	2	39	22	
9092006	L2	13	3	2	1	2	36	23	
9091988	A10	13	3	dead					

**Table IG-3. Indiangrass evaluation data, 8/04/2006 (continued).**

	Map			Leaf	Leafi-	Seed	Culm Ht.	Spread	
<u>Accession</u>	<u>name</u>	<u>Row</u>	<u>Rep</u>	<u>Width</u>	<u>ness</u>	<u>Culms</u>	<u>(inches)</u>	<u>(inches)</u>	<u>Notes</u>
9091988	A10	13	3	2	1	2	45	21	
9091991	Y1	13	3	3	2	3	33	13	
9091991	Y1	13	3	dead					
9091996	Y6	13	3	3	1	2	33	24	
9091996	Y6	13	3	dead					
9091994	Y4	13	3	3	1	2	48	18	blue
9092011	E1	13	3	2	2	2	57	18	
9091999	Y9	13	3	3	2	2	51	17	blue
9092008	K1	13	3	1	2	2	51	27	
9092005	L1	13	3	3	1	1	48	35	upright
9091998	Y8	13	3	3	1	2	48	24	blue, upright

## **ACTIVE STUDIES: TECHNICAL REPORT 2004-2006**

Study: NDPMC-P-0604-RA

Study Title: Evaluation of Prairie Junegrass (*Koeleria macrantha*)

Introduction: Prairie junegrass is a cool-season native grass that grows in small tufts. It has been described as excellent forage for livestock, deer, and elk early in the spring. As the grass is small, its production is low. The quality declines at maturity. It is one of the earliest grasses to begin vegetative growth in the spring. It is easily overgrazed and decreases with increased grazing pressure. It is a component of many native plant communities. No adapted release of prairie junegrass is currently available for revegetation and native seedings in the Northern Great Plains.

Objective: The purpose of this study is to evaluate, identify and composite a population of prairie junegrass from North Dakota, South Dakota and Minnesota origins into a public release for conservation seedings in the Northern Great Plains.

Cooperators: USDA Natural Resources Conservation Service

Description: Prairie junegrass is a short to medium lived, cool-season, perennial bunchgrass that is 6-20 inches tall. The roots are fibrous. Leaves are mostly basal. The seed head is a condensed panicle that opens slightly during flowering. Growth in the spring is usually completed by mid-June.

Distribution: Junegrass is native to most of North America, except the far southeast. It is also native to Europe and Northern Asia. It is very common in mixed grass and shortgrass prairie, meadows, open forest, mountain foothills, and rangeland. It is best adapted to well-drained soils in 12-20 inch precipitation areas.

### **Methods and Materials**

Collection/Assembly: Seed heads were collected in 2006 by NRCS employees from South Dakota, Minnesota, and North Dakota. Seed heads were clipped at maturity and sent to the Plant Materials Center where they were accessioned and placed in the seed cooler for storage until they are planted. Table PJ-1 is a list of collections with information regarding their origin.

Additional seed collections will be made from new locations in 2007. Seed collected in 2006 will be tested for viability in January/February of 2007 to determine viability. Sites of 2006 collections will be revisited in 2007 if samples are found to have poor viability.

### **Results and Discussion**

Collection of seed was difficult in 2006 due to severe drought and heat in many portions of North and South Dakota.

Table PJ-1. Prairie junegrass collection information.						
Accession	Collector	Date	State	County	Location	Other
9092070	Knudson, Aune	7/19/06	ND	Ward	SE1/4SW1/4 sec 2, T152N, R84W	
9092071	D. Tober	8/16/06	ND	Oliver	mlra 54, Arroda Lakes GMA	
9092072	D. Tober	8/16/06	ND	Dunn	1/2mi. W. of Missouri River State Park Hdq	
9092073	A. Berg	8/4/06	ND	Bowman	sec 22, T130N, R104W	S exp., MLRA 54, cobbart compl.
9092074	D. Teske	7/19/06	ND	Sioux	sec 22, T129N, R83W	Daglum soils
9092075	D. Teske	7/17/06	ND	Sioux	sec 9, T132N, R79W	Praire Knight Casino Entrance
9092076	Anderson, Simonsen	7/11/06	ND	Stutsman	sec 2, T141N, R64W	
9092077	C. Roth	6/27/06	ND	Bottineau	sec 16, T162N, R 75W	
9092078	L. Huether	7/5/06	ND	Mountrail	sec 35, T 92N, R 154W	Fred Evans, native range
9092079	L. Huether	7/5/06	ND	Mountrail	sec 17, T 92N, R 157W	Dustin Roise, lightly grazed
9092080	S. Sieler	7/20/06	ND	McLean	SE1/4 sec 16, T 147N, R 79W	MLRA 53B, state school land
9092081	S. Sieler	7/20/06	ND	McLean	SW1/4 sec 16, T 149N, R 79W	State school land
9092082	W. Duckwitz	7/25/06	ND	Grant	S1/2 sec 14, T 135N, R 88W	Heart Butte Dam, hilltop
9092083	Area I-Thief River FO	7/20/06	MN	Kittson	Norway Dunes TNC, 4 mi to Halma	north end of unit
9092084	D. Teske	7/12/06	ND	Sioux	N1/2 NW1/4 sec 36, T 131N, R 84W	
9092085	D. Tober, R. Jones	7/21/06	ND	Wells	8 mi N of Hurdsfield, Wells Co. GMA	
9092086	D. Teske	7/12/06	ND	Sioux	SW NE1/4 sec 27, T 130N, R 83 W	
9092087	L. Huether	7/5/06	ND	Mountrail	sec 20, T92N, R154W	
9092088	L. Huether	7/5/06	ND	Mountrail	sec 30, T 92N, R 156W	Curt Trulson land
9092089	L. Huether	7/5/06	ND	Mountrail	sec 21, T 92N, R 159W	Denny Farhart
9092090	W. Duckwitz	6/29/06	ND	Morton	NE1/4 sec 1, T82N, R 140W	north of buildings
9092091	R. Jones	7/25/06	ND	Morton	sec 16, T 139N, R 85W	right behind New Salem Sue
9092092	Forman, Gustafson	7/10/06	ND	Rolette	SE1/4 NW1/4 sec 1, T160N, R 72W	
9092093	D. Teske	7/8/06	ND	Morton	SW SW1/4, sec 14, T138N, R 81W	Teske acreage, Co. Rd. 138
9092095	Jensen, Bergsagel	8/9/06	SD	Spink	N1/2 sec 21, T116N, R 65W	Bald Mountain near Redfield
9092096	D. Teske	7/18/06	SD	Corson	SE1/4 sec 9, T18N, R 21E	Cottonwood Creek
9092097	Jensen, Bergsagel	8/10/06	SD	Deuel	NE1/4 sec 16, T116N, R49W	8 mi north of Clear Lake along GMA fence
9092098	Jensen, Bergsagel	8/9/06	SD	Faulk	sec 28, 33 T117N, R69W	8 mi south Faulkton
9092099	Jensen, Bergsagel	8/10/06	SD	Codington	sec 13, T119N, R51W	along hwy 20
9092100	Yapp, Schoon	7/12/06	SD	Todd	SEHarrington, 5 mi, 20 mi SW of Rosebud	
9092101	Teske	7/18/06	SD	Corson	SE1/4 sec 8, T18N, R21E	Cottonwood Creek

Table PJ-1. Prairie junegrass collection information (continued).						
Accession	Collector	Date	State	County	Location	Other
9092102	Woods, Sommer	7/11/06	SD	Hutchinson	sec 9, T99N, R57W	Harvey Wall-owner
9092103	R. Jones	7/18/06	MN	Ottertail	Inspiration Peak, 12 mi NE of Ashby	
9092104	Rennolet, Woods	7/11/06	SD	Hutchinson	8 mi SE of FO, Dennis Farst, landowner	
9092105	R. Jones	7/17/06	MN	Clay	TNC Bluestem Prairie, 10 mi E of Moorhead	
9092106	S. Runyan	7/7/06	SD	Hyde	sec 6, T111N, R72W	section line fence
9092107	Jensen, Harding 4H	7/10/06	SD	Harding	North Cave Hills	
9092108	R. Jasken	summer06	MN	Becker	sec 18, T142N, R41W	
9092109	Hanson, Bronder	7/14/06	MN	Sherburne	SW1/4 SW1/4 sec 26, T34N, R27W	
9092110	R. Jones	7/18/06	MN	Douglas	TNC Seven Sisters, 3 mi E of Ashby	
9092111	D. Tober	7/24/06	MN	Pope	Ordway Prairie TNC 9 mi se of Broten, MN	NE of rest stop
9092112	Area I-Thief River FO	7/20/06	MN	Kittson	Norway Dunes TNC, 4 mi to Halma	south end of unit
9092113	L. Alvshere	7/18/06	ND	McKenzie	NENW sec 15, T152N, R101W	Donald Lindvig
9092114	Blessum, Foreman	7/5/06	ND	McHenry	sec 15, T157N, R78W	
9092115	L. Alvshere	8/16/06	ND	McKenzie	NE NE sec 16, T149N, R99W	Gene Traustrom
9092116	Jones, Tober	7/20/06	MN		Agassis Dunes TNC 3 mi S of Fertile	
9092117	L. Alvshere	7/19/06	ND	McKenzie	SWNE sec 25, T149N, R 95W	Arnold Peterson
9092118	L. Alvshere	7/6/06	ND	McKenzie	SESE sec 5, T150N, R96W	Tank Ranch
9092119	L. Alvshere	7/24/06	ND	McKenzie	NESE sec 19, T146N, R103W	John Quinnet, Milt Madison
9092120	Gustafson, Jones	7/20/06	MN		Skull Lake WMA 14 mi N of Lake Bronson	
9092121	D. Tober	9/26/06	ND	Burleigh	McDowell Dam	from 15 plants
9092122	D. Tober	9/26/06	ND	Kidder		
9092123	D. Tober	9/26/06	ND	Stutsman	10 mi N Medina, WPA, W side of highway	
9092124	D. Tober	9/12/06	MN	Big Stone	4 mi W of Beardsley Paradise Retreat Dev.	
9092125	D. Tober	9/26/06	ND	Burleigh	WMA N of Apple Valley Housing Dev.	
9092126	D. Tober	10/2/06	ND	Grant	across from Crappie Creek, Lake Tschida	
9092133	M. Rose	7/25/06	MN	Renville	sec 21, T113N, R35W Cnty Rd 15	native bedrock, MN River
9092134	M. Rose	7/25/06	MN	Redwood Falls	NE1/4 sec 23, T112N, R34W	native pasture (rock outcrops)

## ACTIVE STUDIES: TECHNICAL REPORT 2004-2006

### Study NDPMC-T-0103-RA

Study Title: Native Forbs/legumes for Conservation  
Leadplant *Amorpha canescens*

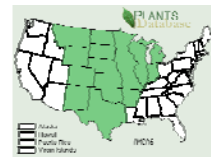
Introduction: Leadplant (*Amorpha canescens*) is a hardy, semi-woody perennial legume. It is a component of the tall grass prairie growing in association with big and little bluestem. The name is derived from the gray lead color of the leaves. Other names given to the species include bird tree, buffalo bellow (because it flowers during buffalo rut), downy amorpha, false greasewood, wild tea, zitka tacan (Lakota), te huto hi (Omaha-Ponca) and prairie shoestring. Forage value is excellent for large livestock animals, except horses. The species is highly palatable and has a high nutritive quality. This accounts for decreased abundance with heavy use. Birds use its structure for nesting and its seeds for food. American Indians used the dried leaves for smoking and for tea. It was also used to kill intestinal worms, and relieve stomach pain, neuralgia and rheumatism (Moerman 1998). Use of this species in prairie seeding or other conservation plantings would add desirable diversity. It also has potential in landscaping.

Objective: The primary objective is to develop a northern hardy leadplant source for public release. This goal is achieved only after the following objectives are met: evaluation of growth habit, propagation methods, and seed production.

Cooperators: USDA, NRCS Plant Materials Center, Bismarck, ND  
North Dakota Association of Soil Conservation Districts, Lincoln-Oakes Nursery, Bismarck, ND

Description: Leadplant is a semi-woody, shrubby perennial, often called a subshrub or half shrub. It grows from 1 to 3 or more feet tall and has one to several main stems. Dense, short hairs covering the leaves and most of the stem give the plant a gray-green appearance. The leaves are odd pinnately compound. The tiny violet/purple flowers with golden yellow anthers are found on clusters of terminal racemes. Flowering is in June and July. Seedpods are one-seeded and hairy. It is a legume with some nitrogen fixation. Leadplant is deep rooted. Seeds per pound average approximately 195,300. It is highly palatable to browse animals and has some palatability to grazers.

Distribution: The species is native to the Great Plains region from south central Canada to central Texas. It is adapted to coarse and medium textured soils. It prefers well-managed, silty and sandy sites. It grows in dryer conditions, but prefers 20-45 inch rainfall (Plants database). It grows most commonly with big and little bluestem in the native prairie. It is infrequent to abundant on well-drained prairie, open woodlands, hillsides, and roadsides (Johnson and Larson 1999).



## **Methods and Materials**

Collection/Assembly: Seed was collected in 1995. All collection sites were in North Dakota.

<b>Collection Site (County)</b>	<b>Location</b>
Burleigh	16-137N-78W, 13-137N-78W
Sioux	30-133N-79W
Ransom	10-135N-52W, Sheyenne National Grasslands
McHenry	J Clark Salyer NWR Sandhills Walk
Morton	ARS Station 4-138N-81W

The majority of seed was collected in Burleigh County (62 dirty pounds) and Sioux County (25 dirty pounds). The remainder of the collections was a pound or less of dirty seed. Seed from all collections were individually cleaned. Once the seed was cleaned, all collections were bulked together and given the accession 9076705. The bulk amount of the clean lot was 34 pounds.

Seed Counts: Seed collected in 1995 was counted out by hand and weighed on a Mettler scale at the ARS Station at Mandan, ND.

<b>Seed Lot: SWC-95-9076705</b>	<b>No Hull</b>	<b>Hull attached</b>
1000 seeds	1.694 g	2.834 g
1000 seeds	1.692 g	2.816 g
1000 seed mean	1.693 g	2.825 g
Seeds/pound	268,000	161,600

Planting Plan: Plants and seed were originally planted in panel D10 in a field enclosed with an 8-foot high deer fence at the PMC. Seedlings grown in the greenhouse and seed were planted in 1998. Due to a severe weed infestation of Canada thistle in panel D10, the surviving plants were dug in 2002 and planted to a single row in panel D11.

Location: Panel D10 PMC (Deer fence)

Planting Dates: 5/20/98 (Transplants); 6/16/98 (Seeded)

Propagation: Seed was mechanically scarified using a tabletop scarifier. Scarification was minimal, as many of the hulls remained on the seed. After scarifying, seed was planted into flats in the greenhouse in February and March of 1998. Seed inoculant for leadplant was mixed with the seed prior to planting in the greenhouse. Amorpha Spec. 1 recommended by Nitragin® was the inoculant used. A few trays planted without the inoculant showed no visual differences compared to the inoculated. Seed was planted in a peat/perlite/vermiculite commercial mix in flats and then cone-tainers. Some seeds germinated within five days. Germination overall was good.

Attempts to propagate leadplant by hardwood cuttings in 1996 failed. Cuttings were made on February 7, 1996 at the Burleigh county site 16-137N-78W. The tips of the branches that were sticking out of the snow were cut. Most of these had seed heads. The heads were removed and the middle sections were used for cutting. Buds were small. They were dipped in Dip and Grow solution and planted in perlite in a mist bed. Cuttings were removed 3/19/96 and disposed, as most was rotting or appeared dead. Perhaps the propagation material was too woody or we did not wait long enough for root initiation.

Direct seeding into the field was not very successful in 1998. Rows were seeded adjacent to the transplanted seedlings on 6/16/98, using a two-row modified Truax drill. Seed was run through the legume box of the drill that was calibrated to seed approximately 20-25 seeds/linear foot. Seed had been scarified but not inoculated. A few plants came up in the seeded rows, but weeds were very severe and few plants established.

Field Map D10: Nine rows (100 feet in length) were planted on the north most end of the deer enclosure area. Seedlings started from seed in the greenhouse and hardened off in the lath house were transplanted on 5/20/98. They were spaced approximately 2 feet apart within the row. Spacing between the rows was 42 inches. Adjacent and to the south of these 9 transplanted rows, 16 rows were seeded in rows 100 feet long and 42 inches apart.

Field Map D11: A single row with plants approximately 2-3 feet apart. Row is approximately 600 feet in length. This was propagated from plants lifted from D10.

Maintenance:

Date	Panel D10 (Deer Fence)
1998	5/19/98 2 pt/ac Treflan prior to seeding
1999	hand weeding, cut tops in fall
2000	hand weeding, cut tops in fall
2001	hand weeding, spot spray
2002	Transplanted plants to D11; sprayed thistle with Curtail, cultivated field after removing transplants.

Date	Panel D11
2002	Hand rogueing
2003	Hand rogueing, sprayed thistle
2004	Hand rogued, sprayed Curtail on thistle
2005	Hand rogued, spot sprayed
2006	4/21/2006 – applied glyphosate at 2 pts/acre when dormant; 4/25/2006 – spot sprayed Pendant @ 2 qts/acre; spot sprayed and rogued throughout the season

Field Testing: Establishment using bare root plants was tested through the Field Planting Program. Lincoln-Oakes Nursery provided bare root plants that they had grown in beds, lifted in the fall and stored over winter in cold storage. These were three year old plants. Plants were allocated to various locations in South Dakota, Minnesota, and North Dakota. Each planting averaged 20-25 bare root plants. Origin of this population was North Dakota, but was not the same population as the PMC material or field.

### Results and Discussion

- Seed germinated within 5 days in the greenhouse. Germination overall was good. Scarified seed germinated more quickly in the greenhouse than seed that was not scarified. Seed with hulls remaining had similar germination percent as scarified seed, but emergence was a few days slower. Scarification does not appear essential for adequate germination in the greenhouse. In the field, germination was much slower and poorer. Weed competition was detrimental to establishment in the field.
- Seedlings are very slow to grow. Seedlings planted in 1998 were one foot or less in height in 1999. Some of the plants flowered, but had little seed.
- Leadplant did not compete well with broadleaf weeds. Wet field conditions were detrimental to plant growth and vigor. Very little seed was produced in Panel D10. Competition and moisture may have contributed to poor seed production.
- Cuttings were not successful as propagation material. The type of tissue may affect results.
- Bare root material dug from Panel D10 and planted to D11 successfully established. Notes taken on 8/5/2002 showed 32 of 500 plants were flowering and 58 of 500 plants or 12 percent were dead.
- Bare root plants grown by Lincoln-Oakes Nursery in beds have established successfully in various field plantings. Field planting reports give detailed notes taken for these plantings.



- Establishment of leadplant is slow from seed. It is not competitive with weeds and will not tolerate excessive moisture. Bare root material can successfully establish a stand.

**Seed Harvest:** Seed was hand stripped from plants in 2003 through 2006. Seed was cleaned using an office debearder and fanning mill. The fuzz was removed from the seed, but a papery membrane remained on most seed after cleaning.

<b>Harvest Year</b>	<b>Bulk amount of clean seed (lbs)</b>
2003	6.0
2004	9.0
2005	7.5
2006	6.0

### References

The following references were used in the plant description, distribution, and general information about the species.

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## ACTIVE STUDIES: TECHNICAL REPORT 2004-2006

### Study NDPMC-T-0103-RA

Study Title: Native Forbs/Legumes for Conservation  
Shell-leaf penstemon *Penstemon grandiflorus*

Introduction: Shell-leaf penstemon is a very showy plant of the Great Plains. It has also been called large or pink beardtongue. The Native Americans used the roots of the plant for chest pains, stomachaches, and toothaches. A decoction of leaves was taken for chills and fever. Aesthetics, fair forage value, and ability to grow on very light, sandy soils make it a desirable forb for inclusion into conservation mixes and other rural landscape plantings. Varieties such as Prairie Palette from Nebraska University and Prairie Jewel™ from Colorado State University and its partners have been released into the horticulture trade. Winter hardiness in more northern portions of the Great Plains and availability of larger amounts of seed for conservation plantings is not known for these releases.

Objective: The purpose of this study is to release a northern hardy shell-leaf penstemon with parental origin from North Dakota, South Dakota, and Minnesota. This can only be accomplished after species and propagation techniques are evaluated.

Cooperators: USDA, NRCS Bismarck Plant Materials Center

Description: The species has been described as both a short-lived perennial and a stout biennial. It has fibrous, fleshy roots. The leaves, which are oppositely attached are shell-like and without stalks (sessile). The unbranched stems grow 2-4 feet tall. The flowers are very showy, pink to lavender and can grow 2 or more inches in size. They are bell-shaped, two lipped, and have a threadlike sterile male stamen that has a tuft of hairs and protrudes from the flower like a “tongue”, thus the name. The species blooms from May to July. Seed pods of the plant are capsules. Seeds are angular, brown to dark brown. There are approximately 550,000 seeds per pound.

Distribution: *Penstemon grandiflorus* grows best on light, sandy or loamy well-drained soils. It tolerates acid, neutral and alkaline soils and grows best in open dry situations. It is native to a large portion of the Great Plains and Midwest.



### **Methods and Materials**

Assembly: Seed was collected in 2001. Stalks of seed capsules were clipped. Once collected, most of the seed fell out the open tips of the capsules. The seed capsules were hammer-milled and run through a 2-screen office fanning mill or pan screens to clean. The following table is a record of collections and the amount of material bulked together to make the composite of accession 9082707. The amount of seed collected for each accession was greater than what was bulked. See file folder for total collection amounts.

<b>Accession</b>	<b>Date</b>	<b>State</b>	<b>County</b>	<b>Location</b>	<b>Landmark</b>	<b>Collector</b>	<b>Grams Bulked</b>
9082698	10/11/01	SD	Lyman	13-103N-73W	Lindly GPA Gammon Bottoms	Bergsagel Jensen	80
9082700	10/05/01	ND	Grant	3-136N-86W	Morton-Grant Co. line pasture	Doyle Jensen	240
9082701	09/24/01	ND	Emmons	30-136N-78W	Hwy 1804- COE	Tober	15

9082702	09/24/01	ND	Emmons		Beaver Bay	Tober	35
9082703	10/19/01	MN	Polk		Agassiz Dunes 1mi S & 1miW of Fertile, MN	Tober Jensen	40
9082704	09/25/01	ND	Ransom	2-135N-53W 14-135N-53W 12-134N-54W	Sheyenne Grasslands	Jensen Bergsagel	410
<b>9082707</b>				Composite			<b>820</b>

Planting Plan:

2002: Seed was planted on 11/19/2002. Approximately 40 seeds/linear foot were planted very shallow into two 3-row beds and sanded on top. Planting was done by Lincoln-Oakes Nursery for the Plant Materials Center. Approximately 200 grams of bulk seeds was used to plant the two beds in the deer fence, field D11.

2003: The few plants growing in field D11 (deer fence) were dug and transplanted to panel A.

2004: Bareroot plants grown by Lincoln-Oakes Nursery were hand planted in May to the same site as the failed beds in field D11 (deer fence).

Maintenance: The field plot was harrowed and packed in October 2002, in preparation for planting. Treflan was sprayed at 2.5 pints/acre on 11/12/2002 as a weed control measure prior to planting. Weeds were controlled by hand weeding from 2003-2005. In 2006, the planting in field D11 (deer fence) was removed. The planting in Panel A is now a demonstration row and will not be harvested.

### Results and Discussion

Locating areas to collect seed was sometimes difficult. All sites with appreciable amounts of plants were lighter, sandy soils. The tops of the plants at some sites had been browsed or grazed, indicating a degree of palatability. Mature seed readily poured from the tips of pods or could be easily shelled out by hammer-milling.

Establishment: Very few plants established. A very dry winter with extreme winds and little or no snowfall may have caused the seeds to scatter from the bed. Seeds may also have been planted too deep or sanded too heavily on the top of the bed. The plants that did grow in the PMC bed were dug and transplanted to a row in Panel A (less than 50 plants). An additional bed was planted in the same manner with the same seed by Lincoln-Oakes Nursery in the fall of 2002. Establishment was much better in two of the rows in their bed. These plants were lifted in the fall of 2003 and placed in cold storage. Plants the first year were rosettes.

Disease and weed pressure was a problem in field D11. Healthy plants, as found in Panel A produced abundant seed per plant.

Propagation by bare root appears to be possible. The plants did establish before being devastated by disease and weeds.

Harvest:

2004: Seed heads were clipped on 9/10/2004 from the salvaged plants in the row in panel A. Seed pods were light brown and tips were starting to open and release seed. The heads were very large and did not appear to have insects or disease.

The plants in field D11 (deer fence) appeared to have disease and insect damage. Leaves were black, heads were small and ripening was very uneven. Approximately 3 pounds PLS was harvested from Panel A and field D11 (deer fence).

2005: Seed heads were clipped from field D11. Very few heads were formed. Plants were diseased. Severe weed pressure on the south end stunted plants. Approximately 1.5 pounds bulk seed was harvested from field D11. Quality of seed was poor.

**Figure SP-1. Plot Layout of shell-leaf penstemon *Penstemon grandiflorus*.**

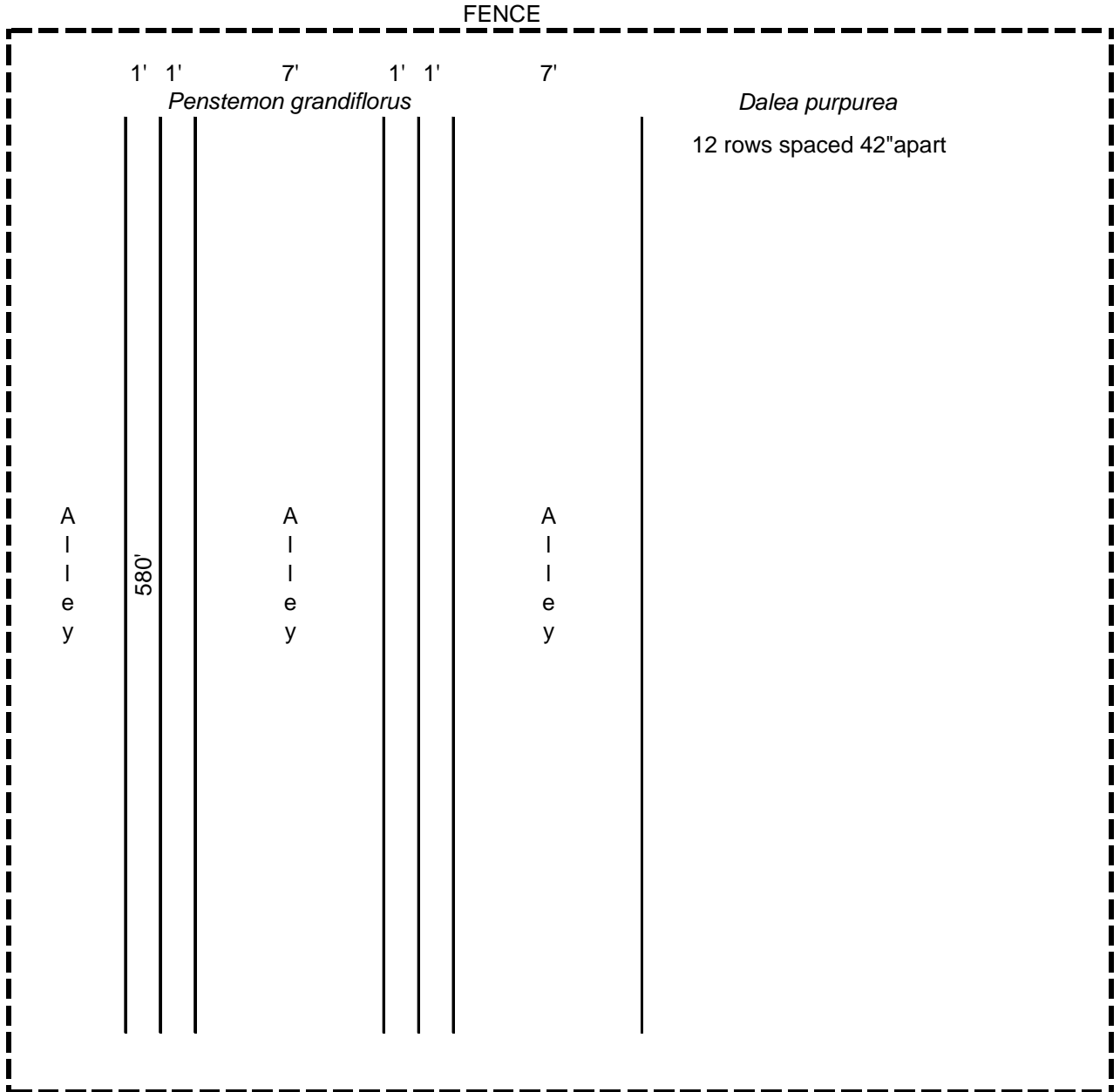
**Study:** NDPMC-T-0103-RA  
Native Forbs/Legumes for Conservation

**Planting Date:** 11/19/2002

**Planting Method:** two 3-row beds were planted and sanded by LON  
approximately 40 seeds/linear foot very shallow into soil, sanded on top

**Location:** D11 Deer Fence PMC

**Accession:** 9082707



## **ACTIVE STUDIES: TECHNICAL REPORT 2004-2006**

### **Study NDPMC-P-0601-RA**

**Study Title:** Native Forbs/Legumes for Conservation  
Fourwing saltbush *Atriplex canescens*

**Introduction:** Fourwing saltbush is a perennial shrub that offers potential for conservation plantings. It grows under low rainfall, can tolerate alkaline and saline conditions, and is palatable and nutritious to most livestock. Research at the Northern Great Plains Agricultural Research Service is evaluating its winter grazing potential.

**Objective:** The purpose of our study is to evaluate adaptability and produce seed of this species. A South Dakota collection of this species will be evaluated. If the species proves adaptable and useful as a conservation plant, a public release will be the goal.

**Cooperators:** USDA, NRCS Plant Materials Center, Bismarck, ND  
USDA, ARS Northern Great Plains Research Service, Mandan, ND

**Description:** Fourwing saltbush is a long-lived perennial shrub. It has a deep, extensive root system. It is an evergreen gray shrub that grows from 2-6 feet tall. It has many branches. Leaves are alternate, and narrowly oblong. Leaves are scurfy on both sides. Male and female flowers are on separate plants. Flowers are in spikes that form dense panicles. It blooms in late summer. Fruiting bracts have four flat wings from which the plant gets its name. It is palatable to browse and grazing animals. Other common names include fourwing shadscale, white greasewood, salt sage, box brush. Fourwing saltbush differs from Nuttall saltbush. Its most noticeable difference is its four wings on the fruit as opposed to the warty bracts enclosing the fruit of Nuttall saltbush.

**Distribution:** Fourwing grows on a wide range of soils, from clays to sands, and can tolerate high lime and saline conditions. It is highly drought and heat tolerant. It is native from western North Dakota south to Texas and Mexico, and west to Washington.

### **Methods and Materials**

**Assembly:** Seed was collected from several plants at the SDSU Cottonwood Range and Livestock Research Center in Jackson County, South Dakota, by Ron Haigh in 1999. The collection site is in Major Land Resource Area 060A Pierre Shale Plains and Badlands. Its legal description is SW1/4 16-15-19E. Its latitude is 43°56'57" N and the longitude is 101°51'30" W. The seed was collected in an enclosure area that excluded cattle and wildlife. No other plants of the species are growing in the nearby vicinity except adjacent to the enclosure. These plants are grazed each year, and appear to have abundant regrowth each spring, according to Ron Haigh. A small envelope of seed was given to the PMC in 2000 by Scot Kronberg, USDA, ARS, Mandan. Seed was propagated in the greenhouse in cone-tainers beginning in January 2001 using soil less potting mix. Seeds germinated with no pretreatment. Seedlings were vigorous and growth was abundant. These plants were then planted at the Bismarck Plant Materials Center in panel D10 within the deer fence. The original collection and the seed collected from the PMC planting will be identified as accession 9082680.

**Planting Plan:** Panel D10, Deer Fence, Bismarck Plant Materials Center. Conditions at the time of planting were dry. The plants were spaced approximately two feet apart. Approximately 25-27 seedlings were planted into a single row running east to west in 2001. In 2003, four additional rows of 9082680 seedlings were planted. The field was relatively free of weeds at the time of planting. The planting is adjacent to a row of winterfat.

Planting Date: 5/14/2001: Plants were transplanted to the field from the lath house where they were hardened off for a few weeks after moving from the greenhouse. In 2003, the planting was June 5.

Maintenance:

Weed Control:

2001-2006: Hand weeded around plants. Thistles were spot sprayed and borders were sprayed with glyphosate and between rows in 2004. Tillage was minimal. Weeds between rows were mowed 1-2 times each season.

Residue Management (D10):

2001-2003: No plant residue was clipped after harvest.

2004: Plants were clipped to a 4-8 inch height in November after seed harvest.

2005: No plant residue clipped.

2006: Plants were clipped to a 4-8 inch height.

Seed Processing: Seed harvested from Panel D10 in 2002 was cleaned using pan screens, a hammer mill with the largest hole screen and a clipper office fanning mill with a blank screen on the bottom, 25/64 to 28/64 size screens on top.

Seed harvested in 2003 was cleaned using an office size debearder equipped with rubber corrugation covering the inside and pan screens.

In 2004 through 2006, seed was cleaned using an office debearder and fanning mill.

Evaluation (D10):

2001: Visual observations of growth were noted.

2002: Plant height and general growth characteristics of the plants were recorded. Seed was harvested by hand stripping on 10/24/2002. Seed was cleaned using a laboratory debearder and clipper fanning mill.

Samples of plant material were collected for forage quality testing. Analyses were by South Dakota State University. Twelve to fifteen inches of the tips of randomly selected plants were cut. Tips came from top and side branches. From these, 6 inch tips were cut and bulked as a sample. The sample included stem and leaf material. These samples were named Tips6. The remainder of the 12 inch to 15 inch cut pieces was used to make a leaf sample. The leaves were stripped from the branches and bulked together. This sample was designated LF12. Samples were air dried prior to sending for analyses of ADF, NDF, and Crude Protein.

2003: Seed was harvested by hand stripping from the 50-foot row planted in 2001 (deer fence D-10). Seed harvest was in late October.

2004-2006: Seed was hand harvested from all rows in D10.

Source Comparison Study: A small trial to compare performance of different sources of fourwing saltbush was planted 6/12/2003. Five plants each of three accessions were planted on the north end of panel A in the previous Initial Evaluation Planting area. Seedlings were grown in the greenhouse and planted to the field on 6/12/2003. Row spacing was 6-7 feet apart. Spacing between plants in the row was approximately 4 feet. Accessions compared were the South Dakota source (9082680), a Wyoming origin source from Wind River Seed (9082855, Wind River lot 14581), and Wytana, a Montana PMC release. The South Dakota source and Wind River seed are *Atriplex canescens*. Wytana is *Atriplex aptera* which is a cross of *Atriplex canescens* X *nutallii*. The south most row is the Wyoming source, the center row is the South Dakota source, and the north most row is Wytana.

2004-2006: Plant residue was clipped in 2005. It was not clipped in 2006. Plant size was noted in 2004. See Table FW-3.

## Results and Discussion

### South Dakota source 9082680 (Deer fence D-10)

#### 2001

Seed readily germinated in the greenhouse. Seedling vigor was excellent. In the greenhouse, plants preferred getting dry before additional watering.

Plants were vigorous in the field and were two to three feet tall when measured on 9/30/2001. Conditions were dry during the growing season of 2001. No seed was produced its first year of growth.

#### 2002

Plants were vigorous. Height on 8/13/2002 averaged 40 inches for the leafy plants which are males. The females which make up about 1/3 of the plants were extremely heavy with seed pods. Their average height was 30 inches. Seed was harvested on 10/24/2002. The plants had received a hard frost prior to harvest. The seed covering had a green tint at harvest. Seed yield was 5.5 pounds bulk clean seed.

Forage quality analyses can be found in Table FW-1. Although the study was not replicated and results were based on single samples, preliminary results indicate plants have some nutritional value.

**Table FW-1.** Forage analysis data of fourwing saltbush *Atriplex*

Sample	Analysis (percent)	As received basis	100% dry matter basis
LF2			
LF2	Total Moisture	16.5	0.000
LF2	Total Dry matter	83.5	100
LF2	Crude Protein	18.6	22.3
LF2	Acid Detergent Fiber	12.7	15.2
LF2	Neutral Detergent Fiber	22.5	27.0
TIP6	Total Moisture	24.1	0.000
TIP6	Total Dry matter	75.9	100
TIP6	Crude Protein	13.7	18.1
TIP6	Acid Detergent Fiber	20.0	26.3
TIP6	Neutral Detergent Fiber	30.1	39.7

#### 2003

Plants again were quite vigorous. Conditions were very dry in 2003. Clean bulk seed harvested from the mature plants was 3.5 pounds. Seedlings planted in 2003 did not produce seed, but were vigorous.

#### 2004-2006

Plants continued to grow larger in size. Seed production in 2005 was very poor. Plant residue had been cut in the fall of 2004. The plants were large and woody at that time. Plants were regrowing, but not vigorous enough to set seed. In 2006, seed production was excellent. It appears that clipping the residue every year or every other year allows for seed production. Clipping when plants are older requires a year of regrowth before seed production resumes. This is probably influenced by moisture conditions as well as age of plants. Plants producing abundant seed in 2006 were flagged. Consistency of seed production will be noted in 2007 for these plants.



Seed Production

Year	Amount Harvested (bulk lbs)
2002	5.5
2003	3.5
2004	6.0
2005	0.5
2006	20.0

Source Comparison Study

2003

Data collected on 9/24/03 indicated differences in growth form among the three accessions (see Table FW-2). Overall, plants of Wyoming origin (9082855 Wind River) were more upright and had less lateral spread than the South Dakota source (9082680). 9082680 had very lateral growth and branching. Wytana was not vigorous and showed little growth in 2003.

2004-2006

Size and shape varied among accessions. Wytana, an Atriplex X is much shorter and less vigorous than the South Dakota or Wind River source. The South Dakota source appeared to be slightly larger than the Wind River source. Seed was produced on all accessions in 2005 and 2006. Only a few plants within each accession appear to produce seed. Drought in 2006 did not appear to reduce the size of the plants.

**Table FW-2.** Fourwing saltbush *Atriplex canescens* evaluation data, taken on 9/24/2003.

Accession	E to W plant no.	Height (inches)	North-South Spread (inches)
9082855(WR)	1	7	31
9082855(WR)	2	4	11
9082855(WR)	3	16	22
9082855(WR)	4	12	16
9082855(WR)	5	13	18
9082680(SD)	1	12	27
9082680(SD)	2	3	29
9082680(SD)	3	5	26
9082680(SD)	4	6	42
9082680(SD)	5	15	18
Wytana	1	3	20
Wytana	2	3	6
Wytana	3	2	4
Wytana	4	2	5
Wytana	5	7	3

**Table FW-3.** Fourwing saltbush *Atriplex canescens* evaluation data, taken on 9/8/2004.

<u>Accession</u>	<u>E to W plant no.</u>	<u>Height (inches)</u>	<u>Width (inches)</u>	<u>Fruit</u>
9082855(WR)	1	33	62	
9082855(WR)	2	19	30	
9082855(WR)	3	31	50	
9082855(WR)	4	26	47	
9082855(WR)	5	18	50	yes
9082680(SD)	1	38	49	
9082680(SD)	2	31	43	yes
9082680(SD)	3	28	51	
9082680(SD)	4	36	50	
9082680(SD)	5	36	48	yes
Wytana	1	23	46	yes
Wytana	2	dead	x	
Wytana	3	11	14	
Wytana	4	5	23	
Wytana	5	13	23	yes

## **ACTIVE STUDIES: TECHNICAL REPORT 2004-2006**

### **Study NDPMC-P-0403-CR**

**Study Title:** Evaluation of strawberry clover

**Introduction:** Strawberry clover is a perennial legume that has shown some tolerance to saline and alkaline conditions. Its short-statured growth habit makes it a good potential ground cover.

**Objective:** The purpose of this study is to evaluate winter hardiness and growth habit of a strawberry clover collected in South Dakota. A second objective is to evaluate saline/alkali tolerance of the species.

**Cooperators:** USDA, NRCS Plant Materials Center, Bismarck, North Dakota  
South Dakota State University, Brookings, South Dakota

**Description:** Strawberry clover is native to Eurasia. It is a low growing legume with creeping stems that root at the nodes. It also spreads easily from seed. The flower heads are round, pink to white and resemble a strawberry. The species has been considered both self fertile and self sterile. The collection from South Dakota was thought to be self fertile. Strawberry clover is not shade tolerant, but has been documented to be more heat tolerant than white clover. Seed size is approximately 661,000 seeds/kg. Literature indicates it is tolerant of saline and alkaline conditions.

### **Methods and Materials**

**Collection:** Seed collected by Dr. Arvid Boe, SDSU, from a fence row on the east edge of the South Dakota State University campus was used to plant a small observation block at the Bismarck Plant Materials Center. Origin was probably from a much earlier nursery block that was planted near the fence row. The PMC has assigned this collection the accession number 9092163..

**Assembly:** Seedlings were started in the greenhouse in March 2004 in individual pots using a potting mix. Seed was lightly scratched by hand rubbing with sandpaper. Seedlings from the greenhouse were planted at the PMC to a small block in Panel A on May 17, 2004. Five 100-ft rows were planted 42 inches apart. Plants within row were spaced one foot apart.

**Maintenance (weed control):**

**2004:** Hand weeding, and rototilling

**2005:** Hand weeding

**2006:** Hand weeding, sprayed with 2,4-DB

**Seed Harvest:**

**2004:** Hand-picked heads, raked off after frost (September-October)

**2005:** Used REM forage harvester, September

**2006:** Used REM forage harvester, September 13

### **Results and Discussion**

Plants were slow to grow after transplanting to the field due to dry conditions. Plant growth was prolific after the plants received rain. Deer and rabbits heavily browsed the plants. Plant spread by 9/8/2004 averaged 2 feet. Overall the plants were very short, but uniform in size. (This may be due to browse.) The plants produced numerous seed heads.

Stand in 2005 and 2006 was dense and the rows had completely grown together. New plants from seed and the lateral spread from the original plants both contributed to the dense stand.

Pocket gophers and broadleaf weeds became a problem in 2005 and 2006. Plants appeared drought-stressed early in 2006 and stand had declined in vigor by the end of the growing season. The application of 2,4-DB did not curl the leaves or appear to kill the plants in 2006, but did control a few of the broadleaf weeds.

Seed production was very good, but seeds were difficult to harvest, as plants were so short in height. Attempts to use a lawnmower with a bagger did not work, nor did a sickle mower. The REM harvester, which has flail knives, cut the entire plant to the ground and cut the vegetation and seed heads off together. After drying the materials, seed was separated using a hammermill and fanning mill.

<b>Seed Production</b>	
<b>Year</b>	<b>bulk weight</b>
2004	1.25 lbs
2005	4.5 lbs
2006	3.5 lbs

In an attempt to study the saline tolerance of strawberry clover, the variety 'Palestine' (9082867) was sent to the NRCS field office in Sturgis, South Dakota, for a field trial on a plot on the Gary Maillox ranch in Meade County. Soil was tested by South Dakota State University for soluble salts and sodium. Alkar tall wheatgrass was seeded to 9.2 acres. Of that 9.2 acres, 4 acres was also seeded to strawberry clover at a rate of 1.75 PLS/acre.

Conditions were extremely dry in the summer of 2006. No strawberry clover seedlings could be found in the checks by field office personnel. Grass competition and drought may have contributed more to the failure to establish than the salts, but this is not certain.

#### Conclusions

- Strawberry clover did not tolerate extreme drought conditions.
- Strawberry clover is a prolific seed producer, but harvest is very difficult due to its short height.
- No conclusions could be drawn from our study concerning tolerances to various salts.

## **ACTIVE STUDIES: TECHNICAL REPORT 2004-2006**

### **Study NDPMC-T-0105-CP**

**Study Title:** Plant materials for saline areas.

**Introduction:** Toxic salts hinder conservation cover establishment. Plant species vary in degree of salt tolerance. The recognition of high salt tolerance species may help revegetate these problem areas.

**Location:** The site is located near Cummings in east central North Dakota, on the edge of a cropland field where several grass seedings had failed to establish. The property is owned by the Mueller brothers and the legal description is SW1/4 Sec 24-T147N-R51W in Traill County.

**Major Land Resource Area (MLRA):** The site is located in MLRA 56, Red River Valley of the North. Nearly all this area is farmed with the most important cash crops being spring wheat, soybeans, potatoes, sugar beets, and corn. Elevation is about 1,000 feet, decreasing to about 600 feet in the north. This nearly level glacial lake plain is bordered on the east by outwash, gravelly beaches, and dunes.

**Soils:** The soils on the evaluation site are a Glyndon silt loam, saline (Gn). This nearly level soil is rated moderate for water holding capacity. This soil contains enough soluble salts to affect plant growth. EM-38 readings varied from a high of 340 (west, road ditch) to a low of 280 (east, out in the field). Controlling salinity and soil blowing, selecting salt tolerant crops, and improving fertility are the main concerns for management.

**Climate:** For MLRA 56, the average annual precipitation is 18 to 22 inches. Most of the precipitation falls during the growing season, which is 105 to 135 days.

### **Methods and Materials**

**Assembly:** The replicated entries planted in 2001 include Red River Germplasm prairie cordgrass (*Spartina pectinata*), 9063136 inland saltgrass (*Distichlis spicata*), and alkali cordgrass (*Spartina gracilis*). Each replication is planted in this order starting from the south perpendicular to the county road. The tenth row included a random mix of miscellaneous entries which included from east to west, Mandan Canada wildrye (3), Dacotah switchgrass (3), Rodan western wheatgrass (3), Badlands little bluestem (3), Bison big bluestem (3), Goldstrike sand bluestem (3), Shoshone beardless wildrye (2), Rodan western wheatgrass (1), Bison big bluestem (1), and Mandan Canada wildrye (1).

**Planting Plan:** Three replications of three nonrandomized plots were planted across the salt gradient (east to west), plus a miscellaneous row. Each replicated row contained 25 plants. The miscellaneous row contained 23 plants and had two blanks on the west side.

**Site Preparation:** The site had been fall tilled as part of the whole field.

**Planting Method:** The 9063136 inland saltgrass was grown in the greenhouse in cone-tainers prior to transplanting. The 9082688 alkali cordgrass rhizomes were freshly dug the morning of transplanting and the Red River prairie cordgrass were from rhizomes taken from cold storage at the PMC. The holes were hand dug and the plants spaced 2 feet apart within row. The rows were 4 feet apart. The inland saltgrass plugs did not readily separate from the cone-tainers and most of them pulled apart with probably about 2 or 3 inches of plug material intact.

**Planting Date:** May 9, 2001

**Fertilization:** None

Weed Control: A broadleaf herbicide was sprayed on the entire field and some hand weeding.

Evaluations and Measurements: Notes were taken on the plots on July 25, 2001. The number of living plants was documented (Table SA-1).

<b>Table SA-1. The number of living plants and percent survival.</b>				
<b>Accession</b>	<b>Rep 1</b>	<b>Rep 2</b>	<b>Rep 3</b>	<b>Avg.</b>
Red River prairie cordgrass	14 (56%)	18 (72%)	14 (56%)	15 (61%)
9063136 inland saltgrass	18 (72%)	15 (60%)	22 (88%)	18 (73%)
9082688 alkali cordgrass	8 (31%)	11 (44%)	3 (12%)	7 (28%)

2001: No weeds, other than a few big kochias, were present. The Red River prairie cordgrass had the most growth with some plants over a foot tall. Inland saltgrass was spreading with some good rhizome development, but it was just a few inches tall. The alkali cordgrass had the poorest survival and the least growth and plant vigor. A surprise in the miscellaneous row was 100 percent survival and good vigor on the Mandan Canada wildrye. The results were mixed on the other miscellaneous entries. On the end of the plots with the highest EM-38 reading only the inland saltgrass was surviving.

2002: Scattered kochia were present but generally the area was void of vegetation. It was determined that the alkali cordgrass had been misidentified and was actually a collection of prairie cordgrass from a somewhat saline area. It did not perform well and was mostly gone in 2002. The Red River prairie cordgrass was also declining in survival and performance. Only 16 percent of the original plants remained. It averaged 3 feet tall with an average spread of 8 inches. There was no seed. The inland saltgrass continued to have the best survival at 53 percent. It was only about 4 inches tall with an average spread of 12 inches. It also had no seed.

2003: No information was collected. A visit to the site in late summer showed the inland saltgrass to continue to spread at a moderate rate. A few more Red River prairie cordgrass plants had died and the remaining plants were about the same size as 2002. The other accession of prairie cordgrass had disappeared.

2004: No information was collected.

2005: No information was collected. The site was reviewed in late May. Red River prairie cordgrass plants had continued to die out. The few remaining plants were along the outside edges of the test plots. Inland saltgrass was still present and in fair vigor, but had not spread significantly. The plot area was generally void of vegetation except for a few scattered kochia and Russian thistle.

2006: No information was collected.

## **ACTIVE STUDIES - TECHNICAL REPORT 2004-2006**

Study: NDPMC-T-0301-WL

Study Title: Perennial Food Plot Study

Introduction: Perennial food plots would benefit wildlife managers as an additional habitat planting that could serve both as a food source and cover.

Objective: The objective of this 5-year study is to evaluate establishment and plant performance of species in two perennial seed mixes, a native mix and an introduced mix. Establishment and growth characteristics will be documented for each mix. Recommended species and seeding rates for wildlife perennial food plots is a potential outcome of this study.

Cooperators: The USDA Natural Resources Conservation Service, Plant Materials Center, Bismarck, North Dakota, in cooperation with the North Dakota State Game and Fish Department, Bismarck, North Dakota.

Location: The study is located northeast of Wilton, North Dakota, on the Russell Stuart Wildlife Management Area (WMA) and Old John's Lake Wildlife Management Area. Two sites were identified, one on each of the wildlife management areas.

Major Land Resource Area: The study is located in MLRA 53B.

Climate: The annual precipitation is 16.5 inches of which about three fourths falls during April through September. Precipitation varies considerably from year to year, ranging from a low of 5.97 inches in 1936 to a high of 30.92 inches in 1876. The average frost free period is 134 days (May 11 through September 22). Plant hardiness zone is 3, with a minimum mean temperature of -30 to -40 degrees F (see climatological information and 2004-2006 weather summary, pages 6-8).

### **Methods and Materials**

#### **Site Preparation and Seeding:**

Both sites were chemically treated on June 10, 2003, and July 15, 2003, with a tank mix of 1 quart/ac of glyphosate and 1 pint/ac Poast®. The plot borders were mowed on August 8, 2004. A third chemical application of 2 quarts of glyphosate, 11 ounces of Stinger®, 2 pints of 2,4-D amine and 3 gallons of ammonia sulfate were applied on August 13, 2004. The plots were burned by the North Dakota Game and Fish Department on October 11, 2004.

Plots were planted on November 4, 2004, using a no-till Truax grass drill. Each site (2.4 acres) was split in half to make two plots (1.2 acre) per site. The south half of each plot was seeded to an introduced mix and the north half was seeded to a native mix. See Tables 1 and 2 for a list of native species and seeding information. See Tables 3 and 4 for a list of introduced species and seeding information. Each of the two plots was also split in half from north to south to compare establishment with and without herbicide application.

#### **2004 General Observations:**

The dense sod of Kentucky bluegrass and other low growing vegetation did not burn well at the Russell Stuart WMA site leaving large areas of litter on the soil surface. Kentucky bluegrass sod retained a large mass of both above and below ground residue that impacted seed to soil contact when no-till seeding into the killed and burned residue. Burning removed most of surface litter at the Old John's Lake WMA.

The site was predominantly smooth brome grass and sideoats grama, which provided a much more desirable seedbed. Available soil moisture at the time of seeding was good at both sites.

#### **2005 General Observations:**

Both the Russell Stuart WMA and the Old John's Lake WMA plots were split in half from north to south to allow half of the native seeding and half of the introduced seeding to have herbicide applied in 2005. A 4 oz/acre rate of Plateau® herbicide was applied on May 5, 2005. No surfactant was used in the application.

No planted seedlings were actively growing on any of the eight treatments at the time of the Plateau® herbicide application on May 5, 2005. Canada thistle, absinth wormwood, and other weedy species seedlings were observed in low numbers for all treatments at this time. The Old John's Lake WMA plot had less actively growing weeds and less surface residue after over-wintering as compared to the Russell Stuart WMA plot. The surface (1-2 inch depth) soil moisture conditions in the plots were very dry.

Plants were evaluated on July, 2005. Species counts were randomly taken using a 2.4-ft<sup>2</sup> frame. See Tables 5 through 12 for data collected on the Russell Stuart WMA plots and Tables 13 through 20 for data collected on the Old John's Lake WMA plots.

On September 9, 2005, general stand observations were noted. The following comments were recorded. All treatments on the Russell Stuart WMA plots had higher planted species densities and much less weed competition than the Old John's Lake WMA plots. All plots planted with native species had the greatest seedling emergence and stand establishment (at Russell Stuart WMA and Old John's Lake WMA plots). Lack of surface residue, which exposed black mineral soil, may have contributed to the poorer stands at Old John's Lake WMA plots. The soil surface may have warmed too soon in the spring, causing seeds to germinate and seedlings to freeze. The Russell Stuart WMA site had more surface residue and was lower in elevation which probably resulted in cooler soil temperatures that reduced the chances for sprouting and emergence of the planted species. Evaluations will be taken in 2006 on stand establishment and individual species performance.

#### **2006 General Observations:**

Both sites received very limited amounts of rainfall for the 2006 growing season. This along with late spring frosts reduced overall plant growth. We observed negative affects on certain species to the extent of early dormancy and even potential death. Native species showing persistence in the stand were stiff sunflower, Maximilian sunflower, purple prairie clover, blue flax, shell-leaf penstemon, big bluestem, and switchgrass. Introduced species observed in the highest numbers included intermediate wheatgrass, Dahurian wildrye, and alfalfa. Even with the use of no-till methods, large populations of absinth wormwood invaded both sites. Old Johns had the highest concentrations of absinth wormwood and will have herbicide applied in 2007 after spring species counts are recorded. The Russell Stuart plots are not as contaminated and no herbicide application is currently planned for 2007. The success of these food plots due to their small size has been greatly influenced by the surrounding vegetation. Smooth brome grass, quackgrass, and Kentucky bluegrass will quickly invade the plots even when they have been chemically removed from the plots prior to planting. Plantings dominated by forbs appear to be less competitive and can result in invasion of unwanted species fairly quickly. Both sites will have data collected in 2007 resulting in three years of data collection. General recommendations on species and management techniques will be developed for future perennial food plot seedings. See Tables 5 through 20 for data collection from 2005 and 2006.



**Table 1. List of native species, including trees and shrubs, planted 11/04/2004 on two 1.2-acre sites.**

Species	Name	Type*	Seeds per lb	Russ Stuart Planted PLS lb/ac	Old John's Planted PLS lb/ac
<i>Elymus canadensis</i>	Canada wildrye	g	115000	0.37	0.37
<i>Panicum virgatum</i>	switchgrass	g	390000	0.11	0.11
<i>Andropogon gerardii</i>	big bluestem	g	176000	0.21	0.21
<i>Dalea candida</i>	white prairieclover	l	278000	0.28	0.24
<i>Dalea purpurea</i>	purple prairieclover	l	290000	0.27	0.27
<i>Astragalus canadensis</i>	Canada milkvetch	l	266000	0.29	0.29
<i>Amorpha canescens</i>	leadplant	l	200000	0.39	0.38
<i>Chamaecrista nictitans</i>	partridge pea	l	50000	1.57	1.57
<i>Helianthus maximiliani</i>	Maximilian sunflower	f	250000	0.17	0.17
<i>Helianthus pauciflorus</i>	stiff sunflower	f	85000	0.51	0.51
<i>Silphium perfoliatum</i>	cup plant	f	34000	1.28	1.28
<i>Linum lewisii</i>	wild blue flax	f	287000	0.15	0.15
<i>Ratibida columnifera</i>	longheaded coneflower	f	737000	0.12	0.06
<i>Liatris punctata</i>	dotted gayfeather	f	63000	0.32	0.32
<i>Echinacea angustifolia</i>	echinacea	f	120000	0.36	0.37
<i>Gaillardia aristata</i>	blanket flower	f	157000	0.27	0.27
<i>Penstemon grandiflorus</i>	penstemon	f	273000	0.16	0.16
<i>Rudbeckia laciniata</i>	golden glow-cutleaf	f	252222	0.06+.12**	0.06+.12**
<i>Solidago rigida</i>	stiff goldenrod	f	772000	0.06	0.06
<i>Agastache foeniculum</i>	giant hyssops	f	1538000	0.03	0.03
<i>Desmodium canadense</i>	showy tick trefoil	f	88000	0.26	0.26
<i>Monarda fistulosa</i>	wild bergamot	f	1463000	0.03	0.03
<i>Liatris ligulistylis</i>	meadow blazingstar	f	90000est	0.09	0.09
<i>Rosa arkansana</i>	rose	w	45000	0.25	0.25
<i>Shepherdia argentea</i>	buffaloberry	w	41000	0.40	0.40
<i>Amorpha fruticosa</i>	false indigo	w	52000	0.32	0.32
<i>Amelanchier alnifolia</i>	juneberry	w	82000	0.20	0.20
<i>Symphoricarpos occidentalis</i>	snowberry	w	74400	0.22	0.22
<i>Ribes aureum</i>	currant	w	240000	0.07	0.07
<i>Prunus virginiana</i>	chokecherry	w	4790	3.40**	3.40**
<i>Cornus sericea</i>	redosier dogwood	w	18500	0.78	0.78
<i>Coreopsis tinctoria</i>	plains coreopsis	a	1650000	0.08	0.08

\*Type: g=grasses; l=legumes; f=forbs; w=woodies; a=annuals

\*\*bulk seed amount, not PLS

**Table 2. Seeding information for native species, including trees and shrubs.**

Type	grasses	legumes	forbs	woodies	annuals	Total seeds/ft <sup>2</sup> *
number	3	5	15	8	1	30
%of mix	10	30	50	10	10	
seeds/ft <sup>2</sup> /specie	1.00	1.80	1.00	0.38	3.00	
seeds/acre**	43560	78408	43560	16335	130680	

\*Annuals were not counted in the 30 seeds/ft<sup>2</sup> seeding rate.

\*\*Actual amount of seed planted for a species may differ from target seeding rate due to seed availability, quality and variation in seeds/pound (depending on reference).

**Table 3. List of introduced species and native trees/shrubs planted 11/04/2004 on two 1.2-acre sites.**

Species	Name	Type	Seeds per lb	Russ Stuart Planted PLS lb/ac	Old John's Planted PLS lb/ac
<i>Leymus racemosus</i>	mammoth wildrye	g	55000	3.58	3.55
<i>Thinopyrum intermedium</i>	intermediate wheatgrass	g	88000	0.76	0.76
<i>Elymus dahuricus</i>	dahurian wildrye	g	86000	0.76	0.76
<i>Thinopyrum ponticum</i>	tall wheatgrass	g	79000	0.82	0.82
<i>Medicago sativa</i>	alfalfa	l	210000	1.10	1.10
<i>Astragalus cicer</i>	cicer milkvetch	l	134000	1.37	1.37
<i>Trifolium pratense</i>	red clover	l	275000	0.67	0.67
<i>Onobrychis vicifolia</i>	sainfoin	l	22000	8.30	8.30
<i>Vicia villosa</i>	hairy vetch	l	20000	9.55	9.55
<i>Rosa arkansana</i>	rose	w	45000	0.37	0.37
<i>Sherpherdia argentea</i>	buffaloberry	w	41000	0.40	0.40
<i>Amorpha fruticosa</i>	false indigo	w	52000	0.32	0.32
<i>Amelanchier alnifolia</i>	juneberry	w	82000	0.20	0.20
<i>Symphoricarpos occidentalis</i>	snowberry	w	74400	0.22	0.22
<i>Ribes aureum</i>	currant	w	240000	0.07	0.07
<i>Cornus sericea</i>	redosier dogwood	w	18500	1.06	1.06
<i>Prunus virginiana</i>	chokecherry	w	4790	3.4**	3.4**
<i>Coreopsis tinctoria</i>	plains coreopsis	a	1650000	0.08	0.08

\*Type: g=grasses; l=legumes; f=forbs; w=woodies; a=annuals

\*\*bulk seed amount, not PLS

**Table 4. Seeding information for introduced species and native trees/shrubs.**

Type	grasses	legumes	forbs	woodies	annuals	Total seeds/ft <sup>2</sup> *
number	4	5	0	8	1	30
%of mix	20	70	0	10	10	
seeds/ft <sup>2</sup> /specie	1.50	4.20	0	0.38	3.00	
seeds/ac/specie**	65340	182952	0	16335	130680	

\*Annuals were not counted in the 30 seeds/ft<sup>2</sup> seeding rate.

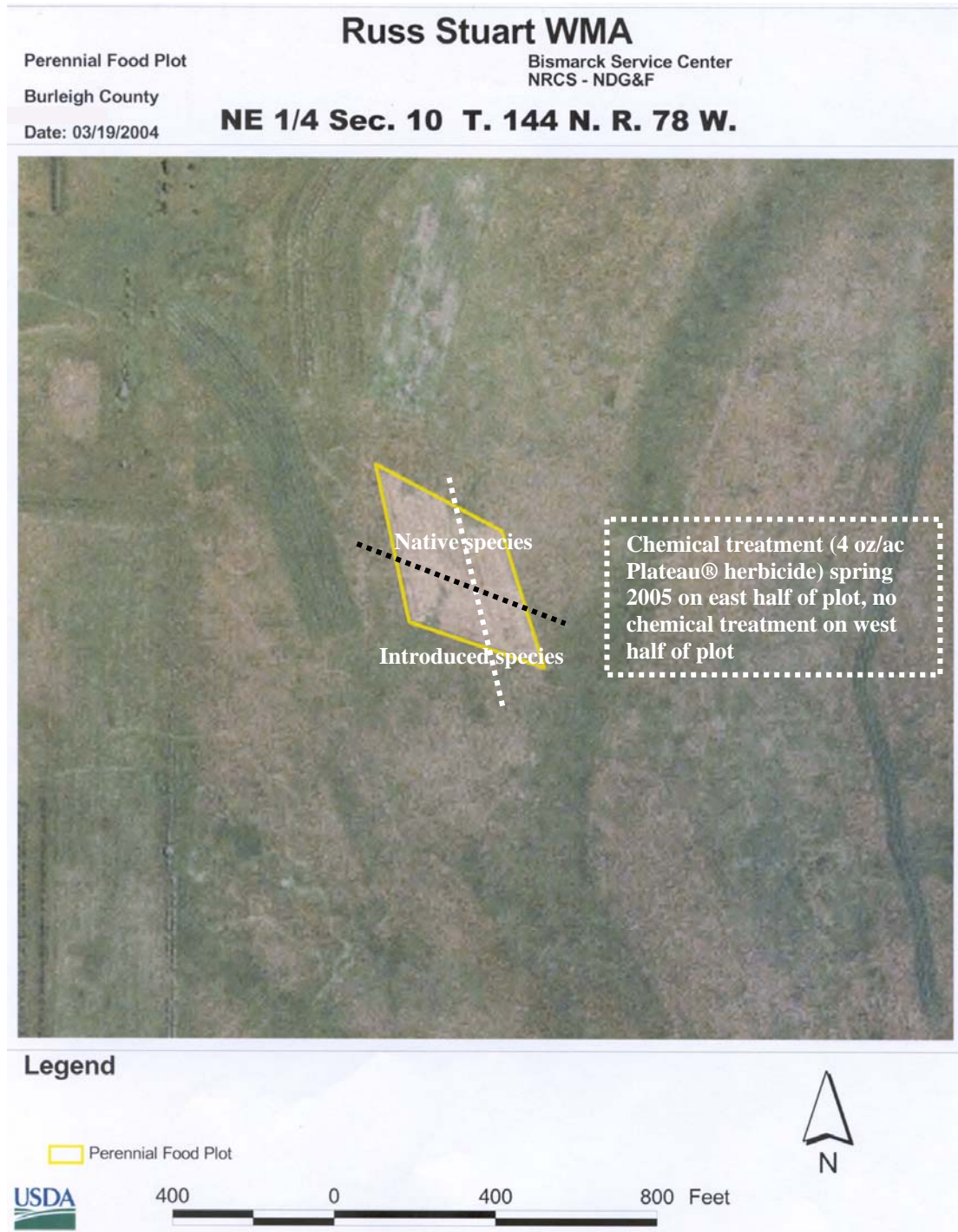
\*\*Actual amount of seed planted for a species may differ from target seeding rate due to seed availability, quality and variation in seeds/pound (depending on reference).

## Russell Stuart Wildlife Management Area

### Site description:

The site is a 2.4-acre plot located on the Russell Stuart Wildlife Management Area in Burleigh County, North Dakota. The site is fairly level and is comprised primarily of Bearden silty clay loam; slight or very slight saline. The ecological site is "limy subirrigated." See Figure 1 for aerial view of the site.

**Figure 1.**



#### **Native species seeding without Plateau® herbicide applied**

**2005:** Weed competition from annual weeds was much higher compared to the native plot that had Plateau® herbicide applied. Annual weeds showing the highest populations were lambsquarter, common ragweed, and kochia. Most of the planted species were observed in the plot. Native shrubs including buffaloberry, golden currant, redosier dogwood, western snowberry, and Juneberry were observed in this plot.

**2006:** Species showing the highest plant densities in the plots were shell-leaf penstemon, blue flax, stiff sunflower and Maximilian sunflower. High species diversity but similar to the native sprayed plot. Less bare ground than native sprayed but increased amounts of Kentucky bluegrass invading the plot.

#### **Native species seeding with Plateau® herbicide applied**

**2005:** Large areas of bare ground were observed on this site. Higher Canada thistle densities were observed compared to the unsprayed native plot. Most planted species were present but their growth was suppressed considerably. Maximilian sunflower and stiff sunflower appeared to be the least affected by the Plateau® herbicide in growth suppression. The overall stand composition was very similar to the unsprayed native plot but most of the actively growing species, both planted and weeds, showed signs of growth suppression.

**2006:** This plot has a more patchy appearance and less total cover than the native unsprayed plot. This is due mainly to less weed presence on this plot. The increased bare ground has allowed increased encroachment of absinth wormwood and Canada thistle but less invasion of annual weeds and perennial grasses. This plot has good plant diversity with Maximilian sunflower, stiff sunflower, shell-leaf penstemon, blue flax, gaillardia, and hyssops being the most prominent in the plot.

#### **Introduced species seeding with Plateau® herbicide applied**

**2005:** A higher percentage of open ground was observed compared to the other three plots. Lower numbers of planted species were observed as compared to the unsprayed plot. Planted species present showed suppressed growth and lower vigor than the unsprayed introduced plot. Canada thistle populations were higher and annual weeds were lower on the sprayed plot compared to the unsprayed plot.

**2006:** Stand is much better than unsprayed introduced plot. Higher plant diversity than the unsprayed introduced plot. Planted species are more vigorous and have less competition from invading perennial weeds.

#### **Introduced species seeding without Plateau® herbicide applied**

**2005:** Annual weed population is similar to the native species seeding without the Plateau® herbicide application. Higher densities of annual weeds occur compared to the introduced species seeding that was sprayed with the Plateau® herbicide. Intermediate wheatgrass, tall wheatgrass, and Dahurian wildrye were the dominant planted grass species observed. The grasses observed were healthy and vigorous, many were headed out, and contained good seed fill. Alfalfa, sainfoin and cicer milkvetch were the dominant planted forbs observed.

**2006:** The poorest stand of all Russell Stuart WMA plots. Planted species of intermediate wheatgrass, tall wheatgrass, Dahurian wildrye and alfalfa dominated the site. Large populations of wormwood, Kentucky bluegrass, and smooth brome grass were invading this plot.

**Table 5.** Russell Stuart WMA; native species seeded with herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
bergamot																					0
blanketflower	1	2								1										1	5
blue flax	1	1	3											1							6
Canada milkvetch	1							1													2
coreopsis				2	1			1											1		5
cup plant																					0
dotted blazing star																					0
echinacea-coneflower											1					1					2
golden glow																					0
hyssops		1																			1
leadplant					3		1								1			1	1		7
longheaded coneflower																					0
Maximilian sunflower		1			1			1		3										1	7
meadow blazing star																					0
partridge pea		1	2																		3
penstemon	3	1	4													1					9
purple prairieclover														1							1
stiff goldenrod	1							1													2
stiff sunflower				2			2	1		1		4									10
tick trefoil	2		1							1									2		6
white prairieclover	1	1																			2
yellow coneflower				1			1														2
big bluestem							1				1									1	3
Canada wildrye						1				1				2				1			5
switchgrass	1			1				1		1											4
buffaloberry					1				1												2
chokecherry																					0
currant																					0
false indigo							1													1	2
juneberry																					0
prairie rose																					0
red dogwood	2																				2
snowberry																					0
% Weed Canopy	5	3	3	15	45	2	5	5	1	1	1	0	2	10	1	2	0	0	0	0	
Remarks:	No forbs in frames 13 and 17.																				

**Table 6.** Russell Stuart WMA; native species seeded with no herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
bergamot		1									1										2
blanketflower	1								2			1							1		5
blue flax			2		1						1			1		2		1			8
Canada milkvetch				2		1												3			6
coreopsis	1	1	2	1	2	11						4	4				1		2		29
cup plant	2		1					2	1							2					8
dotted blazing star									1						1					1	3
echinacea-coneflower				1			1		3	2										1	8
golden glow					1																1
hyssops						1					1		1		1						4
leadplant				2								1			1	1					5
longheaded coneflower			2																		2
Maximilian sunflower	1		2	1		1					2	1	2	2				1			13
meadow blazing star												1									1
partridge pea					2			3			1		1			1					8
penstemon		3			1	1					1							1			7
purple prairieclover	1			1									1			1					4
stiff goldenrod			1	2	1	2	1					1	1		2						11
stiff sunflower		1	1		2	3						1			1		1	1	1		12
tick trefoil		1											1			1		1			4
white prairieclover						1															1
yellow coneflower												2	1		1					2	6
big bluestem	1	1																			2
Canada wildrye		2	1		1				1	1		1	1			1		1			10
switchgrass													1								1
buffaloberry						1															1
chokecherry																					0
currant																					0
false indigo					2				1	1											4
juneberry											1										1
prairie rose																					0
red dogwood									2	1					1						4
snowberry																					0
% Weed Canopy	50	2	40	30	70	25	1	15	15	40	5	10	10	10	15	20	45	55	50	5	

Remarks: Mustard and lambsquarters were the major annual weeds present. Plants are vigorous. Greatest population of planted species of all treatments.

**Table 7.** Russell Stuart WMA, introduced species seeded with herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
alfalfa	1	1														1					3
cicer milkvetch							1														1
hairy vetch																					0
plains coreopsis																					0
red clover																					0
sainfoin								1													1
grasses	10	1	3	4	2	1	5	0	0	6	3	0	5	5	2	0	7	2	3	3	62
buffaloberry		2						1											1		4
chokecherry																					0
false indigo																					0
golden currant																					0
juneberry																					0
redosier dogwood			1																		1
rose																					0
snowberry	1											1									2
% Weed Canopy	2	1	5	10	2	0	10	2	5	3	3	15	3	2	3	1	2	0	10	20	
<p>Remarks: More forbs were present on the north end of this treatment. South end very uneven ground surface. All plants stunted and yellow-colored.</p>																					





**Table 9.** Russell Stuart WMA; native species seeded with herbicide application, random species counts taken 9/8/2006.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				*
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
bergamot	6	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	19
blanketflower	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
blue flax	0	0	0	0	2	0	0	2	2	2	0	0	0	0	1	0	0	1	1	1	25
canada milkvetch	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	4
coreopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
cupplant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
dotted blazing star	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
echinacea-coneflower	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	4
golden glow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	4
hyssops	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
leadplant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
longheaded coneflower	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximilian sunflower	0	7	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	21
meadow blazing star	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
partridge pea	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	6
penstemon	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4
purple prairieclover	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4
stiff goldenrod	0	1	0	0	1	0	0	1	0	1	0	0	0	0	1	0	0	0	0	2	15
stiff sunflower	6	2	6	6	0	9	0	5	0	0	0	0	0	0	13	0	0	10	5	0	129
tick trefoil	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	4
white prairieclover	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
yellow coneflower	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0	0	15
big bluestem	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Canada wildrye	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
switchgrass	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	0	13
buffaloberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
chokecherry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
currant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
false indigo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
juneberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
prairie rose	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
red dogwood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
snowberry	0	0	0	0	0	3	2	0	0	0	2	0	1	0	0	0	0	0	0	2	21
<b>% Weed Canopy</b>	15	20	10	5	20	5	10	25	40	10	5	10	5	25	15	20	5	10	10	10	

\* Seedlings /100 sq.ft.

**Table 10.** Russell Stuart WMA; native species seeded with no herbicide application, random species counts taken 9/8/2006.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				*
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
bergamot	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
blanketflower	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
blue flax	1	0	3	0	1	0	0	5	0	0	0	0	3	0	0	0	0	1	0	0	29
canada milkvetch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
coreopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
cupplant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dotted blazing star	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
echinacea-coneflower	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
golden glow	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	4
hyssops	3	0	0	0	0	0	0	0	0	0	0	2	0	3	0	0	0	0	0	0	17
leadplant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
longheaded coneflower	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximilian sunflower	3	3	0	5	8	0	5	5	3	0	2	0	7	0	12	5	0	14	0	0	150
meadow blazing star	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
partridge pea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
penstemon	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	1	0	0	0	8
purple prairieclover	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
stiff goldenrod	1	1	1	0	2	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	15
stiff sunflower	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	4	2	21
tick trefoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
white prairieclover	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
yellow coneflower	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	1	0	2	13
big bluestem	0	0	0	0	0	1	0	0	1	0	0	0	0	2	0	0	0	0	0	0	8
Canada wildrye	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	3	0	0	0	2	17
switchgrass	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	6
buffaloberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
chokecherry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
currant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
false indigo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
juneberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
prairie rose	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
red dogwood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
snowberry	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	4
<b>% Weed Canopy</b>	60	40	30	10	30	50	40	70	20	30	50	40	80	40	20	30	30	30	50	20	

\* Seedlings /100 sq.ft.

**Table 11.** Russell Stuart WMA, introduced species seeded with herbicide application, random species counts taken 9/8/2006.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				*
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
alfalfa	0	0	1	0	4	0	0	0	0	0	2	1	0	1	0	0	0	0	0	1	21
cicer milkvetch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
hairy vetch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
plains coreopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
red clover	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sainfoin	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	4
Dahurian wildrye	1	0	1	0	0	1	0	0	0	0	0	1	2	0	1	1	1	1	2	1	27
intermediate wheatgrass	0	0	0	1	2	1	1	0	0	1	2	0	0	2	0	0	0	3	0	0	27
mammoth wildrye	0	0	0	0	0	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	10
tall wheatgrass	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6
buffaloberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
chokecherry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
false indigo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
golden currant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
juneberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
redosier dogwood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
rose	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
snowberry	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	1	1	0	0	10
<b>% Weed Canopy</b>	<b>10</b>	<b>5</b>	<b>5</b>	<b>10</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>10</b>	<b>30</b>	<b>40</b>	<b>25</b>	<b>50</b>	<b>10</b>	<b>5</b>	<b>20</b>	<b>20</b>	<b>30</b>	<b>10</b>	<b>10</b>	

\* Seedlings /100 sq.ft.

**Table 12.** Russell Stuart WMA, introduced species seeded without herbicide application, random species counts taken 9/8/2006.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				*
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
alfalfa	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	1	0	10
cicer milkvetch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
hairy vetch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
plains coreopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
red clover	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sainfoin	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	4
Dahurian wildrye	1	1	0	3	1	1	0	2	1	0	1	1	1	1	2	0	0	3	2	1	46
intermediate wheatgrass	0	2	1	0	0	1	1	1	0	1	0	1	1	0	0	1	1	0	0	0	23
mammoth wildrye	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
tall wheatgrass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
buffaloberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
chokecherry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
false indigo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
golden currant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
juneberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
redosier dogwood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
rose	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
snowberry	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
<b>% Weed Canopy</b>	<b>50</b>	<b>40</b>	<b>60</b>	<b>60</b>	<b>50</b>	<b>40</b>	<b>30</b>	<b>20</b>	<b>60</b>	<b>50</b>	<b>30</b>	<b>20</b>	<b>75</b>	<b>60</b>	<b>80</b>	<b>40</b>	<b>30</b>	<b>50</b>	<b>40</b>	<b>40</b>	

\* Seedlings /100 sq.ft.

## Old John's Lake Wildlife Management Area

### Site description:

The site is a 2.4-acre plot located on Old John's Lake Wildlife Management Area in Sheridan County, North Dakota. Soils are mapped as a Williams loam on B slope. The ecological site is loamy. See Figure 2 for an aerial view of the site.

Figure 2.



## Old John's Lake WMA Plot

### **Native species seeding without Plateau® herbicide applied**

2005: Very high weed competition, including high densities of quackgrass, green foxtail, smooth bromegrass, and absinth wormwood were present. This plot had the most planted species present in the planting. The population of both Maximilian and stiff sunflower was less compared to the sprayed native plot. Very little bare ground was present at this time. The best stands were observed on the higher aspects of the site due to the decreased weed competition as compared to the lower site. Good densities of switchgrass and big bluestem were seen.

2006: High diversity of planted species. Shell-leaf penstemon, stiff sunflower, Maximilian sunflower, hyssops, green needlegrass, Canada wildrye, and big bluestem as the dominant planted species observed. Quackgrass and smooth bromegrass observed in heavy densities in many areas.

### **Native species seeding with Plateau® herbicide applied**

2005: More bare ground occurred than on the unsprayed plot. Sweetclover and Canada thistle densities were higher on this site as compared to the unsprayed plot. Planted species densities were less and had suppressed growth when compared to the unsprayed.

2006: This plot has the highest density of quackgrass compared to all the Old Johns plots. More bare ground compared to the unsprayed plots. The species diversity is high. Species most prevalent are shell-leaf penstemon, gallardia, stiff sunflower, Maximilian sunflower, and wild bergamot. Extremely dry conditions and the competition of quackgrass have noticeably reduced the plant vigor of the native species.

### **Introduced species seeding without Plateau® herbicide applied**

2005: The heaviest concentrations of absinth wormwood were observed on this site. The stand was poor and very few of the planted species were observed. Highest densities of sweetclover, smooth bromegrass, and annual weeds occurred compared to the other three treatments.

2006: Very poor stand with heavy infestations of smooth bromegrass, yellow sweetclover and absinth wormwood. The planted species including some alfalfa, intermediate wheatgrass, and Dahurian wildrye were present but vigor was greatly reduced.

### **Introduced species seeding with Plateau® herbicide applied**

2005: The overall stand was poor. Some of the planted species were present in very low numbers. Their growth was suppressed. A higher percentage of bare ground was observed.

2006: Increased percentage of bare ground compared to the unsprayed plots. High concentrations of sweetclover. Cicer milkvetch and alfalfa are fairly abundant in this plot and plant vigor is good. Plot has the lowest concentrations of absinth wormwood but heavy invasion of sweetclover. This plot lacks the grass component and is rated as poor.

**Table 13.** Old John's Lake WMA; native species seeded with herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
bergamot																					0
blanketflower	1										1	1									3
blue flax						1				1					1					1	4
Canada milkvetch																					0
coreopsis				1						2								1			4
cup plant		1				1													1		3
dotted blazing star																	1				1
echinacea-coneflower						2												2		1	5
golden glow																					0
hyssops																					0
leadplant																					0
longheaded coneflower																					0
Maximilian sunflower				1																	1
meadow blazing star																					0
partridge pea			1																1		2
penstemon					1	1							3					1		1	7
purple prairieclover							1						2		1			1			5
stiff goldenrod																					0
stiff sunflower				1		1	1	1	1	1			1	1	1			1			10
tick trefoil																					0
white prairieclover	1						1					1									3
yellow coneflower																					0
big bluestem																			1		1
Canada wildrye													1					1			2
switchgrass																					0
buffaloberry					1																1
chokecherry																					0
currant																					0
false indigo															1						1
juneberry																					0
prairie rose																					0
red dogwood																					0
snowberry																					0
% Weed Canopy	5	3	2	20	1	10	10	15	65	20	1	25	15	75	15	2	2	3	20	35	
Remarks: Nothing found in frame 16; less stunted than at Russell Stuart site; seeded plants are more vigorous than at Russell Stuart site; large quackgrass patches; more weeds than at Russell Stuart site.																					

**Table 14.** Old John's Lake WMA; native species seeded with no herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
bergamot																					0
blanketflower															1						1
blue flax											1		1		1		2				5
Canada milkvetch																					0
coreopsis											1					1					2
cup plant											1										1
dotted blazing star								1													1
echinacea-coneflower			1								1			1		1					4
golden glow																					0
hyssops																					0
leadplant																					0
longheaded coneflower																					0
Maximilian sunflower															1	1					2
meadow blazing star																					0
partridge pea																					0
penstemon						1					1			1							3
purple prairieclover																		1			1
stiff goldenrod															1						1
stiff sunflower	1		1											2	1		2		1		8
tick trefoil														1							1
white prairieclover											1				3					1	5
yellow coneflower																					0
big bluestem		1									1	1				1					4
Canada wildrye																				1	1
switchgrass																1		1			2
buffaloberry			1																		1
chokecherry																					0
currant																					0
false indigo																					0
juneberry																					0
prairie rose																					0
red dogwood																					0
snowberry																					0
% Weed Canopy	15	15	20	75	70	90	70	40	80	90	50	15	25	65	40	30	15	25	30	65	

**Table 15.** Old John's Lake WMA; introduced species seeded with herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
alfalfa	1	2	2	2			3			1			2							1	14
cicer milkvetch	1	2	1	1							1		2						1	1	10
hairy vetch																					0
plains coreopsis																					0
red clover																					0
sainfoin				1																	1
grasses	1		2						1		0		0			4	6	0	0	0	14
buffaloberry																					0
chokecherry																					0
false indigo							1														1
golden currant																					0
juneberry																					0
redosier dogwood																					0
rose																					0
snowberry																					0
% Weed Canopy	50	20	25	25	60	5	35	35	15	35	20	20	15	70	10	15	60	15	10	15	
<p><u>Remarks:</u> Many Canada thistle patches, particularly frames 17, 18, and 19; sideoats grama in frame 7; high density of sweetclover; quackgrass; less sainfoin than Russell Stuart WMA site; less grasses than Russell Stuart WMA site.</p>																					



**Table 16.** Old John's Lake WMA; introduced species seeded with no herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
alfalfa									1	1				1							3
cicer milkvetch										1	1			1							3
hairy vetch																					0
plains coreopsis																					0
red clover																					0
sainfoin														1							1
grasses			2	3	6	6		2	2		2	2	3	9	3					0	40
buffaloberry																				1	1
chokecherry																					0
false indigo																					0
golden currant																					0
juneberry																					0
redosier dogwood												2									2
rose																					0
snowberry																					0
% Weed Canopy	70	40	50	35	40	70	30	60	65	70	75	50	90	95	95	75	70	85	30	60	
Remarks: Large sweetclover patches and quackgrass; poor establishment from seeded species.																					

**Table 17.** Old John's Lake WMA; native species seeded with herbicide application, random species counts taken 9/8/2006.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				*
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
bergamot	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
blanketflower	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
blue flax	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
canada milkvetch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
coreopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
cupplant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dotted blazing star	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
echinacea-coneflower	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	4
golden glow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
hyssops	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
leadplant	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
longheaded coneflower	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximilian sunflower	2	0	3	1	0	2	0	1	3	1	3	0	0	0	0	1	0	3	0	0	42
meadow blazing star	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
partridge pea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
penstemon	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	4
purple prairieclover	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	4
stiff goldenrod	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
stiff sunflower	0	10	0	0	0	4	0	2	0	0	0	0	0	0	1	2	0	0	0	0	40
tick trefoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
white prairieclover	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
yellow coneflower	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
big bluestem	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Canada wildrye	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	1	0	0	0	0	10
switchgrass	2	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
buffaloberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
chokecherry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
currant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
false indigo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
juneberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
prairie rose	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	10
red dogwood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
snowberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>% Weed Canopy</b>	10	15	5	10	20	80	20	10	15	20	10	10	5	20	10	50	40	20	10	5	

\* Seedlings /100 sq.ft.

**Table 18.** Old John's Lake WMA; native species seeded with no herbicide application, random species counts taken 9/8/2006.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				*
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
bergamot	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
blanketflower	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
blue flax	0	0	0	0	0	0	5	0	0	0	0	1	1	0	0	0	0	0	0	0	15
canada milkvetch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
coreopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
cupplant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dotted blazing star	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
echinacea-coneflower	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
golden glow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
hyssops	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
leadplant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
longheaded coneflower	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximilian sunflower	2	0	1	0	0	1	1	0	0	4	5	0	0	0	0	0	1	0	1	0	33
meadow blazing star	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
partridge pea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
penstemon	0	0	0	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	13
purple prairieclover	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	4
stiff goldenrod	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
stiff sunflower	0	0	0	0	1	0	0	0	19	2	0	12	1	14	2	6	1	2	0	0	125
tick trefoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
white prairieclover	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
yellow coneflower	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
big bluestem	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	6
Canada wildrye	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	8
switchgrass	0	0	0	1	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	10
buffaloberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
chokecherry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
currant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
false indigo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
juneberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
prairie rose	0	0	0	0	1	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	15
red dogwood	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
snowberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>% Weed Canopy</b>	60	50	20	70	50	80	90	60	60	50	70	60	70	70	80	80	70	70	60	50	

\* Seedlings /100 sq.ft.

**Table 19.** Old John's Lake WMA; introduced species seeded with herbicide application, random species counts taken 9/8/2006.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				*
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
alfalfa	0	0	2	0	0	0	0	0	0	0	0	1	0	2	2	2	2	3	4	1	40
cicer milkvetch	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
hairy vetch	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
plains coreopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
red clover	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sainfoin	0	1	0	2	0	0	0	0	1	0	0	1	0	0	2	0	1	0	0	3	23
Dahurian wildrye	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
intermediate wheatgrass	0	0	0	0	1	0	2	1	0	2	1	1	0	0	0	1	0	1	1	0	23
mammoth wildrye	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
tall wheatgrass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
buffaloberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
chokecherry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
false indigo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
golden currant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
juneberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
redosier dogwood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
rose	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0	8
snowberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>% Weed Canopy</b>	40	20	60	30	20	20	30	50	40	30	20	60	20	40	40	50	20	30	30	20	

\* Seedlings /100 sq.ft.

**Table 20.** Old John's Lake WMA; introduced species seeded with no herbicide application, random species counts taken 9/8/2006.

SPECIES	FRAME (2.4-ft <sup>2</sup> )																				*
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
alfalfa	0	0	0	0	0	3	1	0	0	1	1	0	0	0	0	1	0	0	0	0	15
cicer milkvetch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
hairy vetch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
plains coreopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
red clover	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sainfoin	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Dahurian wildrye	1	1	0	0	2	0	0	0	0	0	0	1	3	4	0	1	0	0	0	0	27
intermediate wheatgrass	0	1	0	1	0	1	0	0	0	1	1	1	0	0	1	1	1	1	0	0	21
mammoth wildrye	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
tall wheatgrass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
buffaloberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
chokecherry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
false indigo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
golden currant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
juneberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
redosier dogwood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
rose	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2
snowberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>% Weed Canopy</b>	60	50	80	90	70	60	60	70	60	80	70	50	40	50	60	70	50	70	80	80	

\* Seedlings /100 sq.ft.

## ACTIVE STUDIES - TECHNICAL REPORT 2004-2006

Study No. NDPMC-S-0603-CR

Study Name: Wind Cave National Park

Introduction: The U.S. Geological Survey Northern Prairie Wildlife Research Center and the Natural Resources Conservation Service in North Dakota signed a cooperative agreement in September 2005. The USGS and National Park Service are working to preserve the native plant resources and revegetate parklands. The USGS/NPS require that restoration of native plants be accomplished using germplasm from populations as closely related genetically and ecologically as possible to park populations. The Bismarck Plant Materials Center has agreed to propagate seed of selected species and provide the seed to Wind Cave National Park (WICA) in the Black Hills of South Dakota for revegetation and further research. Following is a list of selected species and the amount of seed requested.

<b>Species</b>	<b>Name</b>	<b>PLS lb</b>
<i>Pascopyrum smithii</i>	Western wheatgrass	5
<i>Andropogon gerardii</i>	Big bluestem	5
<i>Bouteloua gracilis</i>	Blue grama	5
<i>Schizachyrium scoparium</i>	Little bluestem	5
<i>Bouteloua curtipendula</i>	Sideoats grama*	5
<i>Aristida purpurea</i>	Purple three-awn	2
<i>Koeleria macrantha</i>	Junegrass	2
<i>Elymus elymoides</i>	Bottlebrush squirreltail	2
<i>Cirsium undulatum</i>	Wavy-leaf thistle	.5
<i>Dalea purpurea</i>	Purple prairieclover	.5
<i>Sphaeralcea coccinea</i>	Scarlet globemallow*	.5
<i>Astragalus missouriensis</i>	Missouri milkvetch*	.5
<i>Oxytropis lambertii</i>	substitute	
<i>Oxytropis campestris</i>	substitute	
<i>Nassella viridula</i>	substitute	

\*Little or no seed was collected for these species. Those listed as substitutes have been grown and planted at the PMC along with the other targeted species.

General information about seed cleaning, propagation, and plant performance is listed under each respective topic. Following the general information is specific information about each species.

### Seed Collection and Processing

Seed was collected by Wind Cave National Park personnel in the fall of 2005. Seed set was poor for some of the species due to drought conditions at WICA. Seed was collected from other species to substitute for those not producing any seed and sent to the PMC.

Seed was collected at the Park by clipping seed heads or hand stripping seed from the heads. At the PMC, seed was cleaned by hand using a rub board, SD seed blower, office size fanning mill, lab debearder, pan screens and hand picking of seed. Seed fill was poor for many of the species. The exact amount of material that was sent from the park was not recorded as much of the weight was from sticks or other vegetative parts. The species for the park were not given an accession number (PMC ID number), as all material will be going back to WICA.

### Greenhouse Propagation

Seed was propagated in the greenhouse at the PMC, with seed planting starting January 11, 2006. The seed of most species was planted into cone-tainers, which are plastic cones with bottom drainage holes. The size of each cone is a 1 ½ inch diameter and 8 ¼ inch depth. Flats were also planted. Plants from

the flats were used to transplant into cones where seed did not germinate. Premier Promix BX with biofungicide, a no-soil potting mix was used. The goal was to produce 200-400 seedlings to be planted into a field plot. Seedlings were hardened off in the lath house prior to field planting.

#### Field Planting

A field plot was prepared by tilling. A subsoiler was used to make a 10 to 12 inch deep trench in which the cone-tainerized seedlings were planted by hand. Moisture conditions were good at the time of planting and the field was irrigated after transplanting. Seedlings were planted in paired rows to help improve pollination. The rows were spaced approximately 4-5 feet apart. A total of four rows contained all of the species. Field row length was approximately 800 feet. Plants were spaced approximately one foot apart within the row. Seedlings for most species were planted to the field in early June of 2006. Some of the forb and grass seedlings were very slow to grow in the greenhouse so were planted to the field plot in early August when they had larger root systems.

#### Field Maintenance

No chemical was used on the field plot in 2006. Weeds were controlled by shallow tilling with a garden tiller and by hand weeding. Weeds were removed throughout the growing season and were not a limiting factor for plant growth. Residue was left standing at the end of 2006. The seedlings were irrigated immediately after field planting and a few additional times from June to September to keep the plants alive in the severe drought and hot conditions of 2006.

#### Field Harvest

Few seeds were harvested in 2006. Any seed harvested was gathered by hand.

#### Species Information

Following is information related to propagation and growth of each targeted species.

Prairie junegrass: Seedheads received from WICA were cleaned by hand stripping from the heads.

Prairie junegrass seed was very small. The amount of dirty seed after stripping from the heads was approximately 30 grams. It was difficult to determine fill on this seed. The SD seed blower did not work well to separate the filled seeds, as static made seeds stick to the sides of the plastic air column. Several seeds per cone-tainer were planted in the greenhouse in mid January. Seed germination was good, and 3-5 seedlings grew in each cone. Attempts to thin the seedlings were not successful. More than one seedling in the cone did not appear to be detrimental to the plants. A total of 479 cone-tainers of seedlings were planted to the field plot at the PMC on 6/12/2006. Only one to two plants died after transplanting to the field. No seed heads were formed in 2006. Deer browsed the species. Plants were vigorous and grew to a height of approximately 4 inches.

Blue grama: Blue grama was received from WICA as clipped heads. Seed was removed from the heads by hand stripping, a rub board and pan screens. Approximately 35 grams of bulk seed remained after cleaning. Seed germination was fair to poor in the greenhouse. A total of 242 seedlings were planted to the field on 6/12/2006. Seedlings thrived in the field. Approximately 90% of the plants produced seedheads. Seed was harvested by hand clipping the heads on 9/26/2006. Seed was cleaned using an office size fanning mill and debearder. It was difficult to remove the sticks once the seed was hammer-milled. Several screen sizes were used to remove the sticks. Air was also turned up to blow good seed over the screens and drop the sticks through. Harvesting by clipping only the top portion of the head would have reduced this problem. Seed fill was not good. A total of 100 grams bulk seed remained after cleaning. Sticks still remain in the clean seed.

Wavyleaf thistle: Seed was received from WICA as whole heads. Seed was carefully removed from the spiny heads using a tweezers and rub board. The hairy appendages were pulled from the block shaped seed before planting in the greenhouse. Many of the seeds had insect holes. These were separated from heavier seed using a SD seed blower. The light and damaged seed was discarded.

Approximately 8 grams of bulk seed remained after cleaning. Seed in the greenhouse germinated within two weeks. Seedlings did not thrive in the greenhouse environment. Damping off became a problem. The size of the cones may have hampered growth, as well. A total of 52 seedlings were planted to the field. Once in the field, the plants thrived and grew into large rosettes reaching to a diameter of one to two feet. A plant spacing of greater than 1 foot would have been better for optimal growth. As expected, this rosette forming species did not produce seed heads the first year. Plants were very spiny and vigorous. Weeding around the plants and harvesting in future years may be a challenge!

Purple prairieclover: Material from WICA was received at the PMC as fluffy seed stripped from the heads. Seed fill was poor. Some of the fuzzy appendages appeared to be slightly green in color, indicating immature seed. Less than 5 grams of bulk seed remained after cleaning. A rub board was used to remove the fuzzy seed covering. The seed was scarified for 10-12 seconds in a Forsberg scarifier prior to greenhouse planting to allow the seed to imbibe water. Seed germinated readily, but seedlings remained very small in the greenhouse and damping off became a severe problem. The biofungicide in the potting soil may have been a factor limiting growth. A total of 247 seedlings were planted to the field. Seedlings were not planted to the field until early August because of their small size. Most of the seedlings survived and grew after planting. No seed heads were produced.

Oxytropis campestris: Seed was received in seed pods from WICA. Seed was removed from the pods using a rub board and SD seed blower. Approximately 18 grams of pods produced 5 grams of seed. Seed was scarified approximately 12 seconds before seeding in the greenhouse. Seedlings remained small in the greenhouse. Approximately 195 plants were planted to the field plot in August of 2006. Seedlings remained small, growing to 2-4 inches before frost.

Big bluestem: Approximately ¼ pound of dirty seed was received from WICA. Seed was cleaned by running seed through an office size debearder for 20-30 minutes. Seed was then cleaned in an office size fanning mill. Approximately 34.6 grams of clean bulk seed remained. Seed germinated readily in the greenhouse, but plants were of poor vigor. Cool greenhouse conditions and lack of proper nutrients in the soil were contributing factors. Approximately 108 seedlings were planted to the field in August. Seedlings grew to about 4-5 inches tall in the field in 2006.

Western wheatgrass: Approximately 81 grams of clipped heads were received from WICA, producing 50 grams of clean bulk seed. Seed readily germinated and seedlings were healthy and vigorous at the time of field planting. A total of 360 seedlings were planted to the field plot. Rhizome spread and leaf growth was excellent in the field. No seed heads were produced in 2006.

Green needlegrass: The thirteen grams of bulk seed with awns that was received at the PMC had been hand stripped. Awns were removed using a rub board. Seed was also scarified a few seconds to scratch the seedcoat and reduce any seedcoat dormancy. Seed germination was fair. Seedlings were planted to the field on 6/8/2006. Plants were very vigorous in the field. Plants grew up to one foot in leaf length. No seed heads were produced in 2006.

Bottlebrush squirreltail: Seed heads were received from WICA. The curved awns were removed by hammer milling. Approximately 37 grams of bulk seed remained after cleaning with a SD seed blower. A total of 286 plants were planted to the field plot. Plants had a bunch type growth and were vigorous in the field. Various plants showed signs of leaf rust. Five seed heads were produced in 2006. None of the seeds were viable.

Red three-awn: Approximately 200 grams of seed with awns was received from WICA. This seed was very difficult to process. Awns could not be removed using a rub board. Awns were removed from some seed by running for a few seconds in an office scarifier. This removed a few awns, but

not a high percentage. The seed also had a tendency to break using the scarifier. The majority of the seed planted in the greenhouse had the awns removed by clipping with a scissors. Germination was rapid in the greenhouse (approximately 1 week). A total of 326 seedlings were planted to the field. Plants were healthy and vigorous. Roots appeared to be quite shallow. Several plants produced heads. Seed was harvested by hand stripping. Attempts to remove awns were again a challenge. Seed was run in a scarifier and hand picked. Many of the seeds were not filled. A total of 5 grams of seed remained after cleaning. Quality of the cleaned seed was poor.

*Oxytropis lambertii*: Very little seed was received from WICA. All seed was planted in the greenhouse. Seed germination was poor. A total of 32 seedlings were planted to the field in August of 2006. Plants remained small, but did grow once in the field. Plants were prostrate in growth. No seed was produced in 2006.

Little bluestem: Seed received from WICA was hand stripped from the plants. Awns were removed using an office debarker. Empty seeds and debris were removed using an office size fanning mill. Approximately 50 grams of bulk seed remained after cleaning. Germination was fair and growth was good in the greenhouse. Approximately 255 seedlings were planted to the field on 6/12/2006. Growth in the field was excellent. Plants were vigorous and produced seed heads. Seed was hand harvested in October 2006, which is later than normal for little bluestem. This is typical for first year plantings. Seed fill was poor. A total of 36 grams of clean bulk seed was produced.

Extensive data on plant growth and characteristics was not gathered in 2006. Plants do not usually reach their full potential the first year of planting. Data will be gathered in 2007. Seed will be harvested. Overall, plants were vigorous and healthy in 2006.



## ACTIVE STUDIES - TECHNICAL REPORT 2004-2006

Study No. NDPMC-S-0602-CR

Study Name: Little Bighorn Battlefield National Monument

Introduction: The National Park Service (NPS), in managing Little Bighorn Battlefield National Monument (LIBI) has a need to preserve the native plant resources and revegetate parklands. The NPS requires that restoration of native plants will be accomplished using germplasm from populations as closely related genetically and ecologically as possible to park populations. Quantities of indigenous seed are needed to revegetate areas disturbed by construction activities for the proposed road rehabilitation project. The NPS has requested assistance from the Bismarck Plant Materials Center (PMC). The PMC has agreed to increase seed collected at LIBI of four selected grass species. Technical assistance in planting, growing and cleaning of seed will also be provided to LIBI. The agreement was signed in September of 2005 and runs through FY 2008.

### **Targeted Species**

<b>Species</b>	<b>Name</b>	<b>Amount PLS pounds</b>
<i>Nassella viridula</i>	Green needlegrass	100
<i>Pseudoroegneria spicata</i>	Bluebunch wheatgrass	100
<i>Bouteloua curtipendula</i>	Sideoats grama	50
<i>Bouteloua gracilis</i>	Blue grama	10

### **Materials and Methods**

Seed was collected by LIBI park personnel in 2005. Seed was sent to the PMC in the fall of 2005 for cleaning and increase. Seed was cleaned using a two-screen office size fanning mill, a small debearder with rubber bats and rubber corrugated lining and pan screens. Each collection of seed was assigned an accession number (identification number). Seed germination and purity were tested by North Dakota State Seed Testing Laboratory. Cleaned seed of green needlegrass was planted at the Bismarck PMC in the fall of 2005 and the other species were planted in the spring of 2006. The seedbeds were black and had been firmed (packed) prior to planting. Seed was planted using a modified Truax grass drill in rows 42 inches apart. Blue grama seed was very limited. It was planted using a plot seeder with rows spaced 8 inches apart. Fields were maintained by hand weeding, tillage, irrigation, and herbicide application. Approximately 100 seedlings were grown in the greenhouse for each of the targeted species. These were transplanted to the field to fill in any areas devoid of plants. Any seed produced in the field plots in 2006 was harvested by hand. Following are details related to seed increase activities for each targeted species.

#### **Green needlegrass Accession 9092048**

Collected seed: Dirty = 7.7 pounds Bulk after cleaning = 4.5 pounds

Seed Cleaning: Debearder and office fanning mill.

Debearder: speed of 160 RPM for 15 minutes. Office mill: screen sizes = 9 round on top and 1/22 bottom screen; air 1/2 open.

Seed Quality: Purity: 97.09% Germination: 2% Dormancy: 86%

Seeding Date: Date: 11/23/2005. Due to the high dormancy, seed was planted in late fall.

Site Preparation: The field site was prepared by cultivating and packing. Trust® (trifluralin) herbicide was sprayed at 2 pints per acre and incorporated prior to seeding. Field conditions were very moist at the time of seeding.

Seeding: Seeding rate was approximately 50 seeds (bulk)/linear foot. Eight rows were planted 42 inches apart and approximately 800 foot in length. The field had little snow cover over the winter, making it vulnerable to seed blowing and dessication.

Maintenance: The field was hand weeded, and irrigated. Broadleaf weeds were sprayed with 2,4-D at 2 pints per acre on 8/10/2006 and 8/21/2006. Late in the season, the tops of the weeds were clipped to help prevent further seeding of weeds.

Plant Performance: Stand was poor in the spring of 2006 and remained poor and spotty throughout the growing season. The field has patches of plants that are thriving, but these are spaced quite far apart. Broadleaf weeds became a severe problem, shading seedlings and competing for moisture.

2006 Seed Harvest: None

#### **Bluebunch wheatgrass Accession 9092050**

Collected seed: Dirty = 6.4 pounds Bulk after cleaning = 3.9 pounds

Seed Cleaning: Seed was cleaned using an office size debearder and fanning mill. Seed was run in the debearder for 10 minutes. A size 14 round screen was used as the top screen and a blank for the bottom screen in the fanning mill. Wind was ¼ to ½ open.

Seed Quality: Purity: 90.20% Germination: 90%.

Seeding Date: 5/4/2006

Site Preparation: The site was prepared by cultivation and packing. Site was sprayed with Trust®(trifluralin) herbicide at 2 pints/acre(May 2, 2006) prior to seeding. The site was black and soil moisture was fair at the time of planting

Seeding: Seeding rate was approximately 40 seeds (bulk)/linear foot. Eight rows were planted 42 inches apart and approximately 800 feet in length.

Maintenance: The site was hand weeded and irrigated throughout the growing season. No additional chemical was applied after seeding.

Plant Performance: Broadleaf weeds were severe in some portions of the field. Stand was spotty.

Plants remained small and very few seed heads were formed. Plant growth was slow and plants remained short. Plants were larger in areas where weeds were not competing.

2006 Seed Harvest: None

#### **Blue grama Accession 9092047**

Collected seed: Dirty = 341 grams Bulk after cleaning: = 51 grams Most collected seed was empty.

Seed Cleaning: Debearder and office fanning mill.

Debearder-speed of 160 RPM for 10 minutes. Office mill screen sizes = 12 round on top and blank on bottom screen. Air ¼ to ½ open.

Seed Quality: No seed tests were run. Hand cutting seed showed fill of 80% or greater for the cleaned seed.

Seeding Date: 6/2/2006

Site Preparation: The field site was prepared by cultivating and packing. Atrazine herbicide was sprayed at 2 pints/acre (5/19/2006) prior to seeding.

Seeding: A plot seeder was used to plant the field bed. The bed is 6 feet wide and 180 feet long. The bed consists of 8 rows spaced approximately 8 inches apart. A seeding rate of 1 gram of bulk seed per 30 linear foot of row was planted. (Approximately 750,000 seeds/pound for blue grama).

Maintenance: The field was hand weeded and irrigated. No herbicide, other than the Atrazine prior to planting, was applied during the growing season.

Plant Performance: The stand was excellent. Weed competition was very minimal. Plants were vigorous and produced numerous seed heads. Maturity of seed was late in the field. Seed maturity is often variable the first year. Though seed heads were many, seed fill was poor. Hot and dry conditions were contributing factors.

2006 Seed Harvest and Cleaning: Harvest date: 9/28/2006. Stems with heads were hand clipped and laid out to dry before storing. The clipped material was stored until cleaning in February. Seed was cleaned using a hammer mill, debearder, and fanning mill. Fanning mill screens were 12, 11, 10, and 8 round. Seed was run in an office debearder for 10 to 15 minutes. Sticks were very difficult to remove from this seed. Harvesting by clipping stems is not the best method for harvesting.

2006 Seed Harvest: 3 pounds of clean bulk seed was harvested.

**Sideoats grama Accession 9092049**

Collected seed: Dirty = 4  $\frac{3}{4}$  pounds Bulk after cleaning: = 1.8 pounds. Seed had been hand stripped.

Seed Cleaning: Office fanning mill.

Office mill screen sizes = 20 and 24 round on top, blank on bottom

Seed Quality: Purity: 97.93% Germination: 26% Dormancy: 15%

Seeding Date: 6/2/2006

Site Preparation: The field site was prepared by cultivating and packing. Atrazine herbicide was sprayed at 2 pints/acre (5/19/2006) prior to seeding.

Seeding: Seeding rate was approximately 49 bulk seeds/linear foot of row. Six rows were planted 42 inches apart and 800 foot in length. Seed fed slowly through the drill, so both the fluffy box and wheatgrass box were used.

Maintenance: The field was hand weeded, and irrigated. No herbicide, other than the atrazine prior to planting, was applied during the growing season. Rows were shallow tilled with a garden tiller to control the small weeds.

Plant Performance: The stand was spotty, but overall was fair. Plants were vigorous and produced some seed heads.

2006 Seed Harvest and cleaning: Harvest date = 9/28/2006. Seed was hand stripped from plants.

Flowering was very late and much of the seed was still green at the time of frost. Seed maturity was quite variable, which is common for first year seedings. Seed was cleaned using an office size fanning mill with number 20 and 24 round screens and a blank on the bottom. Much of the seed was not filled.

2006 Seed Harvest: Dirty amount = 5.5 pounds Clean amount = 1 pound

Comments

The hot and dry growing conditions made seedling establishment difficult. Weed competition was a big challenge in managing the fields.

## **DEMONSTRATION/EDUCATION**

**DEMONSTRATION/EDUCATION: TECHNICAL REPORT 2004-2006**

Demonstration Title: Native Seed Source Demonstration

Introduction: The increased use of native species has resulted in discussion on which seed source should be used for conservation purposes; seed from a native harvest or seed of released varietal material.

Objective: Provide a demonstration area where a native mix comprised of named variety material is compared to a native harvest seed mix. The two mixes were both drilled and broadcast seeded to allow this comparison to be demonstrated as well.

Cooperators: USDA, NRCS, Bismarck Plant Materials Center

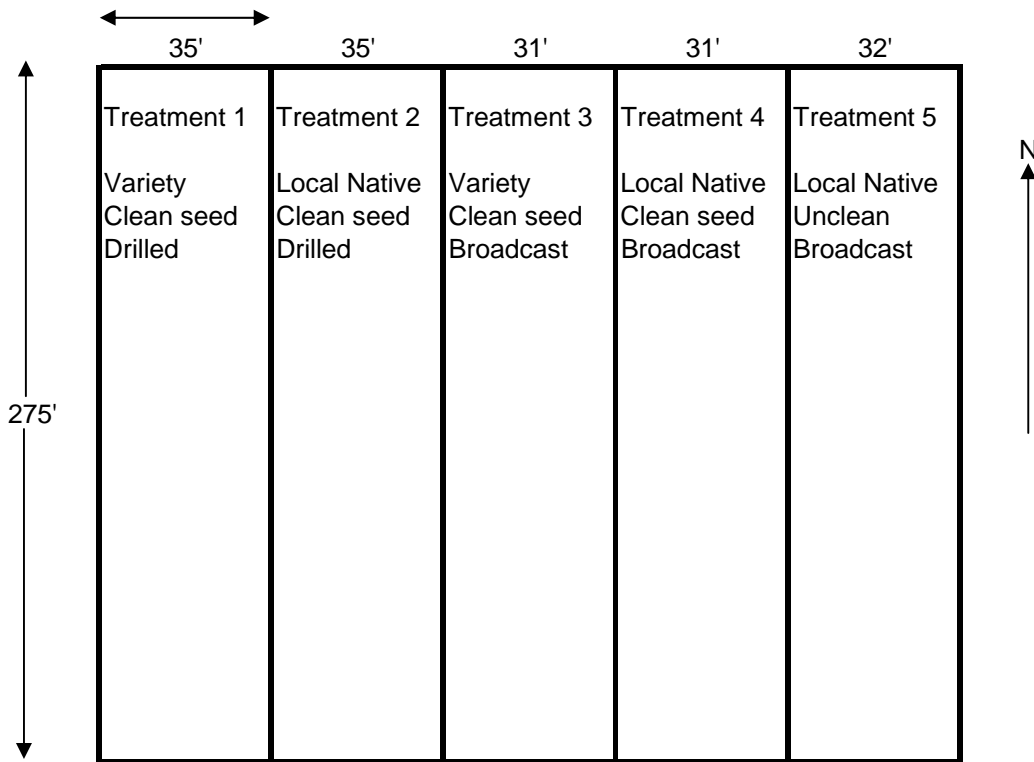
Location: The planting is located on the Plant Materials Center grounds in Panel A.

**Methods and Materials**

Assembly: The demonstration consists of 5 individual nonreplicated plots approximately 35 feet wide by 275 feet long.

Planting Plan: See plot map below.

Location: Panel A  
Seeding Date: 6/17/02  
Seeding Rate: Based on 10.67lbs PLS per acre



Site Preparation and Planting Method: The drilled plots were no-till seeded into prior years standing sudangrass stubble using a Truax notill grass drill. The broadcast plots were cultivated and packed to

provide a clean firm seedbed. The broadcast plots were hand seeded and lightly harrowed and packed using a Brillion packer after the seeding. The variety source mix was matched as close as possible to the local source mix regarding the species and their percentages of the mix (see Tables NS-1 and NS-2 for seed mix and rates). A seeding rate of 10.7 pounds of pure live seed per acre was used for each of the five plots.

Grass species	Variety	Percent of mix	PLS lbs/ac	Grams seeded in plot (.22 ac)
Big bluestem	Bison	84.9	9.1	909
Indiangrass	Tomahawk	5.6	0.6	60
Little bluestem	Badlands	0.5	0.05	5
Prairie cordgrass	Red River	0.9	0.1	10
Blue grama	Bad River	0.7	0.08	8
Switchgrass	Dacotah	0.5	0.05	5
Sideoats grama	Pierre	0.1	0.01	1
<b>Forb species</b>				
Stiff sunflower	Bismarck	2.1	0.22	22
Maximillian sunflower	Medicine Creek	0.7	0.08	8
Narrow-leaf purple coneflower	Bismarck	0.9	0.1	10
Purple prairieclover	Bismarck	0.6	0.06	6
White prairieclover	common	0.5	0.05	5
Big flowered penstemon	wildland collection	0.7	0.08	8
Leadplant	wildland collection	0.7	0.07	7
Canadian milkvetch	common	0.7	0.07	7
<b>TOTALS</b>		<b>100.1</b>	<b>10.72</b>	<b>1,071</b>

Grass species	Percent of mix	PLS lbs/ac	Grams seeded in plot (.22 ac)
Big bluestem	84.9	9.1	909
Indiangrass	6	0.64	64
Little bluestem	0.3	0.027	2.7
Prairie cordgrass	0.7	0.074	7.4
Switchgrass	0.1	0.016	1.6
Sideoats grama	0.04	0.004	0.4
Prairie dropseed	0.4	0.04	4
<b>Forb species</b>			
Northern bedstraw	2.2	0.24	24
Leadplant	0.7	0.08	8
Purple prairieclover	0.4	0.04	4
Apiaceae spp.	1.1	0.12	12
Anemone spp.	0.1	0.01	1
Meadow rue	0.2	0.02	2
Sunflower spp. (2)	0.4	0.04	4
Liatris spp.	0.1	0.01	1
Stiff goldenrod	0.2	0.02	2
Solidago spp.	1.8	0.19	19
<b>Totals</b>	<b>99.64</b>	<b>10.671</b>	<b>1066.1</b>

Planting Date: June 17, 2002

Fertilization: None used

Irrigation: the planting received 1 inch of irrigation water on June 27, 2002, to enhance germination.

Weed Control/Plot Management: Plateau herbicide at the rate of 4oz/acre was applied immediately following the seeding. The plots were rotary mowed to a height of 6-8 inches using a rotary mower for weed control on August 6, 2002.

Results and Discussion: Good soil moisture conditions existed in the no-till drilled plots. Soil moisture conditions were less in the broadcast site, due to soil disturbance during site preparation but were still adequate for germination.

2003: Data was collected on 6/18/2003 using a ½ meter square frame. Ten frames were collected in each plot. Data were recorded on the grass percent, forb percent and a weed rating was given on each frame. Overall stand rating and vigor rating were also recorded for each plot (see table 3 for 2003 recorded data). Initial observations showed the drilled method was quicker to germinate compared to the broadcast method, most likely due to better seed placement with the drill. The drilled variety plot had the highest percentage of grasses present at 65.5 percent compared to 15.2 for the local broadcast uncleaned seed plot. Native forb percentages were higher in the variety broadcast seeded plot (3.3) compared to less than 1 percent for each of the drilled plots. Overall a higher percentage of forbs were observed in all the broadcast seeded plots compared to the drilled plots. The variety drilled plot had the lowest weed rating of 3 compared to the local source drilled plot which was rated at 6. The variety drilled plot had the best overall stand rating. The variety drilled plot, local broadcast clean seed plot and the local broadcast uncleaned plot all had the highest seedling vigor rating of 3. Additional data will be collected in the following years to observe any differences as the stands become established.

2004: The plots were burned in May. The burn was spotty on the broadcast plots due to lower plant densities and increased bare ground compared to the drilled plots which both burned very well due to the higher stand densities. All plantings continue to establish and stand density is increasing. The variety drilled plot were rated as having the highest stand rating overall, followed by the local source drilled, broadcast variety clean seed, broadcast local source clean seed and the broadcast uncleaned local source seed plot. Native forbs showed higher occurrences in the broadcast treatments. Seedling vigor was very similar in all the plots. Weed contamination in the plots was noticeably less in the variety drilled plot compared to the other four plots.

2005: The variety drilled plot continues to be the overall best stand comparing stand rating, plant vigor and weed rating after 4 growing seasons. The broadcast methods favored forbs densities and establishment. Forb occurrence in the drilled plots was less most likely due to seeding depth and competition from higher densities of grass seedlings in the drill rows. The total occurrence of planted species is lower in the broadcast plots but after 3 years all the plots have respectable stands. The drilled plots provided a much quicker grass stand with less weeds compared to the broadcast method. Comparisons between the variety drilled and Local Source drilled plots were not dramatically different with a stand density of 91 percent recorded in the variety drilled plot compared to 81 percent in the local source plot after the 4<sup>th</sup> growing season. See Table NS-3 for data from 2003, 2004 and 2005.

2006: The planting was terminated in 2006 and no data was collected. Without replication of the plots statistic comparisons cannot be made. Basic observations and data from these plots do indicate and supports existing recommended seeding technology. The drilled stands provided a quicker more reliable chance at stand establishment. Broadcast seeding takes longer to establish the same densities as drilled seedings. The appearance of the drilled seeding is distinctive rows and lack of forbs compared to the broadcast seeding which was more natural looking with increased forb densities. Doubling the seeding rates of the broadcast methods, which is currently recommended would have most likely increased stand densities and may have provided similar densities as the drilled plots.

**Table NS-3. Native seed source demonstration evaluation data collected 6/18/2003, 10/25/2004, and 10/5/2005.**

<b>Evaluation</b>						<b>weed</b>	<b>stand</b>	<b>vigor</b>
<b>Date</b>	<b>Treatment</b>	<b>Frame</b>	<b>grass%</b>	<b>forb%</b>	<b>weed %</b>	<b>rating*</b>	<b>rating**</b>	<b>***rating</b>
6/18/2003	1	1	20	0		8		
6/18/2003	1	2	70	0		3		
6/18/2003	1	3	100	0		2		
6/18/2003	1	4	100	0		2		
6/18/2003	1	5	60	0		2		
6/18/2003	1	6	5	0		4		
6/18/2003	1	7	50	0		4		
6/18/2003	1	8	100	0		1		
6/18/2003	1	9	75	1		2		
6/18/2003	1	10	75	0		2		
6/18/2003	1					<b>3</b>	<b>3</b>	<b>3</b>
6/18/2003	2	1	10	1		5		
6/18/2003	2	2	5	0		4		
6/18/2003	2	3	25	0		5		
6/18/2003	2	4	0	1		8		
6/18/2003	2	5	10	0		8		
6/18/2003	2	6	5	0		7		
6/18/2003	2	7	25	0		5		
6/18/2003	2	8	50	0		7		
6/18/2003	2	9	50	2		8		
6/18/2003	2	10	40	0		4		
6/18/2003	2					<b>6</b>	<b>7</b>	<b>5</b>
6/18/2003	3	1	25	0		7		
6/18/2003	3	2	60	0		2		
6/18/2003	3	3	75	2		2		
6/18/2003	3	4	100	1		1		
6/18/2003	3	5	50	1		5		
6/18/2003	3	6	75	10		4		
6/18/2003	3	7	60	3		2		
6/18/2003	3	8	0	1		2		
6/18/2003	3	9	30	5		3		
6/18/2003	3	10	20	10		3		
6/18/2003	3					<b>3</b>	<b>4</b>	<b>4</b>
6/18/2003	4	1	30	0		4		
6/18/2003	4	2	10	1		3		
6/18/2003	4	3	15	5		6		
6/18/2003	4	4	15	1		7		
6/18/2003	4	5	20	0		6		
6/18/2003	4	6	15	1		2		
6/18/2003	4	7	15	0		4		
6/18/2003	4	8	20	10		5		
6/18/2003	4	9	10	5		8		
6/18/2003	4	10	10	0		4		
6/18/2003	4					<b>5</b>	<b>5</b>	<b>3</b>
6/18/2003	5	1	15	5		6		
6/18/2003	5	2	1	0		8		



**Table NS-3. Native seed source demonstration evaluation data collected 6/18/2003, 10/25/2004, and 10/5/2005 (continued).**

<b>Evaluation</b>						<b>weed</b>	<b>stand</b>	<b>vigor</b>
<b>Date</b>	<b>Treatment</b>	<b>Frame</b>	<b>grass%</b>	<b>forb%</b>	<b>weed %</b>	<b>rating*</b>	<b>rating**</b>	<b>***rating</b>
6/18/2003	5	3	20	0		2		
6/18/2003	5	4	35	1		5		
6/18/2003	5	5	0	0		5		
6/18/2003	5	6	1	0		9		
6/18/2003	5	7	30	1		3		
6/18/2003	5	8	15	5		5		
6/18/2003	5	9	20	0		6		
6/18/2003	5	10	15	5		3		
6/18/2003	5					<b>5</b>	<b>6</b>	<b>3</b>
10/25/2004	1	1	100	0	0			
10/25/2004	1	2	100	0	0			
10/25/2004	1	3	70	0	2			
10/25/2004	1	4	25	0	70			
10/25/2004	1	5	60	0	10			
10/25/2004	1	6	80	0	0			
10/25/2004	1	7	70	0	2			
10/25/2004	1	8	100	0	0			
10/25/2004	1	9	40	0	2			
10/25/2004	1	10	100	0	0			
10/25/2004	1					<b>2</b>	<b>2</b>	<b>2</b>
10/25/2004	2	1	60	0	2			
10/25/2004	2	2	70	2	20			
10/25/2004	2	3	10	0	70			
10/25/2004	2	4	70	0	20			
10/25/2004	2	5	70	10	2			
10/25/2004	2	6	20	0	20			
10/25/2004	2	7	30	0	5			
10/25/2004	2	8	25	2	10			
10/25/2004	2	9	10	2	80			
10/25/2004	2	10	30	0	20			
10/25/2004	2					<b>6</b>	<b>4</b>	<b>3</b>
10/25/2004	3	1	70	10	2			
10/25/2004	3	2	70	10	0			
10/25/2004	3	3	10	0	70			
10/25/2004	3	4	70	5	0			
10/25/2004	3	5	60	5	2			
10/25/2004	3	6	80	5	0			
10/25/2004	3	7	70	2	10			
10/25/2004	3	8	60	5	10			
10/25/2004	3	9	80	2	2			
10/25/2004	3	10	60	5	2			
10/25/2004						<b>5</b>	<b>4</b>	<b>3</b>
10/25/2004	4	1	50	2	10			
10/25/2004	4	2	15	0	60			
10/25/2004	4	3	10	0	70			
10/25/2004	4	4	10	0	50			

**Table NS-3. Native seed source demonstration evaluation data collected 6/18/2003, 10/25/2004, and 10/5/2005 (continued).**

<b>Evaluation</b>						<b>weed</b>	<b>stand</b>	<b>vigor</b>
<b>Date</b>	<b>Treatment</b>	<b>Frame</b>	<b>grass%</b>	<b>forb%</b>	<b>weed %</b>	<b>rating*</b>	<b>rating**</b>	<b>***rating</b>
10/25/2004	4	5	20	20	20			
10/25/2004	4	6	10	10	60			
10/25/2004	4	7	50	0	20			
10/25/2004	4	8	40	2	30			
10/25/2004	4	9	60	10	5			
10/25/2004	4	10	60	10	20			
10/25/2004	4					<b>5</b>	<b>5</b>	<b>3</b>
10/25/2004	5	1	30	5	10			
10/25/2004	5	2	40	0	5			
10/25/2004	5	3	50	5	10			
10/25/2004	5	4	60	0	5			
10/25/2004	5	5	80	0	0			
10/25/2004	5	6	20	0	2			
10/25/2004	5	7	5	0	60			
10/25/2004	5	8	70	0	10			
10/25/2004	5	9	70	5	20			
10/25/2004	5	10	30	10	40			
10/25/2004	5					<b>6</b>	<b>5</b>	<b>3</b>
10/5/2005	1	1	90	2	0			
10/5/2005	1	2	100	0	0			
10/5/2005	1	3	80	2	5			
10/5/2005	1	4	70	10	10			
10/5/2005	1	5	80	5	0			
10/5/2005	1	6	100	0	0			
10/5/2005	1	7	100	0	0			
10/5/2005	1	8	90	5	10			
10/5/2005	1	9	100	0	0			
10/5/2005	1	10	100	0	0			
10/5/2005	1					<b>2</b>	<b>2</b>	<b>2</b>
10/5/2005	2	1	80	0	10			
10/5/2005	2	2	70	2	20			
10/5/2005	2	3	70	5	10			
10/5/2005	2	4	100	0	0			
10/5/2005	2	5	60	5	5			
10/5/2005	2	6	50	0	10			
10/5/2005	2	7	100	0	0			
10/5/2005	2	8	90	2	0			
10/5/2005	2	9	90	2	5			
10/5/2005	2	10	100	0	0			
10/5/2005	2					<b>3</b>	<b>2</b>	<b>2</b>
10/5/2005	3	1	60	10	5			
10/5/2005	3	2	60	10	0			
10/5/2005	3	3	50	0	0			
10/5/2005	3	4	80	5	5			
10/5/2005	3	5	50	5	5			
10/5/2005	3	6	60	10	0			

**Table NS-3. Native seed source demonstration evaluation data collected 6/18/2003, 10/25/2004, and 10/5/2005 (continued).**

<b>Evaluation</b>						<b>weed</b>	<b>stand</b>	<b>vigor</b>
<b>Date</b>	<b>Treatment</b>	<b>Frame</b>	<b>grass%</b>	<b>forb%</b>	<b>weed %</b>	<b>rating*</b>	<b>rating**</b>	<b>***rating</b>
10/5/2005	3	7	100	0	0			
10/5/2005	3	8	100	0	0			
10/5/2005	3	9	50	10	5			
10/5/2005	3	10	60	5	5			
10/5/2005	3					<b>3</b>	<b>4</b>	<b>2</b>
10/5/2005	4	1	60	0	20			
10/5/2005	4	2	30	0	30			
10/5/2005	4	3	50	5	20			
10/5/2005	4	4	40	10	5			
10/5/2005	4	5	10	5	50			
10/5/2005	4	6	90	0	0			
10/5/2005	4	7	60	0	10			
10/5/2005	4	8	40	20	20			
10/5/2005	4	9	50	5	10			
10/5/2005	4	10	80	10	0			
10/5/2005	4					<b>6</b>	<b>4</b>	<b>3</b>
10/5/2005	5	1	80	5	10			
10/5/2005	5	2	60	0	30			
10/5/2005	5	3	30	0	30			
10/5/2005	5	4	50	10	10			
10/5/2005	5	5	40	10	20			
10/5/2005	5	6	70	0	10			
10/5/2005	5	7	60	0	20			
10/5/2005	5	8	60	10	20			
10/5/2005	5	9	40	10	30			
10/5/2005	5	10	50	5	20			
10/5/2005	5					<b>6</b>	<b>5</b>	<b>3</b>

Note: Treatment 1=Variety, Drilled, Clean seed  
 Treatment 2=Local, Drilled, Clean seed  
 Treatment 3=Variety, Broadcast, Clean seed  
 Treatment 4=Local, Broadcast, Clean seed  
 Treatment 5=Local, Broadcast, Unclean seed

\* weed rating 1=no weeds 9=solid weed stand  
 \*\*stand rating 1=excellent 9=poor or no stand  
 \*\*\*vigor rating 1=very vigorous 9=very poor vigor

Red frames – size 2.4 ft<sup>2</sup> were used for data collection  
 % grass and forbs was based on fill of 2 rows in the drilled treatments and on entire frame for broadcast

## **CONSERVATION FIELD TRIALS**

## CONSERVATION FIELD TRIALS: TECHNICAL REPORT 2004-2006

Number and Title: MNPMS-F-0101-CR Lake Region Recreational Center, Perham, Minnesota

Objective: lakeshore stabilization

Date Established: May 8, 2001

Cooperators: WesMin RC&D, East Otter Tail SWCD, Lake Regional Recreational Center, Perham Field Office

Location: south end of Otter Tail Lake, southwest of Perham, Minnesota

Methods and Materials: The purpose of the project was to evaluate various mulch treatments and native plant species for effectiveness in controlling shoreline bank erosion. The 12-foot high cut bank was shaped and the shoreline was treated with various bioengineering techniques. The back slope was primarily sand with a small amount of black dirt spread by hand. The area was seeded to a native grass mix donated by Kaste Seed, Inc. Various types of mulch were used to cover most of the back slope. Native plant materials provided by the Bismarck Plant Materials Center consisted of eleven shrubs, two vines, seven grasses, and two forbs. The shrubs and vines were bareroot seedlings of buckbrush, silver buffaloberry, false indigo, dogwood, chokecherry, sand cherry, juneberry, woods rose, silverberry, smooth sumac, sandbar willow, riverbank grape, and woodbine. The grasses and forbs were grown from seed at the Bismarck PMC and consisted of western wheatgrass, Canada wildrye, sand bluestem, big bluestem, prairie sandreed, beardless wildrye, little bluestem and switchgrass. The plants were established in rows into the mulch up and down the slope.

Results and Discussion: Although conditions were dry during planting, summer rainfall amounts were good. Overall establishment was rated as good to excellent for most entries. Data recorded on September 12, 2001, indicated that essentially all the grasses and forbs were off to a good start, and the highest rated woody species were juneberry, false indigo, sand cherry, woods rose, smooth sumac, and woodbine. The mulch treatments were comparable.

The plots were evaluated on August 5, 2002, and September 9, 2003. The weed cover was fairly heavy in 2002, but declined significantly in 2003. The main weed species were kochia, lambsquarters, and plumeless thistle. The seeded and plug planted grass and forb species continued to do well. The most impressive species were sideoats grama, little bluestem, western wheatgrass and Maximilian sunflower. The native shrub species also did well overall. Upslope or downslope did not seem to matter on survival. Plants in the downslope position tended to be taller and more vigorous. The following are average survival percentage and height (feet) in 2002: snowberry (95% - 2); silver buffaloberry (50% - 2); false indigo (80% - 4.3); sand cherry (95% - 2.3); chokecherry (70% - 4.2); dogwood (70% - 2.2); juneberry (80% - 1.5); woods rose (75% - 1.8); silverberry (75% - 2.3); smooth sumac (95% - 2.2); sandbar willow (40% - 3); riverbank grape (70% - 1.5); and woodbine (95% - 3.7). The shrub species with the best survival and vigor included snowberry, false indigo, sand cherry, and smooth sumac. Smooth sumac was also on the site naturally and was spreading. The sandbar willow performed better downslope closer to the shoreline, and was suckering. Woodbine was high in survival and growing vigorously.

The coconut fiber mulch provided the best weed control and also had the highest grass cover. The wood fiber was rated second, and the straw mulch last. There was no significant difference, and all three proved beneficial to vegetation establishment.

2004 – 2006: The plots were monitored on an annual basis, but no information was collected. The grasses continued to increase in density and excellent stabilization was provided. Wormwood sage and

plumeless thistle were the main weed problems. Observations noted on July 19, 2006 included the following:

- The grass species which appeared to be most dominant and in good vigor included sideoats grama, little bluestem, big bluestem, and western wheatgrass. There was very little seed production because of the dry conditions.
- Maximilian and stiff sunflower continued to perform well and were increasing by vegetative spread.
- The shrub species which appeared to have the best survival and vigor included false indigo, silverberry, sandcherry, Juneberry, snowberry, and smooth sumac. Natural occurring populations of smooth sumac were spreading into the plot area. Most of the shrub species had some tip die-back and wilted leaves because of the extremely dry conditions. There was no fruit or seed production noted.
- Both the woodbine and riverbank grape were present, and the plants were in fair vigor.
- The three mulch comparisons continued to be very similar.

The plumeless thistle was cut down and removed by the Perham field office staff in August, 2006. A tour of the site was held in conjunction with the PMC/State Conservationists' Advisory Committee on August 30, 2006.

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Number and Title: NDPMS-F-0104-UR Prairie Restoration Demonstration

Objective: demonstration/reduced water use

Date Established: May 29, 2001

Cooperators: Lake Agassiz RC&D, Cass Co. SCD, Fargo FO, and Fargo Forestry

Location: Xeriscape Gardens, Water Treatment Plant, Fargo, North Dakota

Methods and Materials: The purpose of the planting is to establish a diverse tall grass prairie for public viewing and education as part of the Xeriscape Gardens. The site was fallowed for two years, deep ripped, topdressed with organic compost, and deep rototilled. The planting site was lightly rototilled prior to seeding. The area was seeded and raked by hand. A garden tractor was used to firm the seedbed after raking. A diverse mixture was seeded including 10 native grass species, and 21 native forbs and legumes. The size of the planting is approximately ¼ acre.

Results and Discussion: The planting established fairly well, but the stand was spotty and weeds were a major problem. Mowing and hand pulling were the primary control measures.

The site was a total carpet of annual weeds in the spring of 2002. PMC staff hand sprayed the entire planting with glyphosate. It was anticipated that some loss would occur on the cool-season grasses and early forbs and legumes. The chemical treatment was a success and the stand was looking very good in early summer. The planting continued to develop in total stand density and individual plant communities in 2002 and 2003. Weeds became less of a problem, although summer crews still did some hand pulling and spot spraying. The grass species were well mixed and predominantly warm-season. Canada wildrye was the most common cool-season species. Maximilian sunflower, Lewis flax, blanket flower, and purple prairieclover were the most frequent forbs and legumes. Volunteer tree seedlings, primarily elm and ash, are becoming a problem. Plans are to burn the site next spring. The prairie restoration demonstration was toured by many groups and individuals.

2004-2006: The plots were monitored on an annual basis. Prairie Restorations, Inc. conducted a burn on April 22, 2004. The primary purpose of the burn was to kill volunteer tree seedlings, slow down perennial weed species, and remove litter and canopy cover to improve herbicide effectiveness. The burn was a success and all of the objectives were accomplished. The native plant communities continue to develop. The stand is excellent. Spot spraying was done annually, mainly for Canada thistle and invading tree seedlings. Maximilian sunflower was the most frequent forb species. The site continues to draw many groups and individuals for viewing. In 2006, perennial weed problems are increasing and volunteer trees and Canada thistle are becoming a major concern.

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Number and Title: NDPMS-F-0105-UR Fargo Forestry (Turf Trial)

Objective: reduced maintenance/water conservation

Date Established: May 8, 2001

Cooperators: Lake Agassiz RC&D, Cass Co. SCD, Fargo FO, and Fargo Forestry

Location: Xeriscape Gardens, Water Treatment Plant, Fargo, ND

Methods and Materials: The purpose of the planting is for public viewing and education regarding alternative lawns for reduced energy input and water use. Landscaping blocks were used to create 7 individual plots with separate watering zones. The grasses planted included (east to west) Bad River blue grama; Tatanka buffalograss; 50/50 mix of blue grama/buffalograss; Kentucky bluegrass/perennial ryegrass; perennial ryegrass (three variety mixture); rural mixture (crested wheatgrass, perennial ryegrass, and Kentucky bluegrass); and Triathalawn tall fescue. The plots were seeded by hand into a prepared seedbed, raked, and packed.

Results and Discussion: The warm-season species established readily, but the cool-season species were spotty. The cool-season grasses were overseeded about a month later and the stand evened out. Irrigation water was used for establishment purposes. An irrigation schedule will be prepared next year for each entry separately.

The plots were well established in 2002. The plots were half-mowed for demonstration purposes. A small amount of hand weeding was done, and some spot spraying with glyphosate early in the spring to remove the cool-season from the warm-season. The plots looked very good in 2003 and were toured by many groups and individuals.

2004-2006: The plots were monitored on an annual basis. Stands continue to look good for all entries. Cool-season species are constantly invading the warm-season. Spot spraying and hand digging are done on a regular basis. The buffalograss and blue grama plots continue to perform well, and look especially good in mid-summer when the cool-season species shown signs of dormancy during dry conditions.

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Number and Title: NDPMC-F-0309-OT (Grass/Legume Demonstration)

Objective: species and mixture compatibility demonstration

Date Established: May 28, 2003

Cooperators: Eddy County SCD, Northern Plains RC&D, NDSU Eddy County Extension

Location: Approximately 22 miles southeast of New Rockford, North Dakota

Methods and Materials: The purpose of the planting is for public viewing and education. Fifty-two entries of various grasses, legumes, forbs, and mixtures of each were seeded with a 6-foot plot drill. Plot size is 6' by 35'. There are 8 rows per plot. The border was seeded to a mixture of Bad River blue grama and Hycrest crested wheatgrass. The site was previously in hayland. It was disked several times in the fall of 2002 and spring of 2003.

Results and Discussion: The plots were off to a good start after seeding. Emergence data was collected on June 4, 2003 (Table GL-1). As would be expected, the cool-season species had mostly emerged and the warm-season were just getting started. Weed species were mainly annuals which were clipped in late June. Remnant plants of alfalfa, Kentucky bluegrass, and quackgrass were starting to invade the plots, most noticeably on the east end.

High quality signs identifying individual plots were installed in 2004. The cooperators and landowner have done an excellent job maintaining the site. The demonstration site was toured by many groups and individuals. Kentucky bluegrass and quackgrass were invading the site and have spread into the plots on the east end. Alfalfa, black-eyed susan, Canada thistle, aster and numerous other perennial forbs were



also becoming a problem. Herbicides were applied at recommended rates on May 19, 2005. A backpack sprayer was used to spot treat the various weeds. All non-legume/forb plots were sprayed with 2,4-D Amine 400. Roundup Ultra was sprayed on all pure warm-season plots to control quackgrass and various green broad-leaf species, except on the blue grama and little bluestem plots which were beginning to green-up. Poast® was applied to all the straight legume plots.

The 2,4-D application worked well and killed many of the broad-leaf weeds. The Roundup Ultra also worked extremely well, and released the warm-season species from the high cool-season competition. The annual forage production clipped from the sprayed warm-season plots was generally very good (Table GL-4). The Poast® was marginally effective, but did set back the quackgrass enough to improve the stand ratings in the plots.

Cool-season production appeared to peak in 2004, and was substantially reduced the year of clipping, 2005 (Tables GL-2 and GL-3). Selected plots were hand clipped on August 31, 2005 with assistance from several field offices. Twenty-seven plots were clipped and the forage samples were oven-dried and calculated in pounds per acre. The top five forage producers in decreasing order included tall wheatgrass (5,561 lb/ac), cicer milkvetch (5,355 lb/ac), little bluestem (4,915 lb/ac), switchgrass (4,723 lb/ac), and big bluestem (4,583 lb/ac). The lowest five forage producers in increasing order were smooth bromegrass (588 lb/ac), western wheatgrass (810 lb/ac), needle-and-thread (820 lb/ac), blue grama (909 lb/ac), and creeping foxtail (989 lb/ac).

No information was collected in 2006.

**Table GL-1.** Plant performance at the Kent Otto Demonstration Site.

Common name/variety (VNS=variety not stated )	% Emergence 6/4/03	Common name/variety (VNS=variety not stated )	% Emergence 6/4/03
hard fescue/Durar	60	reed canarygrass/VNS	50
crested wheatgrass/Hycrest	100	blue grama/Bad River	20
quackgrass hybrid/NewHy	50	little bluestem/Itasca	0
redtop/VNS	30	sand dropseed/VNS	20
timothy/Climax	50	sideoats grama/Pierre	0
creeping foxtail/Garrison	50	big bluestem/Bison	0
orchardgrass/Latar	50	sand bluestem/Garden	0
Russian wildrye/Mankota	80	Indiangrass/Tomahawk	0
altai wildrye/VNS	30	prairie sandreed/ND-95	0
dahurian wildrye/VNS	80	strawberry clover/Palestine	0
perennial ryegrass/Linn	100	ladino clover/VNS	0
smooth bromegrass/Manchar	100	red clover/Kenland	25
meadow bromegrass/Fleet	100	alsike clover/VNS	50
intermediate wheatgrass/Reliant	60	birdsfoot trefoil/Dawn	50
pubescent wheatgrass/Manska	80	cicer milkvetch/Lutana	50
tall wheatgrass/Alkar	70	Canada milkvetch/9069117	50
nuttall alkaligrass/VNS	20	sainfoin/Eski	0
prairie junegrass/VNS	50	purple prairieclover/Bismarck	0
slender wheatgrass/Revenue	100	hairy vetch/VNS	30
western wheatgrass/Rodan	50	switchgrass/Dacotah	0
awned wheatgrass/Pintail	80	switchgrass/alfalfa	no data
Canada wildrye/Mandan	5	switchgrass/intermediate wheatgrass	no data
beardless wildrye/Shoshone	0	meadow brome/cicer milkvetch	no data
green needlegrass/Lodorm	50	purple pc/porcupine grass/max sunflower/big blue	no data
porcupine grass/VNS	20	max sunflower/purple pc/Canada milkvetch/blue flax	no data
needle-and-thread/VNS	20	Russian wildrye/intermediate/crested/blue grama	no data

**Table GL-2. Plant Performance at the Kent Otto Demonstration Site - September 24, 2004.**

Common Name/Variety	Weeds(1)	Stand(2)	Vigor(2)	Seed(2)	Height(3)
hard fescue/Durar	7	4	5	9	10
crested wheatgrass/Hycrest	8	7	5	9	14
quackgrass hybrid/NewHy	3	2	5	6	14
redtop/VNS	2	1	2	3	30
timothy/Climax	4	4	5	6	30
creeping foxtail/Garrison	2	1	3	7	16
orchardgrass/Latar	2	1	3	8	15
Russian wildrye/Mankota	6	3	5	9	13
altai wildrye/VNS	6	5	5	8	25
dahurian wildrye/VNS	2	1	2	2	50
perennial ryegrass/Linn	2	1	4	7	21
smooth bromegrass/Manchar	2	1	3	5	32
meadow bromegrass/Fleet	2	1	3	7	38
intermediate wheatgrass/Reliant	2	1	3	5	45
pubescent wheatgrass/Manska	2	1	3	6	45
tall wheatgrass/Alkar	2	1	1	2	50
nuttall alkaligrass/VNS	9	8	na	na	na
prairie junegrass/VNS	5	3	4	9	8 (l)
slender wheatgrass/Revenue	2	1	1	1	38
western wheatgrass/Rodan	2	1	3	7	25 (l)
awned wheatgrass/Pintail	2	1	1	2	38
Canada wildrye/Mandan	2	1	1	1	42
beardless wildrye/Shoshone	8	8	7	9	13 (l)
green needlegrass/Lodorm	3	1	3	6	20 (l)
porcupine grass/VNS	4	4	3	8	25 (l)
needle-and-thread/VNS	4	4	4	7	34
reed canarygrass/VNS	2	1	3	8	27
blue grama/Bad River	6	2	4	7	10 (l)
little bluestem/Itasca	5	2	3	4	30
sand dropseed/VNS	8	8	na	na	na
sideoats grama/Pierre	5	3	3	4	25
big bluestem/Bison	4	2	6	6	36
sand bluestem/Garden	5	2	6	7	31
Indiangrass/Tomahawk	3	2	3	4	46
prairie sandreed/ND-95	8	8	na	na	na
strawberry clover/Palestine	8	8	na	na	na
ladino clover/VNS	6	4	4	9	10
red clover/Kenland	3	1	1	1	29
alsike clover/VNS	8	5	8	9	4
birdsfoot trefoil/Dawn	6	4	4	4	23
cicer milkvetch/Lutana	4	2	3	8	25
Canada milkvetch/9069117	quackgrass				
sainfoin/Eski	quackgrass				
purple prairieclover/Bismarck	quackgrass				
hairy vetch/VNS	quackgrass				
switchgrass/Dacotah	quackgrass				
switchgrass/alfalfa	quackgrass				
switchgrass/intermediate wheatgrass	quackgrass				
meadow brome/cicer milkvetch	quackgrass				
purple pc/porcupine grass/max sunflower/big blue	quackgrass				
max sunflower/purple pc/Canada milkvetch/blue flax	quackgrass				
Russian wildrye/intermediate/crested/blue grama	quackgrass				

(1) 1 = no weeds, 9 = all weeds; (2) 1 = highest, 9 = lowest; (3) height in inches to top of seed head, unless noted as leaf (l).

**Table GL-3. Plant Performance at the Kent Otto Demonstration Site - August 31, 2005.**

Common Name/Variety	Weeds(1)	Stand(2)	Vigor(2)	Seed(2)	Height(3)
hard fescue/Durar	7	4	5	9	7 (l)
crested wheatgrass/Hycrest	8	7	5	9	11 (l)
quackgrass hybrid/NewHy	5	3	3	8	16 (l)
redtop/VNS	8	1	1	2	23
timothy/Climax	5	3	3	5	23
creeping foxtail/Garrison	5	5	4	7	33
orchardgrass/Latar	8	1	2	7	25
Russian wildrye/Mankota	7	7	7	9	11 (l)
altai wildrye/VNS	7	7	7	9	13 (l)
dahurian wildrye/VNS	5	5	5	5	34
perennial ryegrass/Linn	5	5	5	9	9 (l)
smooth brome/Manchar	4	4	6	5	26
meadow brome/Fleet	2	2	4	8	25
intermediate wheatgrass/Reliant	4	4	5	7	23
pubescent wheatgrass/Manska	4	4	4	7	25
tall wheatgrass/Alkar	4	3	3	4	36
nuttall alkaligrass/VNS	na	9	na	na	na
prairie junegrass/VNS	3	2	2	2	21
slender wheatgrass/Revenue	4	3	4	2	22
western wheatgrass/Rodan	5	4	5	8	20
awned wheatgrass/Pintail	3	1	2	1	29
Canada wildrye/Mandan	4	3	3	2	28
beardless wildrye/Shoshone	6	6	6	9	28 (l)
green needlegrass/Lodorm	4	2	2	4	34
porcupine grass/VNS	3	2	1	9	23
needle-and-thread/VNS	5	4	3	4	32
reed canarygrass/VNS	8	1	3	7	34
blue grama/Bad River	3	1	3	6	15
little bluestem/Itasca	9	1	1	1	32
sand dropseed/VNS	na	9	na	na	na
sideoats grama/Pierre	7	3	6	7	22
big bluestem/Bison	9	1	1	2	38
sand bluestem/Garden	7	3	2	3	42
Indiangrass/Tomahawk	3	2	1	1	38
prairie sandreed/ND-95	8	8	na	na	na
strawberry clover/Palestine	na	8	na	na	na
ladino clover/VNS	6	6	6	6	15
red clover/Kenland	4	3	3	3	23
alsike clover/VNS	na	8	na	na	na
birdsfoot trefoil/Dawn	5	4	3	3	21
cicer milkvetch/Lutana	2	2	1	3	22
Canada milkvetch/9069117	5	4	3	3	27
sainfoin/Eski	8	7	7	9	20 (l)
purple prairieclover/Bismarck	7	6	7	9	12 (l)
hairy vetch/VNS	na	8	na	na	na
switchgrass/Dacotah	9	1	1	1	34
switchgrass/alfalfa	na	8	na	na	na
switchgrass/intermediate wheatgrass	na	8	na	na	na
meadow brome/cicer milkvetch	3	3	2	5	32
purple pc/porcupine grass/max sunflower/big blue	na	8	na	na	na
max sunflower/purple pc/Canada milkvetch/blue flax	na	8	na	na	na
Russian wildrye/intermediate/crested/blue grama	na	8	na	na	na

(1) 1 = no weeds, 9 = all weeds; (2) 1 = highest, 9 = lowest; (3) height in inches to top of seed head, unless noted as leaf (l).

**Table GL-4. Annual Forage Production at the Kent Otto Demonstration Site - 2005\***

Common Name/Variety	Pounds Per Acre
quackgrass hybrid/NewHy	1863
redtop/VNS	4422
timothy/Climax	2259
creeping foxtail/Garrison	989
orchardgrass/Latar	2529
smooth bromegrass/Manchar	588
meadow bromegrass/Fleet	1371
intermediate wheatgrass/Reliant	1723
pubescent wheatgrass/Manska	1305
tall wheatgrass/Alkar	5561
prairie junegrass/VNS	1295
western wheatgrass/Rodan	810
awned wheatgrass/Pintail	1353
green needlegrass/Lodorm	3430
porcupine grass/VNS	3342
needle-and-thread/VNS	820
reed canarygrass/VNS	4386
blue grama/Bad River	909
little bluestem/Itasca	4915
sideoats grama/Pierre	1229
big bluestem/Bison	4583
sand bluestem/Garden	4577
Indiangrass/Tomahawk	3516
red clover/Kenland	3876
birdsfoot trefoil/Dawn	3624
cicer milkvetch/Lutana	5355
switchgrass/Dacotah	4723

\*August 31, 2005. Two 2.4-sq. ft. frames per plot were selectively hand clipped to an average 1-inch stubble height. Selected entries were harvested and samples were oven-dried to calculate annual production in pounds per acre.

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Number and Title: MNPMS-F-0217-CR

Objective: streambank stabilization

Date Established: May 15, 2002

Cooperators: West Min RC&D and Douglas County Parks

Location: Spruce Hill County Park

Methods and Materials: The purpose of the planting was to stabilize a streambank slope adjacent to a high use picnic shelter and recreation area. Bareroot rhizomes, 100 each, of Red River prairie cordgrass and 9082708 slough sedge were planted through a netted fiber mulch after some shaping. The slough sedge was planted in two rows near the edge of the streambank, and the prairie cordgrass was scattered further up the slope. Establishment was good the first year. Second year observations noted some settling to have occurred near mid-slope, but most of the cordgrass had survived. There was some rhizome spread. Local cool-season grasses, such as Kentucky bluegrass, were also moving into the site. The shoreline had eroded and most of the slough sedge was not visible at the time of inspection. There were a few scattered plants of the slough sedge that had survived and were spreading by rhizomes.

2004-2006: No information was collected but the site was monitored in 2004 and 2005. The toe of the streambank continued to undercut and some sloughing had occurred. However, the Red River prairie cordgrass has done a good job of providing some stabilization on most of the side slope. Natural occurring bluegrasses have also provided some resistance. The slough sedge is infrequently present in scattered areas. Most of the mulch material is no longer visible.

No information was collected in 2006.

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Number and Title: NDPMS-F-0406RI Morgan WMA

Objective: native prairie restoration containing a minimum of 50% forbs and legumes

Date Established: 2004

Cooperators: ND Natural Resources Trust and the ND Game & Fish Department

Location: Approximately 7 miles northwest of Sykeston, North Dakota on the Robert L. Morgan Wildlife Management Area.

Methods and Materials: Many wildlife species prefer moderately open grasslands with a diversity of forbs, legumes, and shrubs for nesting, feeding, and brood-rearing, while the more dense, higher canopy grass stands are preferred for escape and winter cover. Grasslands that are 50% or more non-grass species are preferred nesting sites because they host high quantities of insects and protein rich plants that are used by young wildlife species, including upland game birds.

The North Dakota Natural Resources Trust cooperatively with the USDA NRCS is utilizing the Wetland Reserve Program to develop the 1,400 acre Robert L. Morgan Wildlife Management Area in east central North Dakota. The Bismarck PMC will be assisting in the restoration process with a goal of seeding at least 50% native forbs, legumes, and shrubs. Approximately forty-five plant species were seeded including 50% non-grass species as calculated by seeds per square foot based on a percentage of the full-seeding rate. Seed costs averaged \$88 per acre for seeding 815 acres in 2004 and 2005. The remaining 226 acres were seed in 2006 with an average seed cost of approximately \$80 per acre.

Perennial weed problems that required special attention included smooth brome grass, leafy spurge, and Canada thistle. Many of the leafy spurge and Canada thistle patches were documented using GPS, and have been spot treated annually. Native grass drills, using all three seed boxes, were used to seed the diverse mixture in May. Acreages planted in 2004 and 2005 were all seeded using no tillage, The seeding in 2006 was disked several times to open up the dense CRP sod that had formed over the years. All areas seed were roller packed using a heavy duty commercial machine. This operation both firmed the seedbed prior to planting, and pushed numerous rocks into the ground and out of the way of equipment. Excellent stands were established in 2004 and 2005. Good moisture conditions were present both years. Stand establishment in 2006 was poor to fair, at least partially due to still soddy seedbed conditions, and an extremely dry spring. Specific site conditions within the large acreages varied considerably each year, and contributed to the differences in stand establishment across the more than 1,000 acres which was seeded.

Generally, all of the 12 seeded grass species did well overall. The forb and legume species had more variation in establishment success. The non-grass species that established the most readily on a consistent basis included: black-eyed susan, blanket flower, purple and white prairieclover, coreopsis, Maximilian sunflower, stiff sunflower, Lewis flax, yellow coneflower, and Canada milkvetch. Most of these species were each seeded in the 3%-5% range. A diverse mixture of additional forb/legume

species was added to the mixture at a much lower rate, but contributed substantially to the overall species richness of the planting. Seasonal displays of color from the forb and legume species were attractive to the general public as well as wildlife. Deer and pheasant populations were observed to be especially abundant in the area.

A Rhizome Field Day was conducted on June 7, 2004. Approximately 34 individuals planted rhizomes of Red River prairie cordgrass and slough sedge around the edge of more than 50 restored wetlands in less than 3 hours. Staff from the Bismarck PMC provided training to the group on proper planting procedures. Rhizomes are easy to plant and a minimum number are needed to get wetland plant communities established quickly.

## **SEED PRODUCTION**

**Accession:** 'Nordan'

**Name/Species:** Crested wheatgrass, *Agropyron desertorum*

**Location:** Minot Experiment Station

**Year of Establishment:** 1999

**Origin/Source:** Selected at USDA, ARS, Mandan, ND

<u>Prod.</u>		<u>App./Cert.</u>	<u>Seed</u>		<u>Bulk (lbs)</u>						<u>Other</u>	
<u>Year</u>	<u>Seed Class</u>	<u>No.</u>	<u>Lab No.</u>	<u>Acres</u>	<u>Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Crop</u>	<u>Test Date</u>
2000	Common	*	2004975	3	1225	87.25	94	0	12.63	0.04	0.08	1/22/2001
2001	Foundation	S0113586	2112669	3	523	96.3	91	0	3.66	0.02	0.02	4/29/2002
2002	Foundation	S0210283	L2204714	3	541	94.05	89	0	5.93	0.02	0	1/6/2003
2003	Foundation	C54968	L2305433	3	200	91.39	88	0	8.57	0	0.04	1/28/2004
2004		S0412380	L2409683	3	134	91.42	89	0	8.06	0.44	0.08	3/23/2005
2005	No harvest											
2006	No harvest											

\*Seedlot contained quackgrass, failed certification

**Accession:** 9076705

**Name/Species:** leadplant, *Amorpha canescens*

**Location:** Field D-11

**Year of Establishment:**

**Origin/Source:** North Dakota (Sioux County, Burleigh County)

<u>Prod.</u>		<u>App./Cert.</u>	<u>Seed</u>		<u>Bulk (lbs)</u>						<u>Other</u>	
<u>Year</u>	<u>Seed Class</u>	<u>No.</u>	<u>Lab No.</u>	<u>Acres</u>	<u>Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Crop</u>	<u>Test Date</u>
2003	breeder		no test	0.05	6.0							
2004	breeder		no test	0.05	9.0							
2005	breeder		no test	0.05	7.5							
2006	breeder		no test	0.05	6.0							



**Accession:** 'Bison' (NDG-4, 9005667, PI-477994)

**Name/Species:** big bluestem, *Andropogon gerardii*

**Location:** Field E-8

**Year of Establishment:** 1997

**Origin/Source:** Oliver County, North Dakota; USDA, ARS, Mandan, North Dakota

<u>Prod.</u>		<u>App./Cert.</u>	<u>Seed</u>		<u>Bulk</u>						<u>Other</u>		
<u>Year</u>	<u>Seed Class</u>	<u>No.</u>	<u>Lab No.</u>	<u>Acres</u>	<u>Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Crop</u>	<u>Test Date</u>	<u>Notes</u>
1998	Foundation	980067-1	9808345	3.04	248.0	95.60	87	0	4.26	0.14	0	3/24/1999	
1999	Foundation	990863-1	9904487	1.76	279.5	90.13	90	0	9.86	0.01	0	1/26/2000	
1999	Foundation	990863-1	9903569	1.28	165.0	93.62	88	0	6.35	0.03	0	1/12/2000	Plateau
2000	Foundation	201150-1	2007607	3.04	294.0	95.89	90	1	3.95	0.16	0	3/13/2001	
2001	Foundation	S0113839	2107325	3.04	419.0	96.95	86	0	2.98	0.07	0	3/27/2002	
2002	Foundation	S0210299	L2210878	3.04	115.0	88.48	30	49	11.51	0.01	0	4/10/2003	
2003	Foundation	C54832	L2304932	3.04	328.0	93.90	28	57	6.1	0	0	2/3/2004	
2004	Foundation	S0412038	L2411492	3.00	446.0	96.61	55	37	3.38	0.01	0	4/15/2005	
2005	Foundation	S0513080	L2509594	3.00	462.0	96.40	47	42	3.6	0	0	3/20/2006	
2006	Foundation	S0611773	L2609510	3.00	26.0	69.03	47	38	30.95	0.01	0.01	3/28/2007	

**Accession:** 'Bonilla' (SD-27, PI-315658)

**Name/Species:** big bluestem, *Andropogon gerardii*

**Location:** Field D-10

**Year of Establishment:** 1987

**Origin/Source:** Morton County; USDA, ARS, Mandan, North Dakota

<u>Prod.</u> <u>Year</u>	<u>Seed Class</u>	<u>App./Cert.</u> <u>No.</u>	<u>Seed</u> <u>Lab No.</u>	<u>Acres</u>	<u>Bulk</u> <u>(lbs)</u> <u>Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Other</u> <u>Crop</u>	<u>Test Date</u>
1988	Foundation	1764	M35857	1.40	320.0	97.04	74	1	2.96	0.00	0.00	3/27/1989
1989	Foundation	91992	N10095	1.40	159.0	95.33	76	0	4.66	0.00	0.01	12/15/1989
1990	Foundation	1650	N2322	1.40	115.0	98.07	83	1	1.92	0.00	0.01	1/17/1991
1991	Foundation	2135	N18291	1.40	118.0	93.76	77	0	6.24	0.00	0.00	1/27/1992
1992	Foundation	1053-1	P08550	1.42	175.0	92.16	73	0	7.83	0.00	0.00	1/12/1993
1993	Foundation	3067-1	9303772	1.42	165.0	95.07	72	0	4.93	0.00	0.00	2/28/1994
1994	Foundation	940232-1	9406903	1.42	276.5	93.34	82	1	6.64	0.00	0.02	1/31/1995
1995	Foundation	950194-1	9514495	1.42	124.5	97.35	89	0	2.64	0.01	0.00	4/22/1996
1996	Foundation	960049-1	9609264	1.42	242.0	85.85	78	0	14.14	0.01	0.00	3/18/1997
1997	Foundation	970037-1	9709197	1.42	180.5	92.18	83	1	7.82	0.00	0.00	3/13/1998
1998	Foundation	980059-1	9803403	1.42	298.0	97.22	88	1	2.78	0.00	0.00	1/5/1999
1999	Foundation	990858-1	9910452	1.42	237.5	94.58	87	0	5.42	0.00	0.00	4/27/2000
2000	Foundation	201151-1	2011941	1.42	168.0	89.14	92	0	10.84	0.01	0.01	5/4/2001
2001	Foundation	S0113838	2106047	1.42	49.0	92.78	88	0	6.75	0.46	0.01	2/26/2002
2002	Foundation	S0210303	L2213179	1.42	71.0	95.5	70	16	4.48	0.01	0.01	5/7/2003
2003	Foundation	C5660	L2311320	1.42	200.0	93.26	73	19	6.74	0.00	0.00	4/22/2004
2004	Foundation	S0412037	L2413895	1.40	198.0	94.75	79	14	5.25	0.00	0.00	5/6/2005
2005	Foundation	S0513081	L2513292	1.40	258.0	97.87	72	15	2.13	0.00	0.00	5/4/2006
2006	minimal harvest	S0611774	no test	1.40	0.0							

**Accession:** 9082680

**Name/Species:** fourwing saltbush, *Atriplex canescens*

**Location:** Field D10df

**Year of Establishment:**

**Origin/Source:** Cottonwood, South Dakota

<b>Prod.</b>		<b>App./Cert.</b>	<b>Seed</b>		<b>Bulk (lbs)</b>						<b>Other</b>	
<b>Year</b>	<b>Seed Class</b>	<b>No.</b>	<b>Lab No.</b>	<b>Acres</b>	<b>Quantity</b>	<b>Purity</b>	<b>Germ.</b>	<b>Dorm.</b>	<b>Inert</b>	<b>Weed</b>	<b>Crop</b>	<b>Test Date</b>
2002	breeder		no test		5.5		78(TZ)	0	1.4	0.00	0.00	11/13/2002
2003	breeder				3.5	98.6	46	9(hard)	1.4	0.00	0.00	3/3/2004
2004	breeder		no test		6.0							
2005	breeder		no test	100-ft row	0.5							
2006	breeder		no test		20.0							

**Accession:** Pierre (SD-251, PI-476980)

**Name/Species:** sideoats grama, *Bouteloua curtipendula*

**Location:** Field E-9

**Year of Establishment:** 1977

**Origin/Source:** Stanley County; Ft. Pierre, South Dakota

<u>Prod.</u>		<u>App./Cert.</u>	<u>Seed</u>		<u>Bulk (lbs)</u>						<u>Other Test</u>	
<u>Year</u>	<u>Seed Class</u>	<u>No.</u>	<u>Lab No.</u>	<u>Acres</u>	<u>Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Crop</u>	<u>Date</u>
1978	Common		H20314	2.40	24.0	89.45	63		10.54		0.01	5/1/1979
1979	Common		I7089	2.40	899.0	88.58	76		11.41	0.01		4/18/1980
1980	Foundation	1020	J7932	1.00	125.0	96.36	69		3.63	0.01		5/11/1981
1981	Foundation	1177	J20193	1.00	346.0	96.74	80		3.24	0.01	0.01	3/25/1982
1982	Foundation	1160	J36814	1.00	344.0	97.43	56		2.55	0.01	0.01	3/24/1983
1983	Foundation	1498	K11299	1.00	520.0	97.85	82	1	2.13	0.01	0.01	4/12/1984
1984	Foundation	1643	K27724	1.00	248.0	98.78	88		1.20	0.01	0.01	4/15/1985
1985					No harvest							
1986	Common		L22863	1.00	123.0	98.77	87	1	1.23	0.00	0.00	3/24/1987
1987	Foundation	16797	M16481	1.00	192.0	93.11	64	1	6.89	0.00	0.00	4/20/1988
1988	Foundation	1777	M29887	1.00	218.0	97.8	77	1	2.18	0.02	0.00	1/3/1989
1989	Foundation	92011	N11668	0.90	129.0	99.34	61	0	0.66	0.00	0.00	1/17/1990
1990	Foundation	1666	N8366	1.10	572.0	98.06	92	0	1.93	0.01	0.00	4/16/1991
1991	Foundation	2143	N20087	1.10	273.5	97.85	80	0	2.13	0.02	0.00	2/28/1992
1992	Foundation	1049-1	P09603	1.10	229.0	93.28	83	0	6.70	0.00	0.02	2/4/1993
1993	Foundation	3062-1	9308492	1.10	113.0	94.19	71	0	5.81	0.00	0.00	4/27/1994
1994	Foundation	940238-1	9411461	1.09	100.0	96.57	68	0	3.43	0.00	0.00	3/21/1995
1995	Foundation	950191-1	9508544	1.09	234.5	97.69	75	0	2.29	0.02	0.00	2/21/1996
1996	Foundation	960044-1	9607307	1.09	186.0	98.43	81	0	1.57	0.00	0.00	2/20/1997
1997	Foundation	970044-1	9711274	1.09	92.5	90.16	88	0	9.84	0.00	0.00	3/19/1998
1998	Foundation	980056-1	9809152	1.09	174.5	96.45	85	0	3.55	0.00	0.00	3/30/1999
1999	Foundation	990860-1	990860-1	1.09	218.5	93.00	81	4	6.96	0.02	0.02	12/14/1999
2000	Foundation	201154-1	2002097	1.09	282.5	98.13	61	24	1.72	0.13	0.02	11/22/2000
2001	Foundation	S0113834	2103684	1.09	288.0	98.30	77	6	1.65	0.00	0.05	12/27/2001
2002	Foundation	S0210298	L2208214	1.09	200.0	95.51	82	0	4.47	0.02	0.00	2/28/2003
2003	Foundation	C56260	L2310165	1.09	157.0	93.95	75	11	6.03	0.02	0.00	4/7/2004
2004	Foundation	S0412041	L2410470	1.10	159.0	98.79	91	0	1.11	0.08	0.02	3/30/2005

**Accession:** Pierre (SD-251, PI-476980) (continued)  
**Name/Species:** sideoats grama, *Bouteloua curtipendula*  
**Location:** Field E-9  
**Year of Establishment:** 1977  
**Origin/Source:** Stanley County; Ft. Pierre, South Dakota

Prod.	App./Cert.	Seed	Bulk (lbs)				Other Test					
<u>Year</u>	<u>Seed Class</u>	<u>No.</u>	<u>Lab No.</u>	<u>Acres</u>	<u>Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Crop</u>	<u>Date</u>
2005	Foundation	S0513077	L2507111	1.10	170.0	98.95	87	1	1.03	0.02	0.00	2/14/2006
2006	Foundation	S0611782	L2602844	1.10	115.0	96.82	30	37	3.16	0.02	0.00	12/4/2006

**Accession:** Pierre (SD-251, PI-476980)  
**Name/Species:** sideoats grama, *Bouteloua curtipendula*  
**Location:** Minot Experiment Station  
**Year of Establishment:** 2004  
**Origin/Source:** Stanley County; Ft. Pierre, South Dakota

Prod.	App./Cert.	Seed	Bulk (lbs)				Other Test					
<u>Year</u>	<u>Seed Class</u>	<u>No.</u>	<u>Lab No.</u>	<u>Acres</u>	<u>Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Crop</u>	<u>Date</u>
2004	establishment	S0412378		3.00	0.0							
2005	failed*	S0513917	L2508235	3.00	300.0	97.69	71	20	2.15	0.16	0.00	2/27/2006
2006	common		no test		20.0							

\*seed lot failed to meet certification and was prohibited from sale in North Dakota due to excess of 25 seeds/lb of wild oats

**Accession:** Bad River ecotype (9063064)  
**Name/Species:** blue grama, *Bouteloua gracilis*  
**Location:** Field D-11  
**Year of Establishment:** 1992  
**Origin/Source:** Haakon County; Philip, South Dakota

<u>Prod. Year</u>	<u>Seed Class</u>	<u>App./Cert. No.</u>	<u>Seed Lab No.</u>	<u>Acres</u>	<u>Bulk (lbs) Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Crop</u>	<u>Test Date</u>
1993	Common		9311846	1.4	13.0	90.14	54	0	9.86	0.00	0.00	5/19/1994
1994	Common		9414480	1.4	26.5	96.25	83	0	3.70	0.00	0.05	5/11/1995
1995	Select (G2)	950187-1	9510001	1.4	229.0	93.88	92	1	6.02	0.05	0.05	3/13/1996
1996	Select (G2)	960038-1	9606989	1.4	63.0	84.86	88	0	15.04	0.05	0.05	2/21/1997
1997	Select (G2)	970035-1	9707327	1.4	175.5	95.75	96	0	4.15	0.05	0.05	3/2/1998
1998	Select (G2)	980060-2	9805427	1.4	189.5	94.62	98	0	5.28	0.05	0.05	3/12/1999
1999	Select (G2)	990866-2	990866-2	1.4	57.0	91.14	97	0	8.86	0.00	0.00	4/28/2000
2000	Select (G2)	201162-1	2006091	1.4	221.0	95.71	95	0	4.20	0.05	0.05	2/14/2001
2001	Select (G2)	S0113835	2105431	1.4	206.0	97.29	80	4	2.71	0.00	0.00	1/24/2002
2002	Select (G2)	S0210300	L2207748	1.4	98.0	94.76	98	0	4.85	0.34	0.05	2/18/2003
2003	Select (G2)	C56404	L2310635	3.34*	66.0	89.72	94	0	10.23	0.05	0.00	4/14/2004
		S0412030										
2004	Select (G2)	S0412031	L2408531	3.34*	200.0	98.26	98	0	1.64	0.10	0.00	3/10/2005
2005	Select (G2)	S0513079	L2507760	1.4	31.0	93.58	93	0	6.32	0.10	0.00	2/22/2006
2006	no harvest	S0611776		1.4	0.0							

\*combined fields D-8 and D-11

**Accession:** Bad River ecotype (9063064)

**Name/Species:** blue grama, *Bouteloua gracilis*

**Location:** Field D-8

**Year of Establishment:** 1995

**Origin/Source:** Haakon County; Philip, South Dakota

<u>Prod.</u>	<u>App./Cert.</u>	<u>Seed</u>	<u>Bulk (lbs)</u>						<u>Other Test</u>			
<u>Year</u>	<u>Seed Class</u>	<u>No.</u>	<u>Lab No.</u>	<u>Acres</u>	<u>Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Crop</u>	<u>Date</u>
1997	Select (G2)	970035-2	9707324	1.94	172.5	94.7	98	0	5.05	0.20	0.05	3/2/1998
1998	Select (G2)	980060-1	9805428	1.94	113.5	95.05	96	0	4.85	0.00	0.00	3/4/1999
1999	Select (G2)	990866-1	9912265	1.94	80.5	90.99	96	0	8.60	0.37	0.04	4/18/2000
2000	Select (G2)	201162-2	2006356	1.94	162.0	96.12	97	0	3.83	0.05	0.00	2/14/2001
2001	Select (G2)	S0113836	2105135	1.94	243.0	92.04	86	0	7.79	0.17	0.00	1/23/2002
2002	Select (G2)	S0210301	L2207397	1.94	112.0	95.12	98	0	4.69	0.14	0.05	2/18/2003
2003	Select (G2)	C56404	L2310635	3.34*	66.0	89.72	94	0	10.23	0.05	0.00	4/14/2004
2004	Select (G2)	S0412030 & S0412031	L2408531	3.34*	200.0	98.26	98	0	1.64	0.10	0.00	3/10/2005
2005	Select (G2)	S0513078	L2508234	1.90	37.0	84.27	93	0	14.89	0.84	0.00	2/27/2006
2006	no harvest	S0611781										

\*combined fields D-8 and D-11

**Accession:** Bismarck germplasm (9006032)

**Name/Species:** purple prairieclover, *Dalea purpurea*

**Location:** Field D-11

**Year of Establishment:** 2002

**Origin/Source:** South Dakota

<b>Prod.</b>		<b>App./Cert.</b>	<b>Seed</b>		<b>Bulk (lbs)</b>				<b>Other</b>			
<b>Year</b>	<b>Seed Class</b>	<b>No.</b>	<b>Lab No.</b>	<b>Acres</b>	<b>Quantity</b>	<b>Purity</b>	<b>Germ.</b>	<b>Dorm.</b>	<b>Inert</b>	<b>Weed</b>	<b>Crop</b>	<b>Test Date</b>
2004	Select (G1)	S0412052	L2406447	0.6	270.00	99.16	22	0	0.82	0.02	0.00	2/8/2005
2005	Select (G1)	S0513083	L2502175	0.6	61.00	98.11	30	58(hard)	1.86	0.03	0.00	11/29/2005
2006	Select (G1)	S0611784	L2604046	0.6	31.00	98.09	26	55(hard)	1.73	0.18	0.00	12/26/2006



**Accession:** Bismarck germplasm (9076759)

**Name/Species:** narrow-leaved purple coneflower, *Echinacea angustifolia*

**Location:** Field D-11

**Year of Establishment:** 1997

**Origin/Source:** 11 sites in central and western North Dakota

<b>Prod.</b>		<b>App./Cert.</b>	<b>Seed</b>		<b>Bulk (lbs)</b>						<b>Other</b>	
<b>Year</b>	<b>Seed Class</b>	<b>No.</b>	<b>Lab No.</b>	<b>Acres</b>	<b>Quantity</b>	<b>Purity</b>	<b>Germ.</b>	<b>Dorm.</b>	<b>Inert</b>	<b>Weed</b>	<b>Crop</b>	<b>Test Date</b>
1999	Select (G1)	990872-1	9907471	0.56	13.50	88.97	20	54	11.02	0.01	0.00	3/1/2000
2000	Select (G1)	201164-1	2003248	0.56	33.50	90.01	12	74	9.91	0.08	0.00	12/19/2000
2001	Select (G1)	S0113842	2103555	0.56	2.00	83.91	27	56	16.09	0.00	0.00	12/28/2001
2002	Select (G1)	S0210292	L2207398	1.00	5.00	89.87	21	54	10.12	0.01	0.00	2/18/2003
2003	No harvest			1	0.00							
2004	removed											

**Accession:** 'Mandan' (9058908)

**Name/Species:** Canada wildrye, *Elymus canadensis*

**Location:** Field E-11

**Year of Establishment:** 1994/1995

**Origin/Source:** Morton County, North Dakota; USDA, ARS, Mandan, North Dakota

<b>Prod.</b>		<b>App./Cert.</b>	<b>Seed</b>		<b>Bulk (lbs)</b>					<b>Other</b>		
<b>Year</b>	<b>Seed Class</b>	<b>No.</b>	<b>Lab No.</b>	<b>Acres</b>	<b>Quantity</b>	<b>Purity</b>	<b>Germ.</b>	<b>Dorm.</b>	<b>Inert</b>	<b>Weed</b>	<b>Crop</b>	<b>Test Date</b>
1994	Foundation	940241-1	9412265	0.61	84.0	97.59	77		2.4	0.01	0.00	3/24/1995
1995	Foundation	950188-1	9509586	0.61	313.0	99.39	94		0.59	0.02	0.00	3/13/1996
1996	Foundation	960046-1	9606063	1.04	696.0	98.77	92		1.22	0.01	0.00	1/23/1997
1997	Foundation	970045-1	9703540	1.04	350.0	98.95	89		1.05	0.00	0.00	12/29/1997
1998	Foundation	980058-1	9806176	1.04	397.0	97.10	75		2.89	0.00	0.01	3/1/1999
1999	Foundation	990864-1	9905684	1.04	269.5	97.37	82		2.62	0.01	0.00	2/22/2000
2000	Foundation	201149-1	2009694	1.04	387.5	98.10	82		1.89	0.01	0.00	4/11/2001
2001	Foundation	S0113830	2106226	1.04	208.0	99.16	75		0.82	0.01	0.01	2/25/2002
2002	Foundation	S0210289	L2207037	1.04	334.0	98.73	93		1.26	0.01	0.00	2/24/2003
2003	Foundation	C56179	L2309840	1.04	188.0	96.52	91		3.47	0.01	0.00	4/16/2004
2004	Foundation	S0412049	L2407359	1	94.0	95.82	86		4.14	0.04	0.00	3/8/2005
2005	Foundation	S0513071	L2504315	1	149.0	97.64	83		2.31	0.05	0.00	1/17/2006
2006	removed											

**Accession:** 'Reliant' (Mandan-1813, PI-556987)

**Name/Species:** intermediate wheatgrass, *Elytrigia intermedia*

**Location:** Field D-7

**Year of Establishment:** 1989

**Origin/Source:** USDA, ARS, Mandan, North Dakota

<b>Prod.</b>		<b>App./Cert.</b>	<b>Seed</b>		<b>Bulk (lbs)</b>						<b>Other</b>	
<b>Year</b>	<b>Seed Class</b>	<b>No.</b>	<b>Lab No.</b>	<b>Acres</b>	<b>Quantity</b>	<b>Purity</b>	<b>Germ.</b>	<b>Dorm.</b>	<b>Inert</b>	<b>Weed</b>	<b>Crop</b>	<b>Test Date</b>
1990	Foundation	1673	N12763	0.92	397.00	99.39	94		0.61	0.00	0.00	6/27/1991
1991	Foundation	2144	N16914	0.92	171.50	98.33	90		1.65	0.01	0.01	12/17/1991
1992	Foundation	1044-1	P09589	0.92	157.00	98.23	90		1.77	0.00	0.00	2/2/1993
1993				0.92	No harvest							
1994	Foundation	940234-1	9407584	0.92	96.50	97.33	98		2.67	0.00	0.00	2/6/1995
1995	Foundation	950192-1	9510849	0.92	286.50	97.39	85	0	2.59	0.01	0.01	3/12/1996
1996	Foundation	960048-1	9606991	0.92	218.50	93.51	92	0	6.49	0.00	0.00	2/13/1997
1997	Foundation	970039-1	9705284	0.92	383.00	98.73	98	0	1.27	0.00	0.00	1/14/1998
1998	Foundation	981858-1	9806829	0.92	360.00	98.09	97	0	1.91	0.00	0.00	2/26/1999
1999	Foundation	990856-1	9906202	0.92	260.00	96.55	96	0	3.44	0.00	0.01	2/22/2000
2000	Foundation	201146-1	2006168	0.92	150.00	96.09	93	0	3.89	0.02	0.00	2/20/2001
2001	Hail				No harvest							
2002	Foundation	S0210288	L2208213	0.92	123.00	98.33	96	0	1.66	0.01	0.00	3/3/2003
2003	Foundation	C56315	L2310270	0.92	223.00	97.74	88	0	2.24	0.01	0.01	4/22/2004
2004	Foundation	C59967	L2409682	0.9	181.00	97.34	94	XXX	2.63	0.00	0.03	4/4/2005
2005	Foundation	C61875	L2502733	0.9	150.00	96.04	91	XXX	3.95	0.01	0.00	12/21/2005
2006	Foundation	C66479	L2606470	0.9	66.00	99.23	95	XXX	0.77	0.00	0.00	2/13/2007

**Accession:** 'Manska' (Mandan-2781, PI-562527)

**Name/Species:** pubescent wheatgrass, *Elytrigia intermedia*

**Location:** Field E-6

**Year of Establishment:** 1990

**Origin/Source:** USDA, ARS, Mandan, North Dakota

<u>Prod. Year</u>	<u>Seed Class</u>	<u>App./Cert. No.</u>	<u>Seed Lab No.</u>	<u>Acres</u>	<u>Bulk (lbs)</u>					<u>Other</u>		<u>Test Date</u>	
					<u>Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Crop</u>		
1991	Foundation	2142	N16913	1.29	667.5	98.04	93	0	1.95	0.01	0.00	3/4/1992	
1992	Foundation	1047-1	P05952	1.29	405.0	94.49	85		5.51	0.00	0.00	11/30/1992	
1993				1.29	no harvest (hail damage)								
1994	Foundation	940229-2	9404404	1.29	47.0	91.19	91	0	8.78	0.01	0.02	12/20/1994	
1995	Foundation	950184-2	9506968	1.29	337.5	98.05	85	0	1.93	0.01	0.01	1/26/1996	
1996	Foundation	960040-2	9606988	1.29	311.0	95.16	88	0	4.83	0.01	0.00	2/13/1997	
1997	Foundation	970034-1	9706070	1.29	606.5	98.22	97	0	1.78	0.00	0.00	1/27/1997	
1998	Foundation	980065-2	9804229	1.29	386.0	98.71	95	0	1.28	0.01	0.00	1/21/1999	
1999	Foundation	990865-1	9902645	1.29	519.5	96.99	98	0	3.00	0.01	0.00	12/20/1999	
2000	Foundation	201152-1	2008385	1.29	356.0	97.43	93	0	2.57	0.00	0.00	3/14/2001	
2001	Hail				no harvest								
2002	Foundation	S0210291	L2214325	1.29	214.0	98.30	96	0	1.70	0.00	0.00	5/23/2003	
2003	Foundation	C55869	L2308857	1.29	396.0	97.33	90	0	2.66	0.01	0.00	4/5/2004	
2004	Foundation	S0412043	L2404349	1.3	504	97.5	96	XXX	2.50	0.00	0.00	1/24/2005	
2005	Foundation	S0513068	L2502732	1.3	183	97.85	96	XXX	2.13	0.01	0.01	12/20/2005	
2006	Foundation	C66558	L2606803	1.3	173	99.14	93	XXX	0.85	0.01	0.00	2/20/2007	

**Accession:** 'Manska' (Mandan-2781, PI-562527)

**Name/Species:** pubescent wheatgrass, *Elytrigia intermedia*

**Location:** Field D-11

**Year of Establishment:** 1993

**Origin/Source:** USDA, ARS, Mandan, North Dakota

<b>Prod.</b>		<b>App./Cert.</b>	<b>Seed</b>		<b>Bulk (lbs)</b>							<b>Other</b>	
<b>Year</b>	<b>Seed Class</b>	<b>No.</b>	<b>Lab No.</b>	<b>Acres</b>	<b>Quantity</b>	<b>Purity</b>	<b>Germ.</b>	<b>Dorm.</b>	<b>Inert</b>	<b>Weed</b>	<b>Crop</b>	<b>Test Date</b>	
1994	Foundation	940229-1	9404403	1	351.0	96.46	96	0	3.53	0.01	0.00	12/20/1994	
1995	Foundation	950184-1	9506967	1	230.0	96.62	82	0	3.37	0.01	0.00	2/5/1995	
1996	Foundation	960040-1	9606990	1	181.0	98.69	92	0	1.31	0	0.00	2/13/1997	
1997	Foundation	970034-2	9707325	1	317.5	97.59	97	0	2.41	0	0.00	3/2/1998	
1998	Foundation	980065-1	9804481	1	255.0	98.19	96	0	1.79	0.01	0.01	1/28/1999	
1999	Foundation	990865-2	9902843	1	340.5	97.86	97	0	2.14	0.00	0.00	12/22/1999	
2000	Foundation	201152-2	2009285	1	300.0	97.13	85	0	2.86	0.00	0.01	4/2/2001	
2001	Hail				No harvest								
2002	Foundation	S0210286	L2211309	1	144.0	97.37	96	0	2.60	0.00	0.03	4/16/2003	
2003	Foundation	C55911	L2308981	1	250.0	98.39	83	0	1.61	0.00	0.00	4/6/2004	
2004	Foundation	S0412042	L2404351	1	271.0	96.79	94	XXX	3.21	0.00	0.00	1/24/2005	
2005	Foundation	S0513067	L2502731	1	93.0	97.97	97	XXX	2.02	0.01	0.00	12/20/2005	
2006	Foundation	C66480	L2606472	1	236.0	98.50	90	XXX	1.50	0.00	0.00	2/21/2007	

**Accession:** Medicine Creek germplasm (ND-3651, 9008065)  
**Name/Species:** Maximilian sunflower, *Helianthus maximiliani*  
**Location:** Field D-11  
**Year of Establishment:** 1983/1985  
**Origin/Source:** Hughes County, South Dakota

<u>Prod. Year</u>	<u>Seed Class</u>	<u>App./Cert. No.</u>	<u>Seed Lab No.</u>	<u>Acres</u>	<u>Bulk (lbs)</u>			<u>Other</u>				<u>Test Date</u>
					<u>Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Crop</u>	
1983	Common		K11447	0.05	3.5	97.03	18		2.90	0.00	0.07	4/27/1984
1984	Common		K31783	0.05	6.0	91.85	23		4.76	3.39	0.00	5/31/1985
1985	Common		L9742	0.63	15.0	79.29	41		20.51	0.71	0.03	4/21/1986
1986	Common		L28597	0.63	8.0	78.05	20		18.21	3.68	0.06	4/2/1987
1987	Common		M20825	0.63	13.0	71.82	6		27.99	0.15	0.04	5/20/1988
1988	Common		N17895	0.70	1.3	99.46	11		0.54	0.00	0.00	4/3/1990
1989	Common		N20601	0.70	4.5	62.66	5		37.24	0.06	0.04	5/4/1990
1990					0.0							
1991	Common		P03393 P03590	0.70	86.5	92.12	65 (TZ)		7.02	0.86		7/29/1992
1992	Common		P17831	0.70	31.0	88.38	1	47	11.03	0.59	0.00	5/11/1993
1993	Common		9312790	0.70	40.5	83.14	1	18	16.57	0.29	0.00	6/13/1994
1994	Common		9402979	0.70	70.5	84.69	0	63	13.92	1.39	0.00	11/14/1994
1995	Common		9513275	0.70	31.0	93.57	18	67	5.18	1.25	0.00	3/25/1996
1996	Common		9604738	0.70	35.5	83.66	15	48	16.05	0.29	0.00	12/19/1996
1997	Common		9709183	0.70	64.0	83.20	4	70	16.75	0.05	0.00	3/2/1998
1998	Common		9811399	0.70	96.5	94.27	30	64	5.26	0.47	0.00	4/13/1999
1999	Select (G1)	990870-1	9909471	0.70	26.0	98.45	18	39	0.68	0.86	0.01	3/20/2000
2000	Select (G1)	201147-1	2005815	0.70	20.0	98.08	25	60	1.47	0.46	0.00	2/5/2001
2001	Select (G1)	S0113843	2105127	0.70	15.5	98.10	58	27	0.94	0.96	0.00	1/23/2002
2002	Select (G1)	S0210293	L2203526	0.70	40.0	95.71	12	79	4.15	0.13	0.01	12/20/2002
2003	Select (G1)	C56405	L2310636	0.70	60.0	99.02	33	56	0.34	0.58	0.06	4/16/2004
2004	Select (G1)	S0412050	L2410471	0.70	27.0	91.55	43	54	4.04	4.39	0.02	3/28/2005
2005	Select (G1)	S0513084	L2503953	0.70	57.0	98.17	6	74	1.12	0.71	0.00	12/27/2006
2006	Select (G1)	C66808	L2607438	0.70	18.0	91.38	35	38	8.45	0.05	0.12	2/21/2007

**Accession:** Bismarck germplasm (9047233)

**Name/Species:** stiff sunflower, *Helianthus pauciflorus*

**Location:** Field E-8

**Year of Establishment:** 1986

**Origin/Source:** Composite of nine accessions of stiff sunflower collected in North Dakota and South Dakota.

<u>Prod. Year</u>	<u>Seed Class</u>	<u>App./Cert. No.</u>	<u>Seed Lab No.</u>	<u>Acres</u>	<u>Bulk (lbs) Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Other Crop</u>	<u>Test Date</u>
1986	Common				2.0	85.31	13		14.68	0.01	0.00	
1987	Common				1.2							
1988	Common				2.5							
1989	Common				219.0							
1990	Common		N2325	0.13	3.0	97.65			2.33	0.02	0.00	12/26/1990
			N5143				93 TZ					2/7/1991
1991	Common		P08556	0.13	1.5	98.45	1	40	1.53	0.02	0.00	12/29/1992
1992	Common		P16137	0.23	6.5	86.6	1	32	13.35	0.02	0.03	4/16/1993
1993	Common		9404402	0.23	7.0	58.92	1	6	40.84	0.23	0.01	12/6/1994
1994	Common		9416737	0.23	5.0	40.52	0	68	59.33	0.15	0.00	5/25/1995
1995	Common		9507024	0.23	32.0	85.58	0	59	14.30	0.12	0.00	2/6/1996
1996	Common		9609261	0.23	11.0	69.29	3	84	30.57	0.14	0.00	3/11/1997
1997	Common		9705357	0.23	14.0	58.98	4	42	41.02	0.00	0.00	1/28/1998
1998	Common		9803106	0.23	4.0	85.82	10	79	14.06	0.12	0.00	12/1/1998
1999	Select (G1)	990871-1	9908078	0.23	12.0	92.53	11	70	7.20	0.27	0.00	3/8/2000
2000	Select (G1)	201161-1	2006846	0.23	7.5	86.74	22	38	12.55	0.71	0.00	3/2/2001
2001	Select (G1)	S0113845	2104444	0.23	2.5	95.16	8	82	4.83	0.01	0.00	1/4/2002
2002	Select (G1)	failed	L2209233	0.23	7.0	89.22	11	34	10.77	0.01	0.00	3/21/2003
2003	Select (G1)	C55868	L2308856	0.23	28.0	96.33	22	63	3.66	0.01	0.00	3/22/2004
2004	Select (G1)	S0412053	L2403176	0.20	7.0	97.37	7	66	1.95	0.67	0.01	12/23/2004
2005	No harvest											
2006	Removed											

**Accession:** 'Lodorm'

**Name/Species:** green needlegrass, *Nasella viridula*

**Location:** Minot Experiment Station

**Year of Establishment:** 2000

**Origin/Source:**

<b>Prod.</b>		<b>App./Cert.</b>	<b>Seed</b>		<b>Bulk (lbs)</b>				<b>Other</b>			
<b>Year</b>	<b>Seed Class</b>	<b>No.</b>	<b>Lab No.</b>	<b>Acres</b>	<b>Quantity</b>	<b>Purity</b>	<b>Germ.</b>	<b>Dorm.</b>	<b>Inert</b>	<b>Weed</b>	<b>Crop</b>	<b>Test Date</b>
2000	Foundation	201568-1	2001852	5.00	695.5	99.37	18	64	0.63	0.00	0.00	11/15/2000
2001	Foundation	S0113585	L2102692	5.00	885.0	90.34	9	89	9.58	0.07	0.01	12/7/2001
2002	Foundation	S0210285	L2202494	5.00	650.0	99.86	16	82	0.14	0.00	0.00	11/29/2002
2003	Foundation	C54599	L2303876	5.00	667.0	99.65	7	90	0.35	0.00	0.00	12/29/2003
2004	Foundation	X0412377	L2412470	5.00	196.5	99.97	33	54	0.03	0.00	0.00	4/26/2005
2005	Foundation	S0513916	L2506373	5.00	341.5	99.93	17	67	0.04	0.03	0.00	2/7/2006
2006	Foundation	C65837	L2604045	5.00	425.0	99.99	32	66	0.01	0.00	0.00	12/26/2006



**Accession:** 'Dacotah' (NDG-965-98, PI-478002)

**Name/Species:** switchgrass, *Panicum virgatum*

**Location:** Minot

**Year of Establishment:** 1999

**Origin/Source:** Burleigh County; Bismarck, North Dakota

<b>Prod.</b>		<b>App./Cert.</b>	<b>Seed</b>		<b>Bulk (lbs)</b>						<b>Other</b>	
<b>Year</b>	<b>Seed Class</b>	<b>No.</b>	<b>Lab No.</b>	<b>Acres</b>	<b>Quantity</b>	<b>Purity</b>	<b>Germ.</b>	<b>Dorm.</b>	<b>Inert</b>	<b>Weed</b>	<b>Crop</b>	<b>Test Date</b>
2000	Common	Failed	2003699	2.00	300.0	96.28	87	9	0.03	3.69	0.00	1/10/2001
2001	Common	Failed	2109464	2.00	635.0	99.13	88	4	0.2	0.67	0.00	4/22/2002
2002	Certified	S0210284	L2214326	2.00	462.0	98.85	75	16	0.44	0.71	0.00	5/9/2003
2003	Foundation	C56850	L2312108	2.00	250.0	99.54	67	19	0.44	0.02	0.00	0/13/2004
2004	No harvest	S0412379										
2005	Foundation	S0513918	L2511313	3.00	1719.0	99.75	88	4	0.1	0.15	0.00	4/20/2006
2006*	Foundation	C66831	L2607547	3.00	17.0	99.44	82	7	0.44	0.10	0.02	3/7/2006

\* This is only a portion of the harvest. Remainder of harvest did not meet foundation standards.

**Accession:** 'Forestburg' (SD-149, PI-478001)

**Name/Species:** switchgrass, *Panicum virgatum*

**Location:** Field D-11

**Year of Establishment:** 1999

**Origin/Source:** Sanborn County; Forestburg, South Dakota; composite of SD-62, 205, 206, 203

<u>Prod.</u>		<u>App./Cert.</u>	<u>Seed</u>		<u>Bulk (lbs)</u>						<u>Other</u>	
<u>Year</u>	<u>Seed Class</u>	<u>No.</u>	<u>Lab No.</u>	<u>Acres</u>	<u>Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Crop</u>	<u>Test Date</u>
2000	Foundation	201163-1	2010929	1.2	776	99.96	77	3	0.02	0.02	0.00	4/18/2001
2001	Foundation	S0113837	2111414	1.2	840	99.95	82	0	0.05	0.00	0.00	4/22/2002
2002	Foundation	S0210302	L2205339	1.2	144	99.82	49	29	0.16	0.02	0.00	1/31/2003
2003	Foundation	C56259	L2310164	1.2	157	99.16	88	7	0.72	0.07	0.05	4/22/2004
2004	Foundation	S0412032	L2415348	1.2	476.5	99.47	68	2	0.51	0.02	0.00	5/19/2005
			L2506244									
2005	Foundation	S0513082	L2515485	1.2	591	98.89	70	0	1.09	0.02	0.00	7/10/2006
2006	Foundation	C67586	L2610436	1.2	200	99.87	87	5	0.11	0.02	0.00	4/20/2007

**Accession:** 'Rodan' (Mandan-456, PI-477993)

**Name/Species:** western wheatgrass, *Pascopyrum smithii*

**Location:** Field D-9

**Year of Establishment:** 2001

**Origin/Source:** Morton County: USDA, ARS, Mandan, North Dakota

<b>Prod.</b>		<b>App./Cert.</b>	<b>Seed</b>	<b>Bulk (lbs)</b>							<b>Other</b>	
<b>Year</b>	<b>Seed Class</b>	<b>No.</b>	<b>Lab No.</b>	<b>Acres</b>	<b>Quantity</b>	<b>Purity</b>	<b>Germ.</b>	<b>Dorm.</b>	<b>Inert</b>	<b>Weed</b>	<b>Crop</b>	<b>Test Date</b>
2001				1.5								
2002	Foundation	S0210287	L2202827	1.5	258	93.61	75	1	6.38	0.01	0	12/23/2002
2003	Foundation	C55407	L2307451	1.5	102	95.57	85	0	4.42	0.01	0	3/16/2004
2004	Foundation	S0412046	L2407360	1.5	104	91.29	87	2	8.68	0.03	0	3/8/2005
2005	No harvest											
2006	Removed											

**Accession:** 9082707

**Name/Species:** shell-leaf penstemon, *Penstemon grandiflorus*

**Location:** Field D-11 and DF

**Year of Establishment:** 2004

**Origin/Source:**

<b>Prod.</b>		<b>App./Cert.</b>	<b>Seed</b>	<b>Bulk (lbs)</b>				<b>Other</b>				
<b>Year</b>	<b>Seed Class</b>	<b>No.</b>	<b>Lab No.</b>	<b>Acres</b>	<b>Quantity</b>	<b>Purity</b>	<b>Germ.</b>	<b>Dorm.</b>	<b>Inert</b>	<b>Weed</b>	<b>Crop</b>	<b>Test Date</b>
2004	Breeder	S0412051	L2403175	0.2	4	92.88	6	78	6.88	0.24	0	1/6/2005
2005	Breeder			0.2	1.5	no test						
2006	Removed											

**Accession:** 'Mankota' (Mandan-1808, PI-556988)

**Name/Species:** Russian wildrye, *Psathyrostachys juncea*

**Location:** Field E-7

**Year of Establishment:** 1989

**Origin/Source:** USDA-ARS, Mandan, North Dakota

<b>Prod.</b>		<b>App./Cert.</b>	<b>Seed</b>		<b>Bulk (lbs)</b>				<b>Other</b>			
<b>Year</b>	<b>Seed Class</b>	<b>No.</b>	<b>Lab No.</b>	<b>Acres</b>	<b>Quantity</b>	<b>Purity</b>	<b>Germ.</b>	<b>Dorm.</b>	<b>Inert</b>	<b>Weed</b>	<b>Crop</b>	<b>Test Date</b>
1990	Foundation	1672	N12762	0.90	61.0	97.01	81	0	2.99	0.00	0.00	6/27/1991
1991	Foundation	2140	N16912	0.90	87.5	98.88	92	0	1.11	0.00	0.01	12/17/1991
1992	Foundation	1048-1	P09590	0.90	346.0	98.29	89	0	1.71	0.00	0.00	1/27/1993
1993	No Harvest	Hail Damage										
1994	Foundation	940240-1	9415075	0.90	85.0	98.19	86	0	1.81	0.00	0.00	5/11/1995
1995	Foundation	950190-1	9513273	0.90	162.0	96.27	89	0	3.68	0.00	0.05	3/28/1996
1996	Foundation	960043-1	9606064	0.90	192.0	98.94	93	0	1.06	0.00	0.00	1/16/1997
1997	Foundation	970041-1	9707326	0.90	286.5	99.57	94	0	0.43	0.00	0.00	3/2/1998
1998	Foundation	980062-1	9905046	0.90	248.0	98.13	91	0	1.87	0.00	0.00	1/31/2000
1999	Foundation	990862-1	9905685	1.05	273.0	97.69	90	0	2.31	0.00	0.00	2/10/2000
2000	Common	Failed	2001552	1.05	154.0	98.37	74	0	1.63	0.00	0.00	11/15/2000
2001	No Harvest	Hail										
2002	Foundation	S0210290	L2210006	1.05	89.0	99.50	97	0	0.48	0.00	0.02	3/31/2003
2003	Foundation	C56740	L2311863	1.05	178.0	97.71	89	0	2.29	0.00	0.00	5/6/2004
2004	Foundation	S0412045	L2404350	1.10	65.0	99.52	94	XXX	0.48	0.00	0.00	1/12/2005
2005	Foundation	S0513070	L2506243	1.10	50.0	99.67	93	XXX	0.31	0.02	0.00	2/10/2006
2006	Foundation	C66130	L2605071	1.10	100.0	99.38	92	XXX	0.62	0.00	0.00	1/25/2007

**Accession:** 'Badlands' ecotype (ND-4115, 9036131)

**Name/Species:** little bluestem, *Schizachyrium scoparium*

**Location:** Field E-13 (adjacent to breeder's block)

**Year of Establishment:** 1989

**Origin/Source:** western North Dakota and western and central South Dakota

<u>Prod.</u>		<u>App./Cert.</u>	<u>Seed</u>		<u>Bulk (lbs)</u>						<u>Other</u>		
<u>Year</u>	<u>Seed Class</u>	<u>No.</u>	<u>Lab No.</u>	<u>Acres</u>	<u>Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Crop</u>	<u>Test Date</u>	
1990	Common		N8367	0.90	28.0	87.89	79	0	12.11	0.00	0.00	4/16/1991	
1991	Common		P03212	0.90	78.5	64.08	59	0	35.92	0.00	0.00	5/28/1992	
1992	Common		P16680	1.04	199.5	95.86	87	0	4.14	0.00	0.00	5/6/1993	
1993	Common		9307613	1.04	83.0	93.94	78	0	6.06	0.00	0.00	4/13/1994	
1994	Select (G2)	no tags	9415448	1.04	81.5	95.82	81	0	4.18	0.00	0.00	5/8/1995	
1995	Select (G2)	9508543	9508543	1.04	60.0	87.14	67	0	12.84	0.02	0.00	2/21/1996	
1996	Select (G2)	960047-1	9606987	2.17	113.0	86.11	75	0	13.85	0.02	0.02	2/18/1997	
1997	Select (G2)	970040-1	9705283	2.17	221.5	93.87	80	0	6.13	0.00	0.00	1/23/1998	
1998	Select (G2)	980064-1	9810818	2.17	53.0	66.21	72	0	33.75	0.02	0.02	4/19/1999	
1999	Select (G2)	990861-1	9911692	2.17	210.0	74.00	70	0	25.98	0.00	0.02	5/1/2000	
2000	Select (G2)	201157-1	2002928	2.17**	108.5	89.69	84	1	10.31	0.00	0.00	12/27/2000	
2000	Select (G2)	201157-1	2003249	12rows	52.0	93.70	84	0	6.26	0.02	0.02	1/3/2001	
2001	Select (G2)	S0113840	2111940	2.17	247.0	92.6	88	0	7.38	0.02	0.00	5/2/2002	
2002	Select (G2)	S0210304	L2209496	2.17	334.0	92.45	75	2	7.55	0.00	0.00	3/25/2003	
2003	Select (G2)	C55305	L2306970	2.17	365.0	95.94	84	3	4.06	0.00	0.00	2/23/2004	
2004	Select (G2)	S0412039	L2406861	2.20	89.0	95.98	71	16	3.85	0.15	0.02	2/22/2005	
2004	Select (G2)	S0412039	L2406860	2.20	224.0	96.83	67	16	3.17	0.00	0.00	2/15/2005	
2005	Select (G2)	S0513073	L2505889	2.20	390.0	93.79	79	7	6.19	0.02	0.00	1/31/2006	
2006	Select (G2)	C66297	L2605801	2.20	241.0	94.17	65	24	5.81	0.00	0.02	1/25/2007	

\*1992 and 1993 harvest is a composite of field and 340 plant breeder's block

\*\*This acreage amount includes the 12 rows sprayed with plateau

**Accession:** 'Itasca' germplasm (9063125)

**Name/Species:** little bluestem, *Schizachyrium scoparium*

**Location:** Minot Experiment Station

**Year of Establishment:** 2001

**Origin/Source:**

<b>Prod.</b>		<b>App./Cert.</b>	<b>Seed</b>		<b>Bulk (lbs)</b>						<b>Other</b>	
<b>Year</b>	<b>Seed Class</b>	<b>No.</b>	<b>Lab No.</b>	<b>Acres</b>	<b>Quantity</b>	<b>Purity</b>	<b>Germ.</b>	<b>Dorm.</b>	<b>Inert</b>	<b>Weed</b>	<b>Crop</b>	<b>Test Date</b>
2002	No seed production											
2003	Select (G2)	C55803	L2308592	4.00	26.0	79.48	42	36	20.04	0.02	0.46	3/19/2004
2004	No harvest	S0412381		3.00								
2005	Select (G2)	S0513915	L2503952	3.00	28.0	97.35	51	27	2.57	0.02	0.06	1/3/2006
2006	Select (G2)			3.00	20.0	no test						

**Name/Species:** cupplant, *Silphium perfoliatum*

**Location:** Field DF

**Year of Establishment:**

**Origin/Source:**

<b>Prod.</b>	<b>App./Cert.</b>	<b>Seed</b>	<b>Bulk (lbs)</b>		<b>Other</b>							
<b>Year</b>	<b>Seed Class</b>	<b>No.</b>	<b>Lab No.</b>	<b>Acres</b>	<b>Quantity</b>	<b>Purity</b>	<b>Germ.</b>	<b>Dorm.</b>	<b>Inert</b>	<b>Weed</b>	<b>Crop</b>	<b>Test Date</b>
2004					5.0	no test						
2005	No harvest (removed)											



**Accession:** 'Tomahawk' (ND-444, PI-478006)

**Name/Species:** Indiangrass, *Sorghastrum nutans*

**Location:** Field E-10

**Year of Establishment:** 1980/1987

**Origin/Source:** Dickey County, North Dakota, and Marshall and Brown Counties, South Dakota; composite of ND-343, SD-44, and SD-56

<u>Prod.</u> <u>Year</u>	<u>Seed Class</u>	<u>App./Cert.</u> <u>No.</u>	<u>Seed</u> <u>Lab No.</u>	<u>Acres</u>	<u>Bulk (lbs)</u>			<u>Other</u>			<u>Test Date</u>	
					<u>Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Crop</u>	
1981	Common		J22004	2.1	105.0	98.42	52	2	1.21	0.37		4/6/1982
1982	Common		J36789	2.1	371.0	97.78	87		0.13	2.09		3/23/1983
1983	Common		K14524	2.1	350.0	94.70	78	2	5.23	0.07		4/24/1984
1984	Common		K27728	2.1	535.0	98.19	78	8	1.67	0.07	0.07	4/8/1985
1985	Common	(gr.1)	L5477	2.1	158.0	98.97	92	1	0.96		0.07	3/4/1986
		(gr.2)	L9740		39.0	66.27	85		33.56		0.17	4/30/1986
1986	Common		L24835	2.1	306.0	93.25	67	12	6.74	0.01	0.00	4/14/1987
1987	Foundation		M20157	2.1	55.0	97.84	83	2	2.06	0.00	0.10	5/31/1988
1988	Foundation	1779	N0859	2.5	285.0	97.50	91	0	2.54	0.00	0.00	4/14/1989
1989	Foundation	92016	N13244	2.5	570.0	99.92	93	0	0.07	0.00	0.01	2/13/1990
1990	Foundation	1670	N3775	2.5	392.0	99.05	94	0	0.94	0.00	0.01	2/12/1991
1991		2145	N24194	2.5	243.5	99.98	93	1	0.01	0.00	0.01	4/16/1992
1992	Foundation	1050-1	P15260	2.5	242.0	98.96	84	1	1.02	0.01	0.01	4/26/1993
1993	Foundation	3065-1	9312026	2.5	240.5	98.06	76	2	1.88	0.03	0.03	5/25/1994
1994	Foundation	940237-1	9416108	2.5	226.6	98.29	92	1	1.69	0.02	0.00	5/25/1995
1995	Foundation	950185-1	9510002	0.55	86.5	97.54	87	2	2.46	0.00	0.00	3/12/1996
1996	Foundation	960045-1	9609262	0.55	153.5	97.80	87	2	2.19	0.01	0.00	3/18/1997
1997	Foundation	970042-1	9706071	0.55	146.5	93.77	82	2	6.23	0.00	0.00	1/29/1998
1998	Foundation	980063-1	9803880	0.55	100.0	95.15	59	26	4.85	0.00	0.00	1/12/1999
1999	Foundation	990857-1	9901982	0.55	107.0	97.34	95	2	2.64	0.01	0.01	12/14/1999
2000	Foundation	201155-1	2002466	2.5	242.5	95.41	86	8	4.57	0.01	0.01	12/18/2000
2001	Foundation	S0113833	2104452	2.5	324.0	97.24	68	10	2.74	0.01	0.01	1/16/2002
2002	Foundation	S0210306	L2206466	2.5	157.0	88.09	5	58	11.67	0.23	0.01	1/31/2003
2003	Foundation	C54496	L2303272	2.5	609.0	98.26	3	86	1.74	0.00	0.00	12/17/2003
2004	Foundation	S0412040	L2403177	2.5	645.0	98.80	8	76	1.20	0.00	0.00	12/28/2004
2005	Foundation	S0513076	L2502365	2.5	693.0	99.13	6	80	0.86	0.01	0.00	12/5/2005
2006	Foundation	C65713	L2603399	2.5	250.0	97.92	3	91	2.08	0.00	0.00	12/14/2006

**Accession:** 'Red River' germplasm (9069159)  
**Name/Species:** prairie cordgrass, *Spartina pectinata*  
**Location:** West 40  
**Year of Establishment:** 1994  
**Origin/Source:** North Dakota, South Dakota, and Minnesota

<u>Prod. Year</u>	<u>Seed Class</u>	<u>App./Cert. No.</u>	<u>Seed Lab No.</u>	<u>Acres</u>	<u>Bulk (lbs) Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Other Crop</u>	<u>Test Date</u>
1994	Common		9414422	2.2	10.5	84.66	41		15.30	0.04	0.00	5/9/1995
1995	Common		9515497	2.2	143.5	94.03	18	2	5.97	0.00	0.00	5/2/1996
1996	Select (G1)	960039-1	9604745	1.8	180.0	82.06	10	0	17.94	0.00	0.00	1/3/1997
1997	Select (G1)	C0011577	SGI97W40	1.8	35.5	60.71	65	14	39.23	0.00	0.06	3/5/1998
1998	Select (G1)	980061-1	9810058	1.8	32.0	81.25	6	87	18.73	0.01	0.01	4/5/1999
1999	Common		9906234	1.8	3.0	75.69	4	33	23.77	0.51	0.03	2/23/2000
2000	Select (G1)	201159-2	2013438	1.8	41.0	91.02	40	32	8.94	0.04	0.00	5/17/2001
2001	No Harvest											
2002	No Harvest											
2003	Select (G1)	C57009	L2312531	1.8	43.0	94.31	6	87	5.67	0.01	0.01	5/14/2004
2004	Removed		S0412036	1.8	0.0							

**Accession:** 'Red River' germplasm (9069159)  
**Name/Species:** prairie cordgrass, *Spartina pectinata*  
**Location:** Field E-12  
**Year of Establishment:** 1997  
**Origin/Source:** North Dakota, South Dakota, and Minnesota

<u>Prod. Year</u>	<u>Seed Class</u>	<u>App./Cert. No.</u>	<u>Seed Lab No.</u>	<u>Acres</u>	<u>Bulk (lbs) Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Other Crop</u>	<u>Test Date</u>
1998	Select (G1)	980061-1	9810056	5.65	78.5	83.06	23	13	16.92	0.01	0.01	4/5/1999
1999	Select (G1)	990867-2	9909378	5.65	465.5	94.38	18	58	5.61	0.01	0.00	3/28/2000
2000	Select (G1)	201159-1	2013017	5.65	212.0	85.06	45	36	14.87	0.06	0.01	5/10/2001
2001	Select (G1)	S0113841	2108447	5.65	272.0	82.14	26	55	17.84	0.01	0.01	4/4/2002
2002	Select (G1)	S0210305	L2213178	5.65	58.0	73.99	29	39	25.94	0.03	0.04	5/14/2003
2003	Select (G1)	C57010	L2312532	5.65	6.0	65.70	7	66	34.28	0.01	0.01	5/14/2004
2004	Removed	S0412034		1.30	0.0							

**Accession:** 'Red River' germplasm (9069159)  
**Name/Species:** prairie cordgrass, *Spartina pectinata*  
**Location:** Field D-11  
**Year of Establishment:** 2004  
**Origin/Source:** North Dakota, South Dakota, and Minnesota

Prod.	App./Cert.	Seed Lab No.	Acres	Bulk (lbs) Quantity	Purity	Germ.	Dorm.	Inert	Weed	Other Crop	Test Date
2004	Select (G1)	S0412033	1.0	no harvest							
2005	Select (G1)	S0513075 S0513074	2.5	318.0	93.98	35	45	5.44	0.42	0.16	3/23/2006
2006	no harvest										

**Accession:** 'Red River' germplasm (9069159)  
**Name/Species:** prairie cordgrass, *Spartina pectinata*  
**Location:** Field E-9  
**Year of Establishment:** 2003  
**Origin/Source:** North Dakota, South Dakota, and Minnesota

Prod.	App./Cert.	Seed Lab No.	Acres	Bulk (lbs) Quantity	Purity	Germ.	Dorm.	Inert	Weed	Other Crop	Test Date
2004		S0412035	1.50	0.0							
2005	combined with field D-11										
2006	No harvest										

**Accession:** 9092163

**Name/Species:** strawberry clover, *Trifolium fragiferum*

**Location:** Panel A

**Year of Establishment:**

**Origin/Source:** old plot at South Dakota State University

<b>Prod.</b>		<b>App./Cert.</b>	<b>Seed</b>		<b>Bulk (lbs)</b>						<b>Other</b>	
<u>Year</u>	<u>Seed Class</u>	<u>No.</u>	<u>Lab No.</u>	<u>Acres</u>	<u>Quantity</u>	<u>Purity</u>	<u>Germ.</u>	<u>Dorm.</u>	<u>Inert</u>	<u>Weed</u>	<u>Crop</u>	<u>Test Date</u>
2004	breeder		no test		1.5							
2005	breeder		no test		4.5							
2006	breeder		no test		3.5							

## **STAFFING**

**STAFFING: TECHNICAL REPORT 2004-2006**

**PERMANENT POSITIONS**

Wayne L. Duckwitz, Manager  
Michael J. Knudson, Forester  
Nancy K. Jensen, Agronomist  
Earl G. Aune, Biological Science Technician/Field Foreman  
Rachel H. Bergsagel, Biological Science Technician  
Michael D. Bellon, Seed Processing Technician (NDSU)  
Leslie A. Glass, Secretary (2006)

**STUDENT TRAINEES**

Caesare D. Toliver, SCEP (2004)  
Robert R. Jones, STEP (2006)

**2004 SEASONAL POSITIONS:**

Danielle M. Burgard, WAE, Biological Science Aid  
Steven H. Czczok, WAE, Biological Science Aid  
Lindy A. Hagens, WAE, Biological Science Aid  
Jerry W. Monroe, WAE, Biological Science Aid

**2005 SEASONAL POSITIONS:**

Michael A. Czczok, WAE, Biological Science Aid  
Steven H. Czczok, WAE, Biological Science Aid  
Dennis R. DeVault, WAE, Biological Science Aid  
Chad Thorson, WAE, Biological Science Aid

**2006 SEASONAL POSITIONS:**

Michael A. Czczok, WAE, Biological Science Aid  
Steven H. Czczok, WAE, Biological Science Aid  
Dennis R. DeVault, WAE, Biological Science Aid

## **INFORMATION**

**INFORMATION: TECHNICAL REPORT 2004-2006**

**Abstracts**

**Increasing the Non-Grass Component of Native Seedings**

Dwight A. Tober, USDA NRCS Plant Materials Program, Bismarck, ND; and Merle O. Bennett, North Dakota Natural Resources Trust, Bismarck, ND

Native seedings in the Northern Great Plains have evolved from mixtures typically including only a few grass species to diverse mixtures of a dozen or more species with a component of 10% to 20% forbs, shrubs, and legumes. Depending on the objective of the planting, there may be advantages to increasing the non-grass component to 50% or more of the total mixture. Adapted seed sources of native forbs, legumes and shrubs are more readily available today compared to 10 years ago. Many wildlife species prefer moderately open grasslands with a diversity of forbs, legumes, and shrubs for nesting, feeding, and brood-rearing, while the more dense, higher canopy grass stands are preferred for escape and winter cover. Grasslands that are 50% or more non-grass species are preferred nesting sites because they host high quantities of insects and protein rich plants that are used by young wildlife species, including upland game birds. The North Dakota Natural Resources Trust cooperatively with the USDA NRCS is utilizing the Wetland Reserve Program to develop the 1,400 acre Robert L. Morgan Wildlife Management Area in east central North Dakota. This presentation will describe the procedures and experiences in the restoration process with a goal of seeding at least 50% native forbs, legumes, and shrubs. Forty-five plant species were seeded including 50% non-grass species as calculated by seeds per square foot based on a percentage of the full-seeding rate. Seed costs averaged \$88 per acre for seeding 815 acres in 2004 and 2005.

7/29/05, Abstract, Society for Range Management 59 <sup>th</sup> Annual Meeting, February 11-17, 2006, Vancouver, B. C.
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