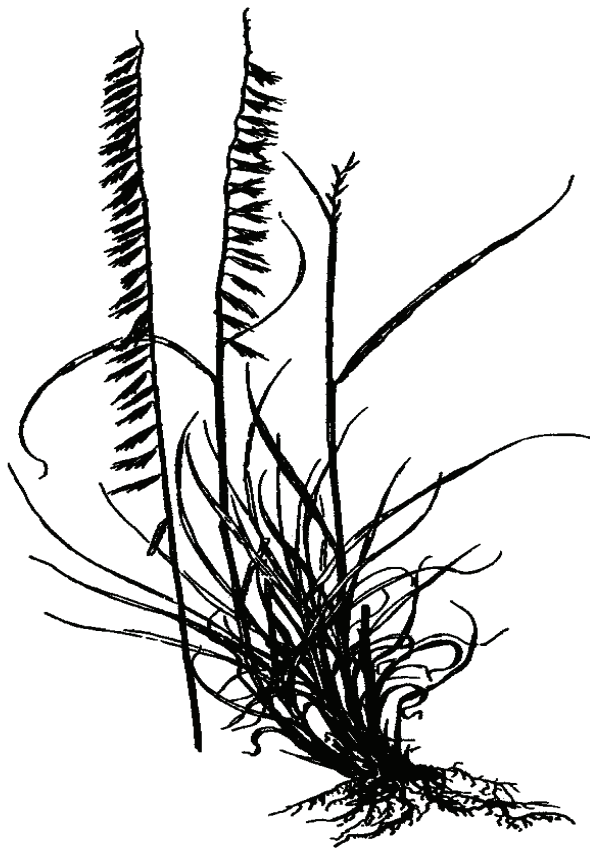


Technical Report 1998-1999

Part 1 of 2: Grasses, Forbs, and Legumes



Sideoats Grama

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

Technical Report

Part I (Grasses, Forbs, and Legumes)

1998-1999

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PART I

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INTRODUCTION

INTRODUCTION: TECHNICAL REPORT – 1998-1999

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

The Bismarck PMC staff met with technical advisors in March 1995, and formulated a summary of plant materials needs and priorities for the next five years. Native prairie ecosystems restoration and wetland/riparian area development probably received the most discussion and support for redirection of study emphasis. Reimbursable funding received at the PMC complements these two high priorities.

PLANT MATERIALS NEEDS AND PRIORITIES SUMMARY
Native Prairie Ecosystems Restoration <ul style="list-style-type: none">- identify additional forbs and legumes- propagation, establishment and management techniques- develop seed source/propagules
Wetland Plant Materials <ul style="list-style-type: none">- expand native specie alternatives- propagation, establishment, management techniques- develop seed source propagules- species for forage, erosion control, water quality, wildlife- determine forage quality of wetland species
Streambank Stabilization <ul style="list-style-type: none">- identify suitable species- develop propagation and establishment techniques
Riparian Plant Materials and Methods <ul style="list-style-type: none">- identify suitable species- develop propagation and establishment techniques
Windbreak Needs <ul style="list-style-type: none">- methods for renovation- cultural responses- adapted species- tall trees for field, farmstead and wildlife plantings
Warm Season Rhizomatous Plants for Critical Areas <ul style="list-style-type: none">- identify suitable species, establishment techniques- triazine resistance
Annual/Perennial Herbaceous Wind Barriers <ul style="list-style-type: none">- identify suitable species, establishment techniques
Warm Season Grasses for Hay, Pasture and Rangeland <ul style="list-style-type: none">- improved forage quality- management techniques
Saline/Alkaline Tolerant Plant Materials <ul style="list-style-type: none">- identify woody and herbaceous species, establishment techniques

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.
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. Field Evaluation Planting sites in Minnesota, South Dakota and North Dakota. These 14 field evaluation planting 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 1998-1999 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 15.47 inches per year. Refer to Table 1 for 1998-1999 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: 1998-1999 Weather Summary - Official Station - Bismarck, North Dakota

Month	Mean Temperature			Precipitation (inches)				
	(degrees Fahrenheit)			Actual			Deviation from Normal	
	1998	1999	Normal	1998	1999	Normal	1998	1999
January	13.2	8.4	9.2	0.09	1.13	0.45	-0.36	0.68
February	30.4	24.9	15.7	1.67	0.39	0.43	1.24	-0.04
March	24.0	35.6	28.2	0.39	0.25	0.77	-0.38	-0.52
April	48.0	43.3	43.0	0.66	1.61	1.67	-1.01	-0.06
May	58.0	56.0	55.0	1.10	6.96	2.18	-1.08	4.78
June	61.4	64.3	64.4	2.90	3.61	2.72	0.18	0.89
July	72.9	71.3	70.4	1.89	2.52	2.14	-0.25	0.38
August	72.5	69.4	68.3	9.29	7.91	1.72	7.57	6.19
September	63.4	55.0	57.0	0.98	1.31	1.49	-0.51	-0.18
October	46.8	45.3	48.1	3.09	0.43	0.90	2.19	-0.47
November	31.0	38.6	28.6	1.40	0.10	0.49	0.91	-0.39
December	20.7	25.5	14.0	0.24	0.23	0.51	-0.27	-0.28
Annual	45.2	44.8	41.8	23.70	26.45	15.47	8.23	10.98
				<u>1998</u>	<u>1999</u>			
		Last Frost (28 degrees)		17-Apr	23-Apr			
		First Frost (28 degrees)		01-Oct	01-Oct			
		Frost Free Period		166 days	160 days			

REGIONAL DESCRIPTION

REGIONAL DESCRIPTION: TECHNICAL REPORT – 1998-1999

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 (*Stipa comata*), slender wheatgrass (*Elymus trachycaulus*), and prairie junegrass (*Koeleria cristata*). 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

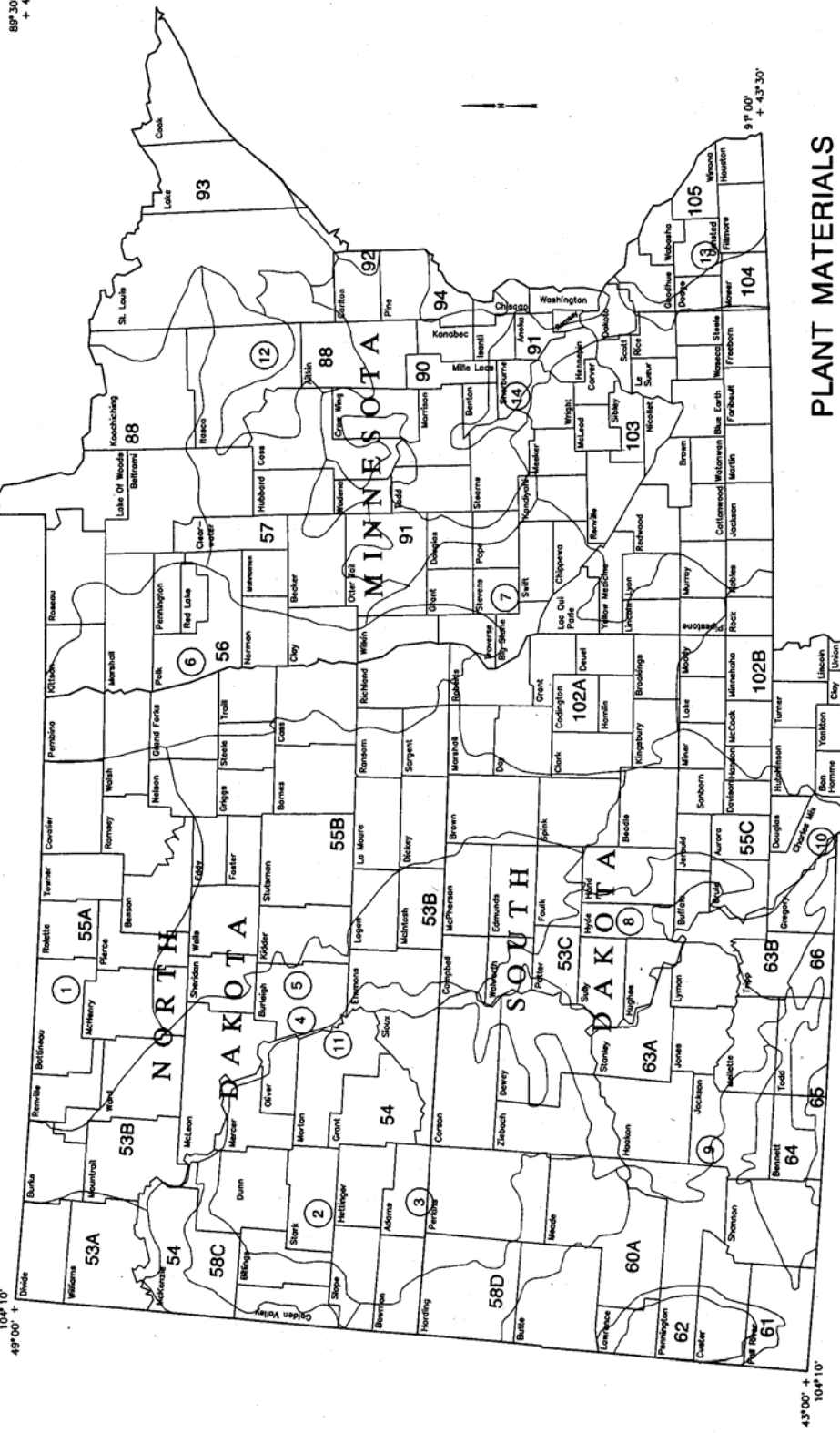
North Dakota and Minnesota are the two coldest states in the nation excluding Alaska. Mean annual temperatures range from 36 degrees F to 48 degrees F for all reporting stations. Plant hardiness zones (USDA) vary from 3 to 4 with mean minimum temperatures between -10 degrees F and -50 degrees F. Annual 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.

Because of cold and drought, the diversity of woody species is severely limited, especially in the Dakotas. The scarcity of native tall tree species for windbreaks has relegated at least a portion of the tree improvement effort in the Northern Great Plains to improving upon existing cultivars of native species or increasing survival and pest resistance of hardy exotics such as Siberian elm. Species from Siberia, Russia, Manchuria, or Mongolia are among the most viable introductions for prairie plantings where precipitation is generally less than 20 inches annually. There is generally little shortage of shrub species for shelterbelt, barrier, or wildlife plantings except in the most hostile environments or specific cases related to pest resistance.

The short length of the growing season limits the potential annual growth rate of trees. Late spring frosts can decimate fruit set of early flowering fruit trees following a week or so of warm temperatures. However, hardy native shrubs like plum, chokecherry, and hawthorn are well adapted and regularly produce abundant crops. Indigenous species may rely on a secondary bud flush to produce foliage in some years. Winter dessication of needle leaved evergreens is not uncommon on exposed sites, making conifer establishment a challenge for vast areas of the Northern Plains. Symptoms of winter injury on hardwoods may be as mild as tip dieback on exterior limbs to complete death of above ground stems and subsequent resprouting. Damaged trees are ideal sites for insects and disease infection.

The importance of adapted seed sources and the need for provenance tests is especially critical in the extreme and variable environment of the northern plains. In the three-state region served by the PMC, winter hardy, drought, and pest resistant cultivars are in demand by the nursery trade. Seed sources from regions further south frequently express superior growth rates but are more susceptible to winter injury.

MAPS

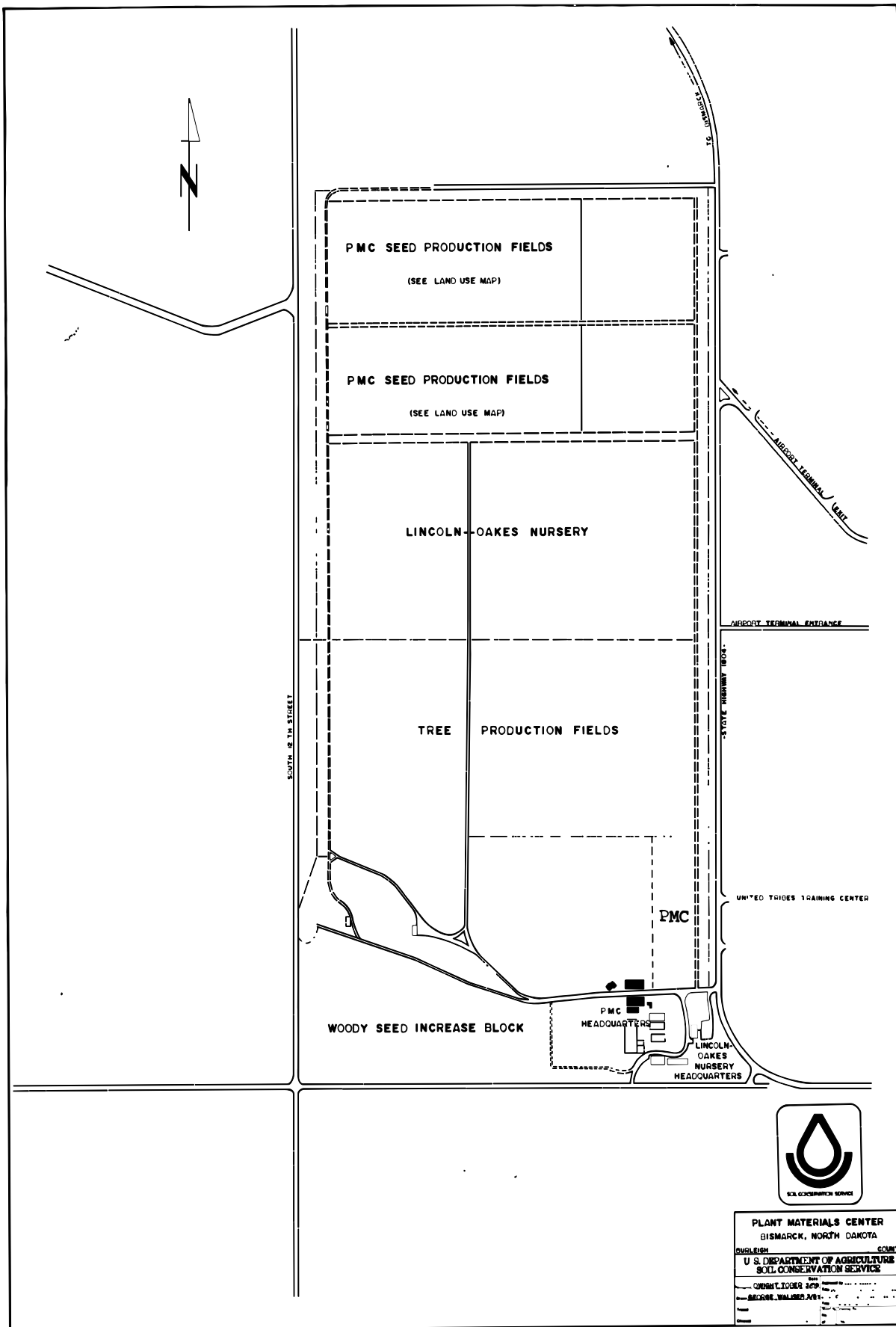


PLANT MATERIALS MINNESOTA, NORTH DAKOTA AND SOUTH DAKOTA

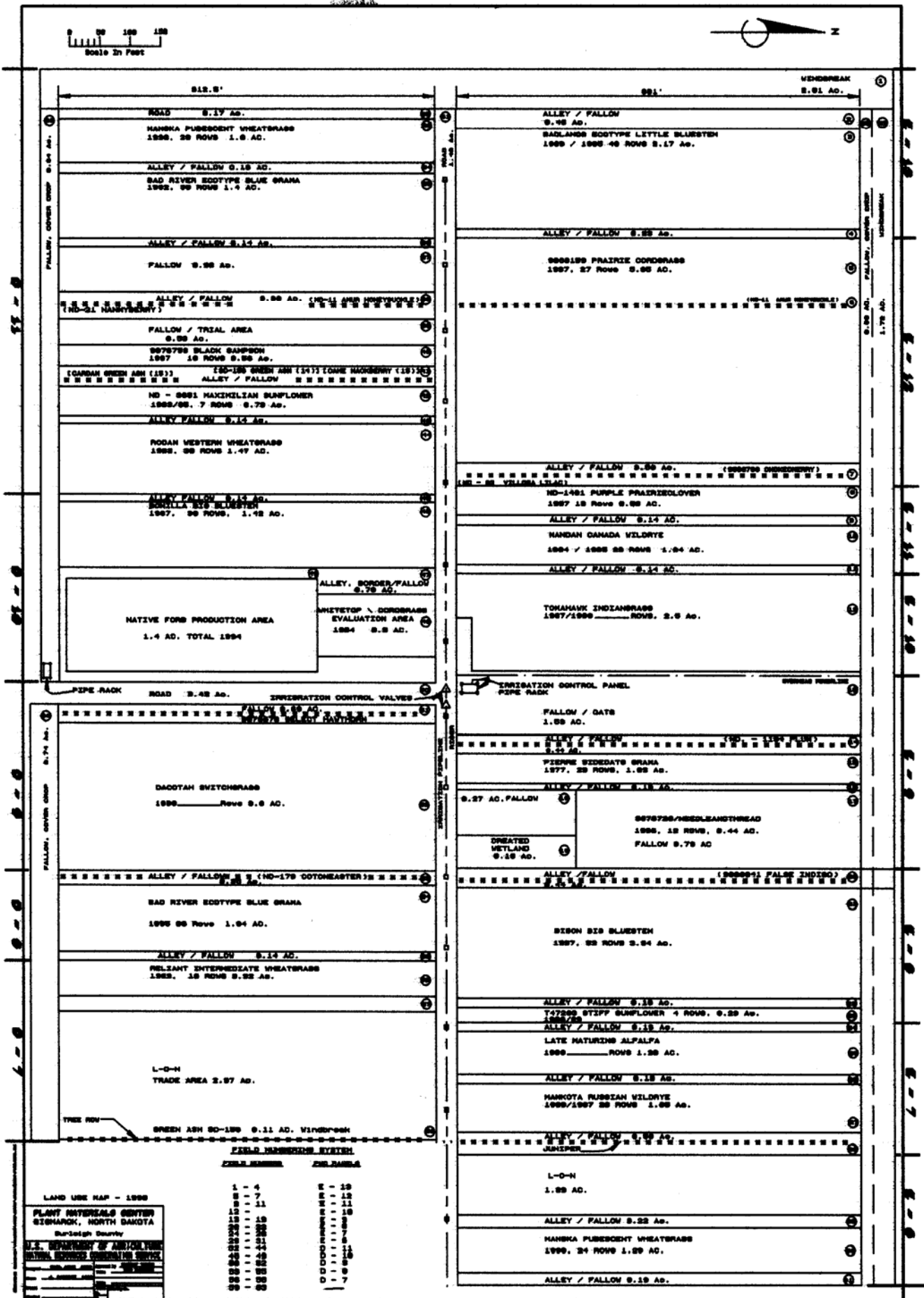
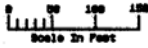
1998

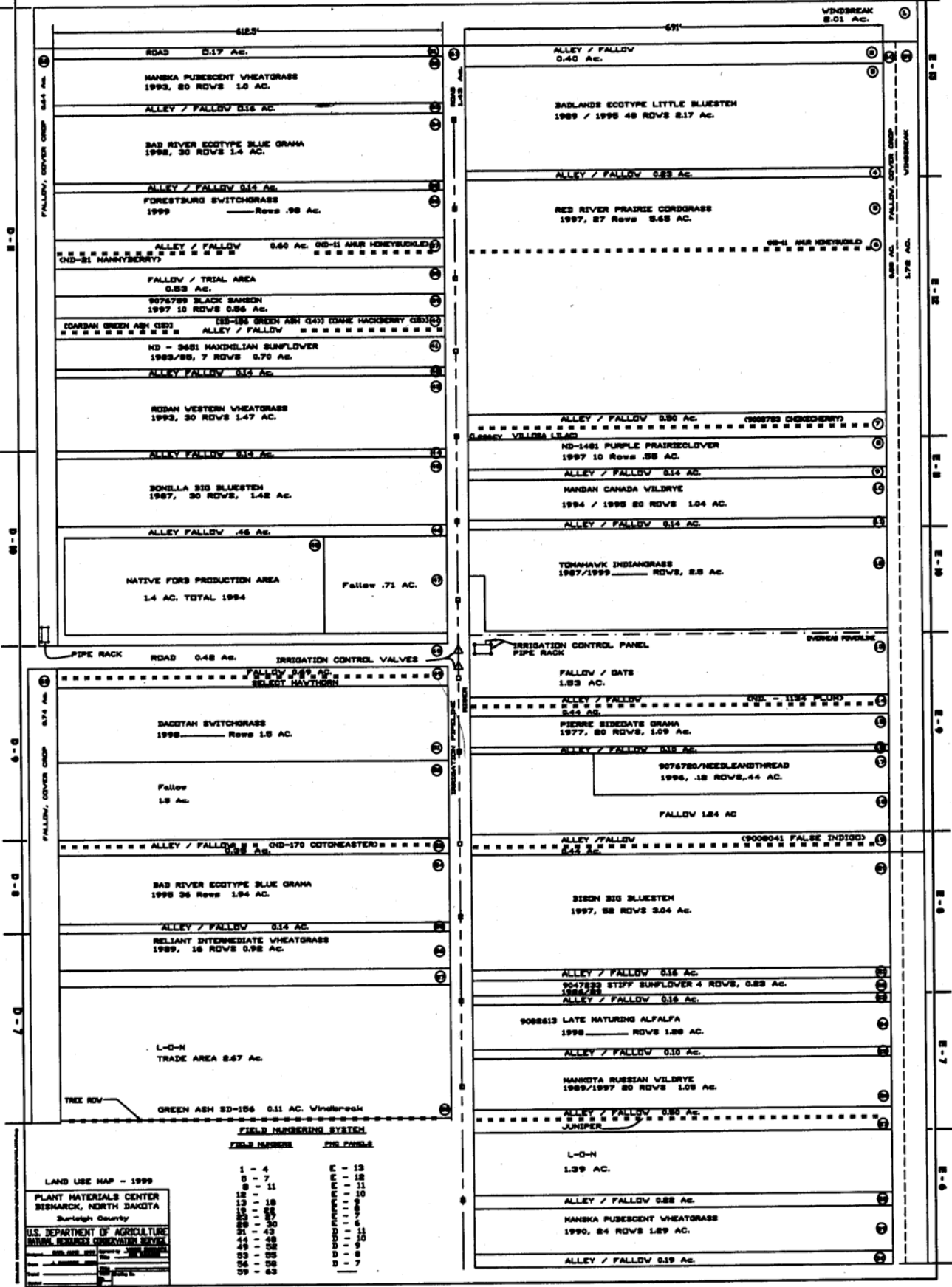
- 105 MAJOR LAND RESOURCE AREAS AND NUMBERS
 (10) FIELD EVALUATION PLANTING SITES
- LEGEND
- 1 NDSU, Institute of Forestry, Bottineau Branch, Bottineau, ND
 - 2 NDSU, Dickinson Branch Exp. Station, Dickinson, ND
 - 3 NDSU, Research and Extension Center, Hefflinger, ND
 - 4 USDI Fish & Wildlife Service, Apple Creek Twp., Burleigh Co., ND
 - 5 McKenzie Slough Game Management Area, McKenzie, ND
 - 6 University of Minnesota, Northwest Exp. Station, Crookston, MN
 - 7 University of Minnesota, West Central Exp. Station, Morris, MN
 - 8 SDSU Central Research Station, Highmore, SD
 - 9 USDA Forest Service, Buffalo Gap National Grasslands, Cottonwood, SD
 - 10 USDI Lake Andes National Wildlife Refuge, Lake Andes, SD
 - 11 USDA Agriculture Research Service, Mandan, ND
 - 12 University of Minnesota, North Central Exp. Station, Grand Rapids, MN
 - 13 Minnesota Dept. of Natural Resources, Rochester, MN
 - 14 University of Minnesota, Becker Research Farm, Becker, MN

Source: 1:2,000,000 DLG Data and information from NRCS field personnel. Albers Equal Area Projection.



PLANT MATERIALS CENTER
 BISMARCK, NORTH DAKOTA
 DAKOTA COUNTY
 U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
 CORNELL UNIVERSITY
 AIRPORT TERMINAL ENTRANCE
 BISMARCK, NORTH DAKOTA





FIELD NUMBERING SYSTEM

FIELD NUMBER	PISTON NUMBER
1 - 4	E - 13
5 - 7	F - 12
8 - 11	G - 11
12 - 18	H - 10
19 - 28	I - 9
29 - 30	J - 8
31 - 43	K - 7
44 - 48	L - 6
49 - 52	M - 5
53 - 55	N - 4
56 - 58	O - 3
59 - 63	P - 2

LAND USE MAP - 1999
 PLANT MATERIALS CENTER
 BISMARCK, NORTH DAKOTA
 Burleigh County
 U.S. DEPARTMENT OF AGRICULTURE
 NATURAL RESOURCES CONSERVATION SERVICE
 1000 10th St. S.W.
 Bismarck, ND 58103
 701/781-2222
 FAX 701/781-2223
 WWW.NRCS.USDA.GOV

ASSEMBLY AND INITIAL EVALUATION

ASSEMBLY AND INITIAL EVALUATION - TECHNICAL REPORT 1998-1999

Study 38I018R

Study Title: Evaluation of miscellaneous herbaceous plant materials

Introduction: Demonstration and initial evaluation of herbaceous plant materials for potential conservation use is an important task of the Plant Materials Program. A site at the PMC has been set aside for such purposes. Herbaceous plant materials collected by various NRCS personnel and other agencies of both released and not released material are assembled in 20-foot long rows. The planting continues to change as old material is removed and new material is planted.

Objectives: The primary objective is to assemble and initially evaluate and/or demonstrate herbaceous plant material that may have potential for conservation use. It also serves as a general plant species identification site.

Cooperators: The USDA Natural Resources Conservation Service, Plant Materials Center, Bismarck, North Dakota, in cooperation with the North Dakota Association of Soil Conservation Districts, Lincoln-Oakes Nursery, Bismarck, North Dakota.

Location: This study is located in Panel A at the Plant Materials Center, Bismarck, North Dakota.

Major Land Resource Area: The site is located in 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 1,600 to 2,000 ft.

Soils: Mandan silt loam (see Introduction - Soils, page 4).

Climate: The average annual precipitation is 16.15 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). About 20 percent of the annual precipitation comes in the form of snow. Plant hardiness zone is 3b, with a minimum mean temperature of -30 to -40 degrees F (see Climatological Information and 1998-1999 Weather Summary, pages 4-6).

Methods and Materials

Assembly: Refer to Table MI-1 for a list of herbaceous plant materials grown from 1998 to 1999.

Planting Plan: (See Maps, Panel A, page 14). Rows 20 feet long are established for each entry. The rows are 42 inches apart with an 8-foot border on the end of each block. Three separate blocks (1-3) were established to accommodate drainage patterns in the field. The rows are numbered consecutively from south to north for a total of 186 potential entries.

Plot Preparation: A clean, firm planting site is prepared by roto-tilling, packing, and harrowing.

Planting Method: Perennial species are started from seed in the greenhouse and vegetatively planted in the IEP. Plants are spaced approximately one foot apart. Annual species are established from seed planted directly in row.

Planting Date: The planting was begun in 1989. Entries are added and removed annually.

Fertilization: No fertilizer has been applied to the plots.

Weed Control: Mechanical cultivation and hand hoeing are completed as needed to control weeds.

Biological Control: None.

Irrigation: None.

Crop Residue Management: Residues are clipped and removed each fall or burned the following spring. A permanent seeding of 'Durar' hard fescue (*Festuca longifolia*) is maintained between blocks and mowed several times during the summer.

Evaluations and Measurements: Data is collected at least one time during the growing season for specific entries. Information is recorded on characteristics such as foliage height and abundance; general plant vigor; seed culm production; disease and insect problems; and phenology. Remarks are also made on any other unusual or noticeable conditions that may exist.

Table MI-1 is a list of entries that were grown from 1998-1999. Rows with more than one entry indicate removal of one and replanting of the later entry, or they are two accessions that have a limited number of plants. Data collected for all entries is on file and can be requested from the Bismarck PMC.

Table MI-1. 1998-1999 Entries							
Row	Variety	Accession	Common Name	Species	Origin	Source	Planting Date
1			Russian sage				
2	9069126	9069126	black samson	<i>Echinacea angustifolia</i>	Morton Co.Gm. Mgt	PMC collection	1994
3	9076710	9076710	dotted gayfeather	<i>Liatris punctata</i>	Morton, Burleigh Co.	PMC collection	1997
4	NDL56	478834	white prairieclover	<i>Dalea candida</i>	Stark Co., ND	PMC collection 1947	1997
5	ND1481	9006032	purple prairieclover	<i>Dalea purpurea</i>	Lyman Co., SD	PMC collection 1975	1997
7	Windsor		cicer milkvetch	<i>Astragalus cicer</i>	selection from Monarch	Peterson Seed Co.	1995
8	Monarch	9017390	cicer milkvetch	<i>Astragalus cicer</i>		Peterson Seed Co.	1995
11	Tretana	9016238	birdsfoot trefoil	<i>Lotus corniculatus</i>		MTPMC	1989
12	Mackinaw	340799	birdsfoot trefoil	<i>Lotus corniculatus</i>	Iowa	MIPMC	1989
13		9076705	leadplant	<i>Amorpha canescens</i>	Burleigh Co., ND	PMC collection	1997
14	Sunrise		Canada milkvetch	<i>Astragalus canadensis</i>	Brookings Co., SD	Arvid Boe-SDSU	1998
15		9069118	2-grooved milkvetch	<i>Astragalus bisulcatus</i>	Lostwood WR,ND	K.Smith, A. Kruse	1995
16		9069117	Canada milkvetch	<i>Astragalus canadensis</i>	Lonetree WMA, ND	BOR, PMC collection	1995
18	Covar	109497	sheep fescue	<i>Festuca ovina</i>	Konya, Turkey	WAPMC	1989
19	Durar	421025	hard fescue	<i>Festuca ovina</i> L. Var. <i>duriuscula</i>	Union, OR	WAPMC	1989
20		9076778	porcupine grass	<i>Stipa spartea</i>	ND NW1/4 13-135-52	Jeff Printz	1998
21	Sherman	420127	big bluegrass	<i>Poa secunda</i>	Sherman Co. OR	WAPMC	1989
23		9070255	sweetgrass	<i>Hierochloe odorata</i>	Burleigh Co., ND	Bonnie Heidel	1992
26		931	western wheatgrass	<i>Pascopyrum smithii</i>	western Dakotas	NDARS	1992
27		932	western wheatgrass	<i>Pascopyrum smithii</i>	Alberta, Sask	NDARS	1992
28			golden brome grass	<i>Bromus inermis</i>		Forest Farms OR	1998
28			brown-deer switchgrass	<i>Panicum virgatum</i>		Forest Farms OR	1998
28			Rostrahlbusch switchgrass	<i>Panicum virgatum</i>		Forest Farms OR	1998
28			variegated cordgrass	<i>Spartina pectinata</i>		Forest Farms OR	1998
28			prairie coneflower	<i>Ratibida columnifera</i>	Burleigh Co., ND	Earl Aune	1997
29	Regar	172390	meadow brome grass	<i>Bromus biebersteinii</i>	Zekars, Turkey	IDPMC	1989
30	Manchar	109812	smooth brome grass	<i>Bromus inermis</i>	Manchuria, China	WAPMC	1989
31	Cottonwood	9023425	smooth brome grass	<i>Bromus inermis</i>	Cottonwood, SD	SDSU, A.Boe	1989
32	Rebound	9023426	smooth brome grass	<i>Bromus inermis</i>	selection from Saratoga	SDSU, A.Boe	1989
33	Lincoln	9004246	smooth brome grass	<i>Bromus inermis</i>	Hungary	ARS, NB	1989
34		9082622	palm sedge	<i>Carex muskingumensis</i>		Per.Passions SF, SD	1998
34	Passion Blue	9082621	blue sedge	<i>Carex flacca</i>		Per.Passions SF, SD	1998
35	MDN1831	9058911	Russian wildrye	<i>Psathyrostachys juncea</i>		ARS, Mandan	1990

Row	Variety	Accession	Common Name	Species	Origin	Source	Date
36	Retain	9023421	creeping meadow foxtail	<i>Alopecurus arundinaceus</i>		SDSU, A.Boe	1989
37	Garrison	436704	creeping meadow foxtail	<i>Alopecurus arundinaceus</i>	Germany, Russia	NDPMC	1989
38				<i>Leymus karelini</i>		ARS, Logan, UT	1991
39		9024575	Canada wildrye	<i>Elymus canadensis</i>		COPMC	1991
40	Vinall	476299	Russian wildrye	<i>Psathyrostachys juncea</i>		ARS, Mandan ND	1989
41	BozoiskySelect	9027398	Russian wildrye	<i>Psathyrostachys juncea</i>	USSR	ARS, Logan, UT	1989
42		272136	Russian wildrye	<i>Psathyrostachys juncea</i>			1989
43	Mankota	556988	Russian wildrye	<i>Psathyrostachys juncea</i>		ARS, Mandan, ND	1989
44	Mandan	9058908	Canada wildrye	<i>Elymus canadensis</i>	Mandan, ND	ARS, Mandan, ND	1990
46	Shoshone	434040	beardless wildrye	<i>Leymus triticoides</i>	Riverton, WY	MTPMC	1989
47	ND2100	9036025	European dunegrass	<i>Leymus arenarius</i>		NDPMC	1989
48	M718		basin wildrye	<i>Leymus cinereus</i>	MTPMC		1989
49	P-15591	9005358	basin wildrye	<i>Leymus cinereus</i>	Sheridan, WY	J.S. Bourret	1989
50	Trailhead	478831	basin wildrye	<i>Leymus cinereus</i>	Roundup, MT	MTPMC	1989
52		478832	mammoth wildrye	<i>Leymus racemosus</i>		MTPMC	1989
53	ND691	313965	mammoth wildrye	<i>Leymus racemosus</i>	P.I. Sta., Pullman, WA	NDPMC	1989
54	Volga	108491	mammoth wildrye	<i>Leymus racemosus</i>	Volga, Russia	MTPMC	1989
55	Nordan	469225	crested wheatgrass	<i>Agropyron desertorum</i>		ARS, Mandan, ND	1989
56	Ephraim	109012	fairway wheatgrass	<i>Agropyron cristatum</i>	Ankara, Turkey	ARS, UT, IDPMC	1989
57	Hycrest	9028605	crestedXfairway	<i>A.desertorumXcristatum</i>		ARS,UT	1989
58		28606	crested wheatgrass	<i>Agropyron desertorum</i>		IDPMC	1989
59	SD77	9058920	fairway wheatgrass	<i>Agropyron cristatum</i>		SDSU, A.Boe	1990
60	Hycrest2	9041328	crestedXfairway	<i>A.desertorumXcristatum</i>		ARS,UT	1990
61	Sundance		foxtail dalea	<i>Dalea leporina</i>	Union Co.,SD	SDSU, A.Boe	1998
62		9057946	standing milkvetch	<i>Astragalus adsurgens</i>	China	MTPMC	1998
63		9076774	silktop dalea	<i>Dalea aurea</i>	Stanley Co.,SD	NDPMC	1998
64	Bandera	477980	Rocky Mt. penstemon	<i>Penstemon strictus</i>	Torrance Co. MN	NMPMC	1998
65		9076876	winterfat	<i>Krascheninnikovia lanata</i>	ND Badlands	NDPMC	1998
66		9063535	winterfat	<i>Krascheninnikovia lanata</i>	MT	MTPMC	1998
67		9067481	winterfat	<i>Krascheninnikovia lanata</i>	ID	IDPMC	1998
68	P27	108434	Siberian wheatgrass	<i>Agropyron fragile</i>	USSR	IDPMC	1989
69		9043501	Salina wildrye	<i>Leymus salinus</i>		COPMC	1998
70	ND1713		altai wildrye	<i>Elymus angustus</i>		Swift Current, Sask.	1989
72	San Luis	483079	slender wheatgrass	<i>Elymus trachycaulus</i>	Rio Grande Co.,CO	COPMC	1989
73	Pryor	432403	slender wheatgrass	<i>Elymus trachycaulus</i>	Clarks Fork River, MT	MTPMC	1989

Row	Variety	Accession	Common Name	Species	Origin	Source	Date
74		9069110	western wheatgrass	<i>Pascopyrum smithii</i>			1994
76	Vavilov		Siberian wheatgrass	<i>Agropyron fragile</i>		ARS,UT	1995
77	Douglas		crested wheatgrass	<i>Agropyron desertorum</i>		ARS,UT	1995
78		9076770	dotted gayfeather	<i>Liatris punctata</i>	Sioux Co., ND	C. Hansen	1998
79		9076875	dotted gayfeather	<i>Liatris punctata</i>	ND composite	NDPMC	1998
80	Slate	9058916	intermediate wheatgrass	<i>Elytrigia intermedia</i>		ARS,NE	1990
81	Clarke	9058901	intermediate wheatgrass	<i>Elytrigia intermedia</i>		Swift Current, Sask	1990
82	Greenar	98568	intermediate wheatgrass	<i>Elytrigia intermedia</i>	USSR	WAPMC	1989
83	Amur	131532	intermediate wheatgrass	<i>Elytrigia intermedia</i>	Manchuria, China	NMPMC	1989
84	Tegmar	109219	intermediate wheatgrass	<i>Elytrigia intermedia</i>	Bolu, Turkey	IDPMC	1989
85	MDN759	116252	pubescent wheatgrass	<i>Elytrigia intermedia</i>		ARS, ND	1989
86	Luna	106831	pubescent wheatgrass	<i>Elytrigia intermedia</i>	USSR	NMPMC	1989
87	Topar	107330	pubescent wheatgrass	<i>Elytrigia intermedia</i>	USSR	IDPMC	1989
88	SD54	9058924	intermediate wheatgrass	<i>Elytrigia intermedia</i>		SDSU, A.Boe	1989
89	Reliant	9058868	intermediate wheatgrass	<i>Elytrigia intermedia</i>		ARS, ND	1989
90	Manska	9058891	pubescent wheatgrass	<i>Elytrigia intermedia</i>		ARS, ND	1990
91	Greenleaf	9058915	pubescent wheatgrass	<i>Elytrigia intermedia</i>		Lethbridge, Alberta	1990
92	Bannock	9021076	thickspike wheatgrass	<i>Elymus lanceolatus</i>	Composite OR, ID, WA	IDPMC	1998
93	Jose	150123	tall wheatgrass	<i>Elytrigia elongata</i>	Australia	NMPMC	1989
94	Alkar	93526	tall wheatgrass	<i>Elytrigia elongata</i>	USSR	WAPMC	1989
95		220584	reed grass	<i>Calamogrostis pseudophragmites</i>		MSPMC	1989
97	Dacotah	478002	switchgrass	<i>Panicum virgatum</i>	Breien, ND	NDPMC	1989
98	Forestburg	478001	switchgrass	<i>Panicum virgatum</i>	Forestburg, SD	NDPMC	1989
99	Sunburst	9023429	switchgrass	<i>Panicum virgatum</i>	SD	SDSU, A.Boe	1989
100	Summer	214759	switchgrass	<i>Panicum virgatum</i>	Otoe Co.,NE	SDSU, A.Boe	1989
101	Neb28	9002193	switchgrass	<i>Panicum virgatum</i>	Holt Co., NE	ARS, NE	1989
102	ND3743	9019600	switchgrass	<i>Panicum virgatum</i>	Neb28 field, Ramsey Co., ND	D. Strom	1989
103	ND445	9058940	switchgrass	<i>Panicum virgatum</i>	syn of Blackwell	KSPMC	1989
104		9058857	switchgrass	<i>Panicum virgatum</i>			1989
105	Pathfinder	9002191	switchgrass	<i>Panicum virgatum</i>	NE-KS	ARS, NE	1989
107	Cave-in-rock	469228	switchgrass	<i>Panicum virgatum</i>	southern IL	MOPMC	1989
108	Blackwell	421520	switchgrass	<i>Panicum virgatum</i>	Blackwell, OK	KSPMC	1989
109	Pete	421612	eastern gamagrass	<i>Tripsacum dactyloides</i>	KS/OK	KSPMC	1990
111	Bison	477994	big bluestem	<i>Andropogon gerardii</i>	Oliver Co., ND	NDPMC	1989

Row	Variety	Accession	Common Name	Species	Origin	Source	Date
112	Bonilla	315658	big bluestem	<i>Andropogon gerardii</i>	Beadle Co., SD	NDPMC	1989
113	Sunnyview	9023422	big bluestem	<i>Andropogon gerardii</i>	SD	SDSU, A.Boe	1989
114	Champ	9005158	big bluestem	<i>Andropogon gerardii</i>		Sharp Bro.,KS	1989
115	Pawnee	9005159	big bluestem	<i>Andropogon gerardii</i>	Pawnee Co., NE	Sharp Bro.,KS	1989
116	Rountree	474216	big bluestem	<i>Andropogon gerardii</i>	Moorehead, IA	MOPMC	1989
118		9058858	big bluestem	<i>Andropogon gerardii</i>		SDSU, A.Boe	1989
119		9058859	big bluestem	<i>Andropogon gerardii</i>		SDSU, A.Boe	1989
120		9058860	big bluestem	<i>Andropogon gerardii</i>		SDSU, A.Boe	1989
122	ND1105	9005697	sand bluestem	<i>Andropogon hallii</i>	Grant Co., ND	NDPMC	1989
123	Garden	421277	sand bluestem	<i>Andropogon hallii</i>	Garden Co., NE	KSPMC	1989
124	Goldstrike	9023423	sand bluestem	<i>Andropogon hallii</i>	W&N central NE		1989
126	Tomahawk	478006	Indiangrass	<i>Sorghastrum nutans</i>	ND,SD	NDPMC	1989
127	Holt	434347	Indiangrass	<i>Sorghastrum nutans</i>	Holt Co., NE	Sharp Bro, KS	1989
128		9063117	Indiangrass	<i>Sorghastrum nutans</i>	Rochester FEP	NDPMC	1992
129		9069127	buffalograss	<i>Buchloe dactyloides</i>	Perkins Co., SD	D.Tober	1994
130	Bison		buffalograss	<i>Buchloe dactyloides</i>	OK		1994
131	Pronghorn	9049969	prairie sandreed	<i>Calamovilfa longifolia</i>		KSPMC;ARS,NE	1990
132	ND95	477995	prairie sandreed	<i>Calamovilfa longifolia</i>	Bowman Co., ND	NDPMC	1989
133	Goshen	433949	prairie sandreed	<i>Calamovilfa longifolia</i>	WY	MTPMC	1989
134		477007	prairie sandreed	<i>Calamovilfa longifolia</i>		MIPMC	1989
135	Blaze	9004410	little bluestem	<i>Schizachyrium scoparium</i>	KS,NE		1989
136	Camper	9004460	little bluestem	<i>Schizachyrium scoparium</i>	KS,NE		1989
137	Aldous	421553	little bluestem	<i>Schizachyrium scoparium</i>	Flinthills, KS		1989
138	Cimarron	421552	little bluestem	<i>Schizachyrium scoparium</i>	KS,OK,TX		1989
139	ND4114	9036130	little bluestem	<i>Schizachyrium scoparium</i>	western ND and east Central SD	NDPMC	1989
140	Badlands	9036131	little bluestem	<i>Schizachyrium scoparium</i>	western Dakotas	NDPMC	1989
141	ND4116	9047147	little bluestem	<i>Schizachyrium scoparium</i>	eastern SD and southern MN	NDPMC	1989
142	ND4117	9047148	little bluestem	<i>Schizachyrium scoparium</i>	14 selected plants from central and NE ND	NDPMC	1989
143	ND2466	9047200	little bluestem	<i>Schizachyrium scoparium</i>	low maintenance	NDPMC	1989
144	Killdeer	476981	sideoats grama	<i>Bouteloua curtipendula</i>	ND	NDPMC	1989
145	Pierre	476980	sideoats grama	<i>Bouteloua curtipendula</i>	Stanley Co., SD	NDPMC	1989
146	Butte	477002	sideoats grama	<i>Bouteloua curtipendula</i>	NE	NDPMC	1989

<u>Row</u>	<u>Variety</u>	<u>Accession</u>	<u>Common Name</u>	<u>Species</u>	<u>Origin</u>	<u>Source</u>	<u>Date</u>
147		9069091	redtop	<i>Agrostis alba</i>	Ransom Co., ND	NDPMC	1993
149	Bad River	9058861	blue grama	<i>Bouteloua gracilis</i>	Haakon Co., SD	NDPMC	1989
150	ND3775	9023424	blue grama	<i>Bouteloua gracilis</i>	SD	NDPMC	1989
151	ND264	434443	alkali sacaton	<i>Sporobolus airoides</i>	west of Bowman, ND	NDPMC	1989
152	cycle2	9076693	little bluestem	<i>Schizachyrium scoparium</i>	SD, ND	NDPMC	1995
156	Orbit	9005214	tall wheatgrass	<i>Elytrigia elongata</i>		Swift Current, Sask.	1990
157	Platte	9058930	tall wheatgrass	<i>Elytrigia elongata</i>		ARS, NE	1990
158	Willis	9065916	blue grama	<i>Bouteloua gracilis</i>		NMPMC	1995
161	Rush	281863	intermediate wheatgrass	<i>Elytrigia intermedia</i>	Germany	IDPMC	1990
162	Rush	281864	intermediate wheatgrass	<i>Elytrigia intermedia</i>		IDPMC	1990
163		9076676	silky prairieclover	<i>Dalea villosa</i>	ND	NDPMC	1995
172		9063135	inland saltgrass	<i>Distichlis spicata</i>	Bowman Co., ND	NDPMC	1992
173		9063136	inland saltgrass	<i>Distichlis spicata</i>	Bowman Co., ND	NDPMC	1992
174		9063137	inland saltgrass	<i>Distichlis spicata</i>	Bowman Co., ND	NDPMC	1992
180	ND3651	9008065	maximilian sunflower	<i>Helianthus maximiliani</i>		NDPMC	1990
182	Wytana	346419	fourwing saltbush	<i>Atriplex canescens</i>		MTPMC	1989

INITIAL EVALUATION PLANTING: TECHNICAL REPORT – 1998-1999

Study No.: 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 1984). 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. 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).

Slough sedge (*Carex atherodes*) 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 intent of the study is to evaluate and release a *Carex atherodes* selection adapted to North Dakota, South Dakota, Minnesota and portions of south central Canada. Expected uses are wetland restoration, enhancement, and creation.

Cooperators: USDA Natural Resources Conservation Service and Ducks Unlimited Canada (DUC).

Species Description:

Growth habit: It is a perennial herb with thickened rootstocks which are long scaly rhizomes. It is loosely tufted, growing in loose clumps.





Leaves: 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 leaflike and exceed the inflorescence.

(Picture from USDA 1995)

Flowers: 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.



(Picture from Hurd et. al. 1998)



Seed: 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 trigonous with blunt angles. It is brown in color.

Methods and Materials

Collection:

Date: July through August 1997

Who: USDA, Natural Resources Conservation Service
Ducks Unlimited, Canada

What: Seed < 50 gm when cleaned for each accession

Location: Various sites in South Dakota, North Dakota, Minnesota, Manitoba, and Saskatchewan

How: Seed was hand stripped or heads clipped. Each collection (accession) is a composite of seed from several plants at one location. Table SS-1 provides collection details.

Seed Processing of Collection:

Perigynium was removed from seed by rubbing seed over a rubber corrugated rub board and by 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. Seeds of these accessions were counted out by hand at the PMC and weighed on a Mettler balance scale at Mandan, ARS. Table SS-2 is a list of weights. A range exists for weight of 500 seeds. The average itself ranges from 218,000 to 243,000 depending on method of calculation.

Propagation of Collection:

1998

The amount of seed for propagation was minimal. Preliminary data indicated a low germination. In an effort to increase this, part of the seed was scarified by rubbing seed between medium textured sandpaper, part of the seed was soaked in hot tap water and part of the seed had no treatment.

Seed was planted on blue blotters soaked with distilled water. One hundred seeds/box were planted. Light and temperature in the germinator was set at 30°C/20°C alternating temperature and 12 hours light/12 hours dark alternating with the temperature. Table SS-3 indicates germination of initial collections of the accessions. Once seed germinated, seedlings were transplanted from germinator box to conetainers in the greenhouse using tweezers to carefully move the tiny seedlings. Plants were less than an inch in size when they were transplanted from the germination boxes to the greenhouse conetainers. Approximately 14 plants from each of the accessions that germinated were transplanted to conetainers. The remainder of the seedlings in the germinator boxes was discarded. A medium (without soil) of peat, perlite, and vermiculite was used to grow the plants in the greenhouse. Plants were set in the lath house to acclimate to field conditions before transplanting. Figure SS-1 is a map of the field planting in panel A at the PMC.

Field Maintenance: The field 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. This was to aid in holding water for the plants, as the soils of this field are a Mandan Silt Loam. Drainage on this field is very good as a deep gravel deposit lies below.

Date	Maintenance completed
1998	hand weed
1998	walk-behind roto-till
1998	no chemical
1998	irrigation twice as needed for establishment
1999	hand weed
1999	walk-behind roto-till early
1999	no chemical
1999	removal of berm for weed control
1999	no irrigation

Evaluation

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 06/11/99. 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.

Proposed Activity

Plants that are superior in vigor, growth, and seed production will be selected. Seed harvest from each selection is anticipated. This seed will be propagated and further screening is expected.

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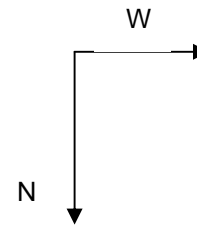
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Figure SS-1. Field map of the slough sedge (*Carex atherodes*) evaluation

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	McClean	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.*

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* specie 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.

plant #	Accession	Year	Rep	Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
1998 collection date: 9/24/1998										
1999 collection date: 6/08/1999										
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	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-leafed			

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

plant #	Accession	Year	Rep	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		dk 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		dk green	1	3	2
1	9076796	1998	1	29	none	none	single stem			
1	9076796	1999	1	27	3		single	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	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, ylw tint			
1	9076799	1999	1	44	1		ylw, seeds, wrong sp.	3	1	1
1	9076799	1998	2	53	100	1				
1	9076799	1999	2	62	1		ylw leaved	3	1	1
1	9076799	1998	3	50	50	2				
1	9076799	1999	3	56	2		ylw, fine leaved	2	1	1
2	9076799	1998	1	53	27	3	fine-lf, ylw tint			
2	9076799	1999	1	57	2		"	2	1	1
2	9076799	1998	2	43	91	2				
2	9076799	1999	2	46	1		"	3	2	1
2	9076799	1998	3	38	77	2				
2	9076799	1999	3	44	2		"	2	1	1
3	9076799	1998	1	46	58	2	fine-lf, ylw, loose crn			
3	9076799	1999	1	44	1		"	3	1	1
3	9076799	1998	2	39	83	1				
3	9076799	1999	2	50	1		"	3	1	1
3	9076799	1998	3	37	110	2				
3	9076799	1999	3	48	1		"	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	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		"	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-leafed			
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	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-leafed			
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	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-leafed			
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	plt 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-leafed			
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		dk 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	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-lf			
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-leafed			
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		"	1		3
2	9076819	1998	2	55	56	2				
2	9076819	1998	2	73	2		"	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		"	2		3
3	9076819	1998	2	80	90	1				
3	9076819	1998	2	89	1		"	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	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				
1	9076821	1998	3	60	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	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		"	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		"	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	Height	Spread	Amount Shoots	Comment	Crown Density	Seed production	Leaf Width
1	9076826	1998	2	55	3		yellow, very fine lf	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 lf	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		dk 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	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-leafed			
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	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		"	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		"	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	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-leafed			
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	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, ylw, 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 grn,wide lf	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		"	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		"	2		2
3	9076845	1998	2	25	55	1	dk dull green			
3	9076845	1998	2	22	1		prostrate, dk green	3		1
1	9076846	1998	1	20	49	3				
1	9076846	1998	1	28	2		Species? Ylw	3		1
1	9076846	1998	2	30	45	2	wrong species			
1	9076846	1998	2	34	2		dk green, very fine lf	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		"	3		1
2	9076846	1998	2	20	70	2	wrong species			
2	9076846	1998	2	36	2		"	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		"	3		1
3	9076846	1998	2	20	50	2	wrong species			
3	9076846	1998	2	37	2		"	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, prostate, dk grn	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	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, dk green	1		2
2	9076847	1998	1	20	5	3				
2	9076847	1998	1	15	3		"	3		2
2	9076847	1998	2	35	65	2				
2	9076847	1998	2	32	1		"	2		2
2	9076847	1998	3	20	55	2				
2	9076847	1998	3	20	1		"	1		2
3	9076847	1998	1	27	70	2				
3	9076847	1998	1	20	1		"	2		2
3	9076847	1998	2	25	67	1				
3	9076847	1998	2	23	1		"	2		2
3	9076847	1998	3	20	55	2				
3	9076847	1998	3	24	2		"	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		dk 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	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		"	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		"	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	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		"	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		"	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	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 <i>Carex atherodes</i>.						
Forage Quality						
<u>Accession</u>	<u>Row</u>	<u>Plant</u>	<u>Stage</u>	<u>%CP*</u>	<u>%ADF**</u>	<u>%NDF***</u>
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

ADVANCED EVALUATION

FIELD EVALUATION PLANTING: TECHNICAL REPORT 1998-1999

Study 38A344X

Study Title: Field evaluation of cool-season grasses for use in livestock forage systems, range, wildlife habitat and water quality improvement.

Introduction: The adaptation and performance of cool-season grasses for pasture, range, wildlife habitat, and water quality improvement have been identified as high priority needs. A field evaluation planting site is needed representative of Major Land Resource Area 102A. This site provides an evaluation of plant materials under uniform soil, culture and management.

Objective: The objective is to conduct advanced evaluation studies to determine the adaptation and performance of selected species and varieties of native and introduced cool-season grasses for livestock forage systems, range, wildlife habitat, and erosion control.

Cooperators: The USDA Natural Resources Conservation Service (NRCS), in cooperation with the University of Minnesota, West Central Experiment Station, Morris, Minnesota.

Location: The site is located in Stevens County, Minnesota, Sec. 31, T. 125 N., R.41 W.

Major Land Resource Area¹: The site is located in Major Land Resource Area (MLRA) 102A, Loess, Till, and Sandy Prairies. This is nearly level to rolling glacial plain mantled by loess except in the north. Slopes are long, smooth, and gentle except the hilly to steep slopes bordering some of the larger stream valleys. Relief is mainly in a few feet to a few tens of feet. Elevations range 1,000 to 2,000 feet.

Soils: The soils on the evaluation site are a Doland silt loam.

Climate: For MLRA 102A, the average annual precipitation is 20 to 30 inches; increasing from north to south and from west to east. About three-fourths falls from midspring to early autumn. The sparse winter precipitation is snow. The average annual temperature is 40 to 50 degrees F, increasing from north to south. The average freeze-free period is 140 to 160 days. The plant hardiness zone is 4a with an average annual minimum temperature of -30 to -20 degrees F. Climatic data recorded at Morris, Minnesota, for 1998-1999 is shown in Table MO-1.

Methods and Materials

Assembly: Thirty-two entries of 21 cool-season species replicated four times are being evaluated (see Figure MO-1). Refer to Table MO-2 for additional information on entries included in the evaluation. Fifty-six non-replicated miscellaneous entries of cool-season and warm-season grasses, forbs, and legumes were also planted for demonstration (see Figure MO-2).

Planting Plan: The experimental design is a randomized complete block with three replications plus an array. Each plot is 6 feet by 25 feet. The array includes 32 entries grouped by species (see Figure MO-1). Each replication includes the same 32 entries which are randomized. The entire planting includes 128 plots.

Site Preparation: The evaluation site was previously a manure trial area. The last application of manure was made in 1971.

Planting Method: The plots were seeded with a modified plot seeder with an 8 inches row spacing. A separate packet of seed was prepared for each row of the planting to provide for exact seeding rates. Seed packets were

¹ Land Resource Regions and Major Land Resource Areas of the United States, USDA, SCS, Agric. Handbook 296, 156 pp. Rev. Dec. 1981.

prepared to plant each entry at the recommended seeding rate as specified in the North Dakota NRCS Technical Guide.

Planting Date: The plots were seeded the week of April 29, 1998.

Fertilization: None

Weed Control/Plot Management: Mowed spring of 1999. No herbicides were applied.

Evaluation and Measurements:

1998: On June 8, 1998, a site visit was made and the plots were evaluated for stand rating, vigor, leaf stage, and weed competition. A second visit was made on September 1, 1998, and stand rating and weed competition were evaluated. Ten frames per plot were taken to determine percent stand. The data taken is summarized in Table MO-3. After one growing season, Latar orchardgrass and Fawn tall fescue had the best stands, with the least amount of weed competition. It remains to be seen how winter hardy some of the varieties are. The miscellaneous entries were rated for stand, vigor, leaf stage, and weed competition (Table MO-5). Weed competition was rated high on many entries especially the forbs and legumes. Alfalfa was abundant on some plots.

1999: In April, the plots were rated for stand establishment, vigor and weed competition. The data taken is summarized in Table MO-4. Most of the varieties in the replicated cool season grass plots had acceptable stands, with orchardgrass, creeping foxtail, and the tall wheatgrasses having the better stands. In the second week of August we returned to the plots with the small forage harvester to clip samples and determine forage production on a pounds per acre basis. At that time, most of the plots, which had less than a 50 percent stand in the spring, were not sampled. Because of the poor stand, weeds, especially quackgrass had moved in. The grasses, which were not sampled, included Russian wildrye, green needlegrass, thickspike wheatgrass, and Altai wildrye. Of the grasses that were sampled, the highest forage producers were two of the tall wheatgrass varieties. At that time the average height of the grasses was measured, as well as stand rating and weed competition. In late September, the regrowth was measured. Stand ratings were also taken in September on the nonreplicated miscellaneous plots (see Figure MO-2 for plot layout map). These grasses have been slow at getting established, due to competition from weeds (see Table MO-5 for stand ratings). The miscellaneous entries were rated for stand (Table MO-5). Weed competition continues to be a problem for many entries, primarily alfalfa and perennial thistle species. The forb and legume entries failed to establish due to weed competition.

Table No. MO-1: 1998-1999 Weather Summary - Official Station - Morris, Minnesota

Month	Mean Temperature			Precipitation (inches)				
	(degrees Fahrenheit)			Actual		Normal	Deviation from Normal	
	1998	1999	Normal	1998	1999		1998	1999
January	12.0	7.9	7.1	1.03	1.27	0.91	0.12	0.36
February	27.4	24.4	12.9	1.18	0.19	0.54	0.64	-0.35
March	27.5	31.9	26.5	1.13	1.64	1.31	-0.18	0.33
April	48.7	45.5	43.1	1.61	1.32	2.11	-0.50	-0.79
May	63.0	59.1	56.3	3.13	3.75	3.05	0.08	0.70
June	64.0	66.9	65.9	5.59	3.31	4.11	1.48	-0.80
July	71.2	73.4	70.8	4.19	4.93	3.90	0.29	1.03
August	71.0	68.8	68.2	3.59	4.91	3.59	0.00	1.32
September	65.6	58.6	57.8	0.31	2.55	3.31	-3.00	-0.76
October	49.4	45.3	45.9	5.14	0.31	2.44	2.70	-2.13
November	32.4	39.1	29.5	1.27	0.07	1.28	-0.01	-1.21
December	22.6	23.2	13.5	0.23	0.32	0.99	-0.76	-0.67
Annual	46.2	45.3	41.5	28.40	24.57	27.54	0.86	-2.97
				1998	1999			
		Last Frost (28 degrees)		24-Mar	18-Apr			
		First Frost (28 degrees)		03-Nov	02-Oct			
		Frost Free Period		223 days	166 days			

Table MO-2. Study 38A343X, List of Entries, Field Evaluation of Cool-Season Grasses for Pasture, Rangeland, Wildlife Habitat and Erosion Control.

ARRAY #	VARIETY	ACCESSION	COMMON NAME	SCIENTIFIC NAME	ORIGIN	SOURCE
1	Nordan	PI-469225	crested wheatgrass	<i>Agropyron desertorum</i>	Asia	Agronomy Seed Farm
2	Hycrest	9028605	crested X fairway	<i>Agropyron cristatum x desertorum</i>	Asia	PMC, Meeker, CO
3	Reliant	PI-556987	intermediate wheatgrass	<i>Elytrigia intermedia</i>	Asia	ARS, Mandan, ND
4	Clarke	9058901	intermediate wheatgrass	<i>Elytrigia intermedia</i>	Asia	Dept. of Ag., SK, Canada
5	Oahe	9006492	intermediate wheatgrass	<i>Elytrigia intermedia</i>	Asia	SDSU, Brookings, SD
6	Greenleaf	9058915	pubescent wheatgrass	<i>Elytrigia intermedia</i>	Asia	Dept. of Ag., AB, Canada
7	Manska	PI-562527	pubescent wheatgrass	<i>Elytrigia intermedia</i>	Asia	ARS, Mandan, ND
8	Orbit	9005214	tall wheatgrass	<i>Elytrigia elongata</i>	Turkey	Dept. of Ag., SK, Canada
9	Alkar	PI-98526	tall wheatgrass	<i>Elytrigia elongata</i>	Russia	Ranier Seeds
10	Jose	PI-150123	tall wheatgrass	<i>Elytrigia elongata</i>	Eurasia	PMC, Los Lunas, NM
11	Magna	9058914	smooth bromegrass	<i>Bromus inermis</i>	Russia	Newfield Seed Co.
12	Rebound	9023426	smooth bromegrass	<i>Bromus inermis</i>	Russia	Domestic Seed & Supply
13	Lincoln	9004246	smooth bromegrass	<i>Bromus inermis</i>	Russia	U of Nebraska, Lincoln, NE
14	S-9183	9058932	smooth X meadow bromegrass	<i>Bromus inermis x biebersteinii</i>	Asia	Dept. of Ag., SK, Canada
15	Paddock	9058934	meadow bromegrass	<i>Bromus biebersteinii</i>	Russia	Dept. of Ag., SK, Canada
16	Regar	PI-172390	meadow bromegrass	<i>Bromus biebersteinii</i>	Turkey	PMC, Aberdeen, ID
17	Swift	9058900	Russian wildrye	<i>Psathyrostachys juncea</i>	Russia	Dept. of Ag., SK, Canada
18	Mankota	9058867	Russian wildrye	<i>Psathyrostachys juncea</i>	Russia	ARS, Mandan, ND
19	Bozoisky	9027398	Russian wildrye	<i>Psathyrostachys juncea</i>	Russia	PMC, Bridger, MT
20	Arthur	9058909	Dahurian wildrye	<i>Elymus dahuricus</i>	China	Newfield Seed Co.
21	Eejay	9058935	Altai wildrye	<i>Leymus angustus</i>	Russia	Dept. of Ag., SK, Canada
22	Newhy	9052852	hybrid bluebunch	<i>Pseudoroegneria sp. x Elytrigia sp.</i>		PMC, Los Lunas, NM
23	Garrison	PI-436704	creeping foxtail	<i>Alopecurus arundinaceus</i>	Russia	PMC, Bismarck, ND
24	Climax	9082608	timothy	<i>Phleum pratense</i>	Europe	Newfield Seed Co.
25	Fawn	9056173	tall fescue	<i>Festuca arundinacea</i>	Europe	Wind River Seed
26	Latar	PI-111536	orchardgrass	<i>Dactylis glomerata</i>	Russia	PMC, Pullman, WA
27	Palaton		reed canarygrass	<i>Phalaris arundinacea</i>	United States	Wind River Seed
28	Critana	PI-469235	thickspike wheatgrass	<i>Elymus lanceolatus</i>	Montana	PMC, Bridger, MT
29	Rodan	PI-477993	western wheatgrass	<i>Pascopyrum smithii</i>	North Dakota	PMC, Bismarck, ND
30	Flintlock	9004443	western wheatgrass	<i>Pascopyrum smithii</i>	Nebraska	ARS, Lincoln, NE
31	Lodorm	9003992	green needlegress	<i>Nassella viridula</i>	North Dakota	Agronomy Seed Farm
32	Mandan	9058908	Canada wildrye	<i>Elymus canadensis</i>	North Dakota	ARS, Mandan, ND

Figure MO-1. Study 38A343X, Cool-Season Grass Plots, Morris, MN, seeded 4/28/98.

← E

Array		Rep 1	Rep 2	Rep 3	
1.	crested wheatgrass	Nordan	7	17	15
2.	crested X fairway	Hycrest	18	15	10
3.	intermediate wheatgrass	Reliant	24	26	27
4.	intermediate wheatgrass	Clarke	32	31	14
5.	intermediate wheatgrass	Oahe	31	1	5
6.	pubescent wheatgrass	Greenleaf	3	5	2
7.	pubescent wheatgrass	Manska	12	13	20
8.	tall wheatgrass	Orbit	13	25	26
9.	tall wheatgrass	Alkar	6	10	4
10.	tall wheatgrass	Jose	16	14	12
11.	smooth bromegrass	Magna	5	11	16
12.	smooth bromegrass	Rebound	17	6	8
13.	smooth bromegrass	Lincoln	10	9	9
14.	smooth X meadow bromegrass	S-9183	25	7	23
15.	meadow bromegrass	Paddock	9	30	19
16.	meadow bromegrass	Regar	1	4	21
17.	Russian wildrye	Swift	4	19	13
18.	Russian wildrye	Mankota	11	28	17
19.	Russian wildrye	Bozoisky	8	3	3
20.	Dahurian wildrye	Arthur	28	8	24
21.	Altai wildrye	Eejay	19	20	30
22.	hybrid bluebunch	Newhy	15	21	1
23.	creeping foxtail	Garrison	2	18	6
24.	timothy	Climax	29	16	7
25.	tall fescue	Fawn	14	22	22
26.	orchardgrass	Latar	20	24	31
27.	reed canarygrass	Palaton	26	27	11
28.	thickspike wheatgrass	Critana	21	12	18
29.	western wheatgrass	Rodan	30	2	32
30.	western wheatgrass	Flintlock	22	23	29
31.	green needlegrass	Lodorm	27	29	25
32.	Canada wildrye	Mandan	23	32	28

Figure MO-2. Plot Layout of Miscellaneous Species.

U of M WEST CENTRAL EXPERIMENT STATION- MORRIS, MN
 Miscellaneous Plots (non-replicated)
 Seeded April 29, 1998 – Plot Size 6' X 25'

1.	switchgrass	Dacotah		
2.	switchgrass	Forestburg		
3.	switchgrass	Sunburst	T	
4.	switchgrass	Summer	r	
5.	switchgrass	Neb-28	i	
6.	switchgrass	Pathfinder	a	
7.	big bluestem	Bison	t	
8.	big bluestem	Bonilla	h	
9.	big bluestem	Sunnyview	a	
10.	big bluestem	Pawnee	l	
11.	big bluestem	Champ	a	
12.	big bluestem (late)	9063121	w	
13.	big bluestem (early)	9063122	n	
14.	Indiangrass	Tomahawk		
15.	Indiangrass	Holt		
16.	little bluestem	Badlands	T	
17.	little bluestem	Camper	a	
18.	little bluestem	Itasca	l	
19.	prairie sandreed	Goshen	l	
20.	prairie sandreed	Pronghorn		
21.	sand bluestem	Garden		
22.	sand bluestem	Goldstrike	F	
23.	sideoats grama	Pierre	e	
24.	sideoats grama	Killdeer	s	
25.	sideoats grama	Butte	c	
26.	blue grama	Bad River	u	
27.	buffalograss	Tatanka	e	
28.	buffalograss	Cody		
29.	prairie cordgrass	Red River		
30.	mammoth wildrye	ND-691		
31.	mammoth wildrye	Volga		
32.	altai wildrye	Prairieland		
33.	altai wildrye	Pearl		
34.	beardless wildrye	Shoshone		
35.	bluebunch beardless wildrye	Whitmar		
36.	bluebunch wheatgrass	Goldar		
37.	bluebunch wheatgrass	Secar		
38.	sheep fescue	Covar		
39.	hard fescue	Durar		
40.	streambank wheatgrass	Sodar		
41.	tall wheatgrass	Elbee		
42.	western wheatgrass	Walsh		
43.	western wheatgrass	Rosana		
44.	western wheatgrass	Barton		
45.	basin wildrye	Trailhead		
46.	slender wheatgrass	Revenue		
47.	slender wheatgrass	Adanac		
48.	slender wheatgrass	Primar		
49.	stiff sunflower			
50.	Maximilian sunflower			
51.	Canada milkvetch			
52.	leadplant			
53.	silky prairieclover			
54.	white prairieclover			
55.	purple prairie clover			
56.	two-groove milkvetch			

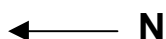


Table MO-3. Field Evaluation of Cool-season Grasses, Morris, MN – 1998 data

Cultivar	Common name	Stand Rating		% stand	Vigor	Leaf Stage	Weed Competition	
		08-Jun	01-Sep	01-Sep	08-Jun	08-Jun	08-Jun	01-Sep
Nordan	crested wheatgrass	3	6	16	3	3	9	6
Hycrest	crested X fairway	2	5	22	2	4	7	4
Reliant	intermediate wheatgrass	5	4	52	5	3	9	5
Clarke	intermediate wheatgrass	5	6	28	5	3	9	5
Oahe	intermediate wheatgrass	5	6	30	5	3	9	6
Greenleaf	pubescent wheatgrass	5	4	46	3	3	9	5
Manska	pubescent wheatgrass	3	4	56	3	3.5	9	4
Orbit	tall wheatgrass	3	4	36	3	3	9	5
Alkar	tall wheatgrass	3	5	34	3	3	9	5
Jose	tall wheatgrass	3	4	47	3	3	9	3
Magna	smooth brome	3	3	61	3			3
Rebound	smooth brome	5	4	65	3	3.5	9	5
Lincoln	smooth brome	5	3	54	3	3.5	9	6
S-9183	smooth X meadow brome	5	4	57	5	3	7	3
Paddock	meadow brome	3	3	69	2	4	7	3
Regar	meadow brome	3	4	52	3	4	9	4
Swift	Russian wildrye	3	6	12	5	3	9	6
Mankota	Russian wildrye	5	6	15	5	3	9	6
Bozoisky	Russian wildrye	3	7	14	5	4	7	5
Arthur	Dahurian wildrye	3	3	74	3	3	5	3
Eejay	Altai wildrye	3	9	2	5	3.5	5	6
Newhy	hybrid bluebunch	3	4	51	3	4	5	4
Garrison	creeping foxtail	3	3	70	3	4	5	4
Climax	timothy	3	3	62	3	3	9	5
Fawn	tall fescue	3	2	82	3	3	9	2
Latar	orchardgrass	3	2	83	3	3	5	2
Palaton	reed canarygrass	5	4	69	5	3	5	3
Critana	thickspike wheatgrass	3	8	3	3	4	7	5
Rodan	western wheatgrass	3	6	18	3	4	7	4
Flintlock	western wheatgrass	5	7	6	3	3	5	5
Lodorm	green needlegrass	3	8	4	7	2	9	6
Mandan	Canada wildrye	3	5	33	3	3	9	4

Stand Rating: 1=excellent, 9=very poor; Vigor: 1=excellent, 9=very poor; Leaf stage: no. of leaves, st=stooling; Weed competition: 1=none, 9=severe

Table MO-4. Field Evaluation of Cool-season grasses, Morris, MN – 1999 Data

Cultivar	Common name	% stand	stand	vigor	weed competition		height	quackgr	forage production (lbs/acre)				regrowth
							(inches)	comp	Array	Rep 1	Rep 2	mean	(inches)
		27-Apr	11-Aug	27-Apr	27-Apr	11-Aug	11-Aug	11-Aug	11-Aug	11-Aug			27-Sep
Nordan	crested wheatgrass	62	3	4	3	4	39	7	3223	4416	3549	3963	13
Hycrest	crested X fairway	64	2	3	3	3	43	9	3277	4425	3680	3794	12
Reliant	intermediate wheatgrass	55	2	3	3	2	56	4	6115	7660	6688	6821	14
Clarke	intermediate wheatgrass	59	2	4	3	2	56	6	5932	6845	6617	6465	13
Oahe	intermediate wheatgrass	57	2	3	4	2	55		4674	6668	6379	5907	14
Greenleaf	pubescent wheatgrass	72	2	3	3	2	57	4	4664	7169	6887	6240	15
Manska	pubescent wheatgrass	59	2	3	3	2	53	4	5068	4811	6337	5405	15
Orbit	tall wheatgrass	80	1	4	3	2	61	8	6382	8052	7210	7214	16
Alkar	tall wheatgrass	82	1	3	3	2	62	8	6127	8644	6606	7125	17
Jose	tall wheatgrass	83	1	3	3	2	62	5	6025	7619	4632	6092	14
Magna	smooth brome	64	2	4	4	2	51	6	5443	4268	4115	4609	16
Rebound	smooth brome	64	1	3	2	2	51	8	4956	4085	3622	4221	18
Lincoln	smooth brome	68	2	3	2	2	51	9	4857	4925	4378	4720	17
S-9183	smooth X meadow brome	71	2	4	3	2	51	8	4249	3582	5469	4433	16
Paddock	meadow brome	91	2	3	2	2	50	3	3964	3597	3575	3712	18
Regar	meadow brome	81	2	3	3	2	49	8	4609	4521	3645	4258	19
Swift	Russian wildrye	32	5	5	6	6	24	9	0	0	0	0	12
Mankota	Russian wildrye	41	5	4	5	6	38	7	0	0	0	0	11
Bozoisky	Russian wildrye	47	4	4	4	5	36	9	0	0	0	0	14
Arthur	Dahurian wildrye	85	2	3	2	2	51	8	4411	5073	4269	4584	11
Eejay	Altai wildrye	4	6	5	6	7	34	9	0	0	0	0	14
Newhy	hybrid bluebunch	67	2	2	4	2	52	5	4813	5370	4662	4948	16
Garrison	creeping foxtail	92	2	2	3	3	41	8	3887	4163	4278	4109	15
Climax	timothy	77	3	4	3	4	45	6	4024	4852	4385	4420	12
Fawn	tall fescue	88	2	3	2	3	41	2	4653	3777	3792	4074	19
Latar	orchardgrass	95	2	3	2	2	41	8	3129	3436	2639	3068	12
Palaton	reed canarygrass	74	1	3	3	2	51	7	4164	7419	5164	5582	20
Critana	thickspike wheatgrass	19	6	5	5	8	37	5	0	0	0	0	9
Rodan	western wheatgrass	59	2	4	4	2	39	8	3058	4222	4132	3804	10
Flintlock	western wheatgrass	26	3	5	5	3	43	8	2748	4098	3223	3356	12
Lodorm	green needlegrass	12	5	6	6	6	52	9	0	0	0	0	16
Mandan	Canada wildrye	79	1	3	2	2	55	4	5817	6454	4715	5662	11

Stand rating: 1=excellent, 9=very poor; Vigor: 1=excellent, 9=very poor; Weed competition: 1=none, 9=severe; Quackgrass competition: 1=none, 9=severe

Table MO-5. Field Evaluation of Miscellaneous Plots, 1998-1999.

Cultivar	Common name	Stand Rating			Vigor	Leaf Stage	Weed Competition	
		6/8/98	9/1/98	9/27/99	6/8/98	6/8/98	6/8/98	9/1/98
Dacotah	switchgrass	2	5	5	3	3	3	7
Forestburg	switchgrass	1	5	4	3	3	3	7
Sunburst	switchgrass	1	4	3	2	3.5	3	7
Summer	switchgrass	1	4	3	2	3	2	7
Neb-28	switchgrass	1	3	3	2	3	2	6
Pathfinder	switchgrass	1	3	2	2	3	2	6
Bison	big bluestem	2	2	5	3	4	2	6
Bonilla	big bluestem	2	5	4	3	4	3	7
Sunnyview	big bluestem	3	5	4	3	3.5	2	7
Pawnee	big bluestem	3	4	4	3	3.5	2	6
Champ	big bluestem	3	5	5	3	3	3	7
9063121	big bluestem	7	5	5	5	3	3	7
9063122	big bluestem	5	5	6	3	4	5	7
Tomahawk	Indiangrass	3	5	5	3	3	5	7
Holt	Indiangrass	2	3	3	2	4	5	7
Badlands	little bluestem	5	6	5	3	4	5	7
Camper	little bluestem	2	4	5	3	3.5	5	7
Itasca	little bluestem	3	6	7	3	4	5	7
Goshen	prairie sandreed	4	6	8	3	4	5	7
Pronghorn	prairie sandreed	3	6	8	3	4	4	7
Garden	sand bluestem	2	6	8	2	5	3	7
Goldstrike	sand bluestem	3	6	8	3	4	4	7
Pierre	sideoats grama	3	4	7	2	4	5	7
Killdeer	sideoats grama	3	4	7	3	4	5	7
Butte	sideoats grama	3	4	6	2	5	5	7
Bad River	blue grama	2	4	8	2	4	3	7
Tatanka	buffalograss	3	4	8	2	5	5	8
Cody	buffalograss	5	5	8	2	5	5	8
Red River	prairie cordgrass	7	7	8	4	3	5	8
ND-691	mammoth wildrye	2	8	8	1	st	5	8
Volga	mammoth wildrye	2	8	8	1	st	5	8
Prairieland	altai wildrye	2	6	7	2	st	5	7
Pearl	altai wildrye	2	6	6	2	st	5	7
Shoshone	beardless wildrye	2	5	3	3	st	5	7
Whitmar	bluebunch beardless wildrye	2	7	8	3	st	5	8
Goldar	bluebunch wheatgrass	2	7	8	2	st	5	8
Secar	bluebunch wheatgrass	2	8	8	2	st	5	8
Covar	sheep fescue	5	8	6	3	st	5	8
Durar	hard fescue	3	5	6	2	st	5	8
Sodar	streambank wheatgrass	3	6	6	3	4	5	8
Elbee	tall wheatgrass	2	6	9	3	3	5	8
Walsh	western wheatgrass	2	4	5	2	4	5	6
Rosana	western wheatgrass	2	3	4	1	4	5	5
Barton	western wheatgrass	2	6	6	2	4	5	7
Trailhead	basin wildrye	2	7	8	1	4	5	8
Revenue	slender wheatgrass	2	3	6	1	st	5	6
Adanac	slender wheatgrass	3	4	5	2	st	5	6
Primar	slender wheatgrass	2	4	5	1	st	5	6

Table MO-5. Field Evaluation of Miscellaneous Plots, 1998-1999 (continued).

Cultivar	Common name	Stand Rating			Vigor	Leaf Stage	Weed Competition	
		6/8/98	9/1/98	9/27/99	6/8/98	6/8/98	6/8/98	9/1/98
	stiff sunflower	7			3	2	5	8
	maximilian sunflower	7			2	3	6	8
	Canada milkvetch	5			3	2	6	8
	leadplant	6			3	2	6	8
	silky prairieclover	5			3	3	6	8
	white prairieclover	5			3	4	6	8
	purple prairieclover	5			3	4	6	8
	two-groove milkvetch	5			2	4	7	8

Stand rating: 1= excellent, 9=very poor

Vigor: 1= excellent, 9=very poor

Leaf Stage: number of leaves, st=stooling

Weed Competition: 1=none, 9=severe

FIELD EVALUATION PLANTING: TECHNICAL REPORT 1998-1999

Study 38A348X

Study Title: Field evaluation of warm-season grasses for use in livestock forage systems, wildlife habitat and water quality improvement

Introduction: Adaptation and performance of warm-season grasses for livestock forage systems, wildlife habitat, and water quality improvement is not known for Major Land Resource Area (MLRA) 054 in North and South Dakota. Warm-season grasses would offer livestock food and wildlife habitat at a time when many of the cool-season species are dormant or not productive.

Objective: The objective is to determine the adaptation, and performance of selected species and varieties of native warm-season grasses for wildlife habitat, livestock forage systems, and water quality improvement. Stand establishment, forage quality and forage production will be evaluated. Knowing the optimum time of production and quality of these grasses is important for grazing and haying management.

Cooperators: USDA Natural Resources Conservation Service
North Dakota State University (NDSU)
Hettinger Research and Extension Center
Adams County Soil Conservation District
Joseph Clement, landowner

Site Description: SE ¼ of the SE ¼ of sec.24, T. 129 N., R. 96 W., Adams County, North Dakota. This is approximately 2 miles south of the city of Hettinger, ND. Precipitation of the area averages 16 inches per year. Elevation is 2,700 feet and slope of the land is 1-3 percent.

Soils: Shambo loam, sandy loam texture.

Major Land Resource Area: MLRA 54. Nearly all of the land in this MLRA is farms and ranches which is a combination of livestock production and grain farming. About three-fifths of the area is in native grasses and shrubs that are grazed. The less sloping soils, making up about one-third of the total area are dry farmed. Wheat, other small grains, feed grains, hay, silage corn, and flax are the principal crops. Elevation is 500 m in the east and gradually slopes to about 1100 m in the west. The rolling plain is underlain by soft calcareous shale, siltstone, and sandstone. Buttes, badland, and moderately steep slopes are adjacent to major valleys.

Climate: Adams County has a continental, semiarid climate. Summers are usually quite warm. They are characterized by frequent spells of hot weather and occasional cool days. The county is very cold in winter, when arctic air frequently surges over the area. Most precipitation falls during the warm period and is normally heaviest in late spring and early summer. In winter, snow is usually in drifts, leaving large areas of bare ground.

The average winter temperature is 17 degrees F, and average daily minimum temperature is 6 degrees. The average annual precipitation in MLRA 54 is 12.7 to 17.7 inches. The total annual precipitation in Adams County is about 16 inches. Of this, 13 inches, or about 80 percent, usually falls from April through September. In two years out of ten, the rainfall in April through September is less than 10 inches. The average seasonal snowfall is about 29 inches. Climatic data recorded at Hettinger, North Dakota, for 1998-1999 is shown in Table HE-1.

Potential Natural Vegetation: This area supports natural prairie vegetation. Western wheatgrass, blue grama, needleandthread, and green needlegrass are dominant species. Prairie sandreed and little bluestem

are important species on the very shallow soils. Buffaloberry, chokecherry, and prairie rose are common in draws and narrow valleys.

Methods and Materials

Assembly: A total of 17 entries were replicated three times. The 17 entries were comprised of 9 species with two accessions per specie. *Spartina pectinata* was the exception, with only one accession.

Planting Plan: The experimental design is a randomized complete block, with three replications and an array. Each plot is 6 feet wide and 25 feet long. The borders were planted with Bison big bluestem. In between the first and second replication, three varieties of buffalograss were planted in the border area. See Figure HE-1 for the planting plan.

Site Preparation: The plot was in an area previously planted to a CRP mix mostly composed of intermediate/pubescent wheatgrass. The site was clean tilled in the fall of 1997 and sprayed with glyphosate. In 1998, the site was cultivated, harrowed, packed and then planted on May 5, 1998.

Planting Method: The plots were seeded using a 6-foot Truax/Kincaid small plot seeder. The drill was equipped with double disc openers and a cone attachment for metering the seed for each row. See Figure HE-1 for planting map and seeding rates.

Maintenance: Plots were mowed off in the spring of 1999. On May 20, 1999 the following chemicals were applied by the Hettinger Research Extension Center:

Chemical Applied	Purpose	Date of Application
½ oz Peak		May 20, 1999
1pt.ac Buctril for broadleaf weed control	broadleaf weed control	May 20, 1999
10 oz of a chemical with floroxyplur as the active ingredient	kochia control	May 20, 1999

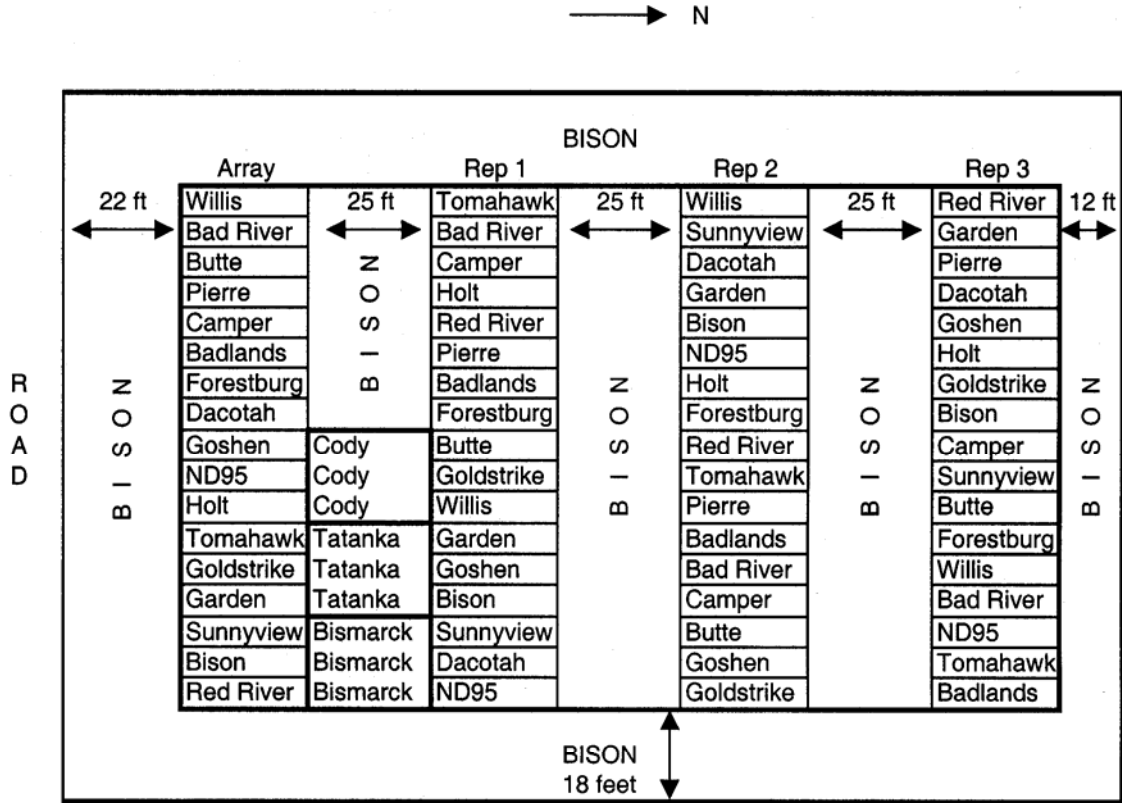
Alleys were mowed and invading wheatgrass plants were hand-weeded out of the plots in 1998 and 1999.

Evaluation and Measurement: The PMC was responsible for stand evaluation. Forage production and forage yield evaluations were conducted by Dr. Kevin Sedivec and graduate student Donovan Craig from North Dakota State University Animal and Range Science Department. Forage was clipped at various intervals of time throughout the growing season. Samples were taken in 1998 and 1999 and will be taken in 2000. Quantities were measured and forage is being analyzed for crude protein, ADF, and NDF for each of the clippings. Method of evaluation and results of their work will not be included in this report. It will be included in the Plant Materials Center 2000-2001 Technical Report. Listed in Table HE-2 are the data collected by the PMC in 1998 and 1999.

Results and Conclusions: The extremely dry conditions during the seeding year of 1998 contributed to somewhat poor stand establishment. As was expected, sideoats and blue grama establishment overall was good. Big bluestem and switchgrass growth was noteworthy under such harsh conditions.

Figure HE-1. Planting map and seeding rates, study 38A348X.

Study 38A348X North Dakota State University, Hettinger Research and Extension Center. Field evaluation of warm-season grasses for use in livestock forage systems, wildlife habitat, and water quality improvement.



Planting Date: May 5, 1998
 Plot Size: 6 feet X 25 feet
 Firebreak on North, East, and West sides

Seeding Rate (lb/ac)	Species	Varieties
8.3	big bluestem	Bison, Sunnyview
12.5	sand bluestem	Garden, Goldstrike
7.1	sideoats grama	Pierre, Butte
2.0	blue grama	Bad River, Willis
6.0	prairie sandreed	ND95, Goshen
6.8	switchgrass	Dacotah, Forestburg
5.3	little bluestem	Badlands, Camper
8.3	Indiangrass	Tomahawk, Holt
7.5	prairie cordgrass	Red River
3.0 lb/1000 ft ²	buffalograss	Tatanka, Cody, Bismarck

Table No. HE-1: 1998-1999 Weather Summary - Official Station - Hettinger, North Dakota

	Mean Temperature			Precipitation (inches)				
	(degrees Fahrenheit)			Actual			Deviation from Normal	
Month	1998	1999	Normal	1998	1999*	Normal	1998	1999
January	16.6	N/A	12.7	0.24	0.91	0.29	-0.05	0.62
February	31.1	N/A	18.1	1.47	0.52	0.26	1.21	0.26
March	21.5	N/A	28.4	0.60	0.10	0.56	0.04	-0.46
April	43.8	N/A	41.9	0.50	1.83	1.86	-1.36	-0.03
May	55.7	N/A	53.3	1.37	3.44	2.82	-1.45	0.62
June	58.1	N/A	63.4	3.33	3.17	3.40	-0.07	-0.23
July	71.7	N/A	70.1	1.17	1.48	2.05	-0.88	-0.57
August	71.9	N/A	68.2	1.57	3.63	1.53	0.04	2.10
September	64.6	N/A	56.3	0.57	2.08	1.52	-0.95	0.56
October	45.3	N/A	44.8	4.18	0.56	1.02	3.16	-0.46
November	33.4	N/A	28.8	0.62	0.14	0.39	0.23	-0.25
December	22.5	N/A	16.0	M	0.26	0.41	M	-0.15
Annual	44.7	N/A	41.8	15.62	18.12	16.11	-0.49	2.01

*Data not available for Hettinger station, data used is from Reeder, North Dakota, M=missing data, N/A=data not available

			1998	1999			
		Last Frost (28 degrees)	N/A	N/A			
		First Frost (28 degrees)	N/A	N/A			
		Frost Free Period	N/A	N/A			

Table HE-2. Hettinger Warm-Season Grass Field Evaluation Planting, 1998-1999 data.

<u>Date</u>	<u>Species</u>	<u>Variety</u>	<u>Rep</u>	<u>% Stand</u>	<u>Stand</u>	<u>Vigor</u>	<u>Leaf Stage</u>	<u>Seed Prod.</u>	<u>Weed Comp.</u>	<u>Height (inches)</u>
06/30/1998	Andropogon gerardii	Bison	1		4	4	4		3	3
08/11/1998	Andropogon gerardii	Bison	1	32.5					4	
06/29/1999	Andropogon gerardii	Bison	1	54					5	13
09/13/1999	Andropogon gerardii	Bison	1		3	3		5	3	34
06/30/1998	Andropogon gerardii	Bison	2		5	5	4		3	3
08/11/1998	Andropogon gerardii	Bison	2	18					4	
06/29/1999	Andropogon gerardii	Bison	2	41					6	14
09/13/1999	Andropogon gerardii	Bison	2		3	3		5	4	35
06/30/1998	Andropogon gerardii	Bison	3		6	4	5		2	3
08/11/1998	Andropogon gerardii	Bison	3	23.5					3	
06/29/1999	Andropogon gerardii	Bison	3	39.5					6	17
09/13/1999	Andropogon gerardii	Bison	3		2	3		5	4	36
06/30/1998	Andropogon gerardii	Sunnyview	1		6	3	4		3	3
08/11/1998	Andropogon gerardii	Sunnyview	1	33.5					3	
06/29/1999	Andropogon gerardii	Sunnyview	1	31					6	13
09/13/1999	Andropogon gerardii	Sunnyview	1		4	4		7	4	29
06/30/1998	Andropogon gerardii	Sunnyview	2		4	5	3		3	4
08/11/1998	Andropogon gerardii	Sunnyview	2	25.5					4	
06/29/1999	Andropogon gerardii	Sunnyview	2	23.5					7	17
09/13/1999	Andropogon gerardii	Sunnyview	2		4	3		5	5	35
06/30/1998	Andropogon gerardii	Sunnyview	3		7	4	4		2	2
08/11/1998	Andropogon gerardii	Sunnyview	3	23					3	
06/29/1999	Andropogon gerardii	Sunnyview	3	30					6	15
09/13/1999	Andropogon gerardii	Sunnyview	3		3	4		6	4	30
06/30/1998	Andropogon hallii	Garden	1		5	3	5		3	4
08/11/1998	Andropogon hallii	Garden	1	31					4	
06/29/1999	Andropogon hallii	Garden	1	47					6	13

Table HE-2 (continued)										
Date	Species	Variety	Rep	% Stand	Stand	Vigor	Leaf Stage	Seed Prod.	Weed Comp.	Height (inches)
09/13/1999	Andropogon hallii	Garden	1		3	2		3	4	36
06/30/1998	Andropogon hallii	Garden	2		5	3	4		3	3
08/11/1998	Andropogon hallii	Garden	2	31.5					3	
06/29/1999	Andropogon hallii	Garden	2	52					8	13
09/13/1999	Andropogon hallii	Garden	2		2	1		2	3	42
06/30/1998	Andropogon hallii	Garden	3		6	4	4		3	4
08/11/1998	Andropogon hallii	Garden	3	39					3	
06/29/1999	Andropogon hallii	Garden	3	24.5					7	10
09/13/1999	Andropogon hallii	Garden	3		3	3		4	3	31
06/30/1998	Andropogon hallii	Goldstrike	1		7	3	5		3	4
08/11/1998	Andropogon hallii	Goldstrike	1	23.5					3	
06/29/1999	Andropogon hallii	Goldstrike	1	39.5					6	9
09/13/1999	Andropogon hallii	Goldstrike	1		4	3		6	6	36
06/30/1998	Andropogon hallii	Goldstrike	2		7	3	4		4	3
08/11/1998	Andropogon hallii	Goldstrike	2	40.5					3	
06/29/1999	Andropogon hallii	Goldstrike	2	48.5					5	11
09/13/1999	Andropogon hallii	Goldstrike	2		3	2		2	4	40
06/30/1998	Andropogon hallii	Goldstrike	3		6	4	4		2	3
08/11/1998	Andropogon hallii	Goldstrike	3	18.5					3	
06/29/1999	Andropogon hallii	Goldstrike	3	16.5					7	17
09/13/1999	Andropogon hallii	Goldstrike	3		3	4		5	4	35
06/30/1998	Bouteloua curtipendula	Butte	1		3	3	5		3	4
08/11/1998	Bouteloua curtipendula	Butte	1	34.5					4	
06/29/1999	Bouteloua curtipendula	Butte	1	71					4	11
09/13/1999	Bouteloua curtipendula	Butte	1		1	1		1	2	30
06/30/1998	Bouteloua curtipendula	Butte	2		4	3	5		3	4
08/11/1998	Bouteloua curtipendula	Butte	2	38.5					3	
06/29/1999	Bouteloua curtipendula	Butte	2	60.5					3	17
09/13/1999	Bouteloua curtipendula	Butte	2		1	1		1	2	25
06/30/1998	Bouteloua curtipendula	Butte	3		4	3	5		3	4
08/11/1998	Bouteloua curtipendula	Butte	3	28					3	

Table HE-2 (continued)										
Date	Species	Variety	Rep	% Stand	Stand	Vigor	Leaf Stage	Seed Prod.	Weed Comp.	Height (inches)
06/29/1999	Bouteloua curtipendula	Butte	3	42.5					5	13
09/13/1999	Bouteloua curtipendula	Butte	3		2	1		1	2	29
06/30/1998	Bouteloua curtipendula	Pierre	1		5	3	5		4	4
08/11/1998	Bouteloua curtipendula	Pierre	1	33.5					4	
06/29/1999	Bouteloua curtipendula	Pierre	1	61					6	11
09/13/1999	Bouteloua curtipendula	Pierre	1		3	3		3	3	26
06/30/1998	Bouteloua curtipendula	Pierre	2		6	3	4		4	4
08/11/1998	Bouteloua curtipendula	Pierre	2	34					4	
06/29/1999	Bouteloua curtipendula	Pierre	2	58.5					6	14
09/13/1999	Bouteloua curtipendula	Pierre	2		2	2		2	4	24
06/30/1998	Bouteloua curtipendula	Pierre	3		6	4	4		2	3
08/11/1998	Bouteloua curtipendula	Pierre	3	40					3	
06/29/1999	Bouteloua curtipendula	Pierre	3	37.5					5	12
09/13/1999	Bouteloua curtipendula	Pierre	3		2	2		2	3	31
06/30/1998	Bouteloua gracilis	Bad River	1		5	3	4		4	3
08/11/1998	Bouteloua gracilis	Bad River	1	50.5					4	
06/29/1999	Bouteloua gracilis	Bad River	1	66					5	6
09/13/1999	Bouteloua gracilis	Bad River	1		3	2		2	3	22
06/30/1998	Bouteloua gracilis	Bad River	2		4	3	5		3	4
08/11/1998	Bouteloua gracilis	Bad River	2	35.5					4	
06/29/1999	Bouteloua gracilis	Bad River	2	55					6	12
09/13/1999	Bouteloua gracilis	Bad River	2		3	3		2	3	15
06/30/1998	Bouteloua gracilis	Bad River	3		5	3	5		2	5
08/11/1998	Bouteloua gracilis	Bad River	3	32.5					4	
06/29/1999	Bouteloua gracilis	Bad River	3	54.5					7	11
09/13/1999	Bouteloua gracilis	Bad River	3		2	2		2	2	23
06/30/1998	Bouteloua gracilis	Willis	1		5	4	5		4	4
08/11/1998	Bouteloua gracilis	Willis	1	30					3	
06/29/1999	Bouteloua gracilis	Willis	1	52					5	9
09/13/1999	Bouteloua gracilis	Willis	1		3	2		3	6	18
06/30/1998	Bouteloua gracilis	Willis	2		5	3	3		3	5

Table HE-2 (continued)										
Date	Species	Variety	Rep	% Stand	Stand	Vigor	Leaf Stage	Seed Prod.	Weed Comp.	Height (inches)
08/11/1998	Bouteloua gracilis	Willis	2	21.5					4	
06/29/1999	Bouteloua gracilis	Willis	2	43					8	13
09/13/1999	Bouteloua gracilis	Willis	2		3	2		5	4	16
06/30/1998	Bouteloua gracilis	Willis	3		7	3	5		3	4
08/11/1998	Bouteloua gracilis	Willis	3	31.5					5	
06/29/1999	Bouteloua gracilis	Willis	3	30					7	11
09/13/1999	Bouteloua gracilis	Willis	3		3	3		3	4	18
06/30/1998	Calamovilfa longifolia	Goshen	1		7	3	4		3	4
08/11/1998	Calamovilfa longifolia	Goshen	1	18.5					3	
06/29/1999	Calamovilfa longifolia	Goshen	1	8					8	6
09/13/1999	Calamovilfa longifolia	Goshen	1		6	6		7	6	30
06/30/1998	Calamovilfa longifolia	Goshen	2		8	3	4		4	5
08/11/1998	Calamovilfa longifolia	Goshen	2	11.5					4	
06/29/1999	Calamovilfa longifolia	Goshen	2	19					7	18
09/13/1999	Calamovilfa longifolia	Goshen	2		5	6		4	7	48
06/30/1998	Calamovilfa longifolia	Goshen	3		8	4	3		2	4
08/11/1998	Calamovilfa longifolia	Goshen	3	6.5					4	
06/29/1999	Calamovilfa longifolia	Goshen	3	19					7	16
09/13/1999	Calamovilfa longifolia	Goshen	3		5	5		6	5	53
06/30/1998	Calamovilfa longifolia	ND95	1		6	3	4		3	3
08/11/1998	Calamovilfa longifolia	ND95	1	17					5	
06/29/1999	Calamovilfa longifolia	ND95	1	20					7	13
09/13/1999	Calamovilfa longifolia	ND95	1		5	5		8	6	32
06/30/1998	Calamovilfa longifolia	ND95	2		7	3	4		4	5
08/11/1998	Calamovilfa longifolia	ND95	2	18.5					4	
06/29/1999	Calamovilfa longifolia	ND95	2	32.5					7	15
09/13/1999	Calamovilfa longifolia	ND95	2		4	7		6	5	40
06/30/1998	Calamovilfa longifolia	ND95	3		8	3	4		3	4
08/11/1998	Calamovilfa longifolia	ND95	3	19.5					4	
06/29/1999	Calamovilfa longifolia	ND95	3	20					7	13
09/13/1999	Calamovilfa longifolia	ND95	3		6	6		8	6	40

Table HE-2 (continued)										
Date	Species	Variety	Rep	% Stand	Stand	Vigor	Leaf Stage	Seed Prod.	Weed Comp.	Height (inches)
06/30/1998	Panicum virgatum	Dacotah	1		3	3	4		3	3
08/11/1998	Panicum virgatum	Dacotah	1	41.5					3	
06/29/1999	Panicum virgatum	Dacotah	1	65.5					3	15
09/13/1999	Panicum virgatum	Dacotah	1		2	3		3	3	24
06/30/1998	Panicum virgatum	Dacotah	2		3	4	3		3	2
08/11/1998	Panicum virgatum	Dacotah	2	54.5					3	
06/29/1999	Panicum virgatum	Dacotah	2	66.5					4	20
09/13/1999	Panicum virgatum	Dacotah	2		2	1		1	2	35
06/30/1998	Panicum virgatum	Dacotah	3		5	3	4		2	3
08/11/1998	Panicum virgatum	Dacotah	3	48.5					3	
06/29/1999	Panicum virgatum	Dacotah	3	44.5					5	19
09/13/1999	Panicum virgatum	Dacotah	3		1	1		1	2	35
06/30/1998	Panicum virgatum	Forestburg	1		2	3	5		3	4
08/11/1998	Panicum virgatum	Forestburg	1	56.5					3	
06/29/1999	Panicum virgatum	Forestburg	1	64					3	13
09/13/1999	Panicum virgatum	Forestburg	1		1	1		1	2	36
06/30/1998	Panicum virgatum	Forestburg	2		5	3	4		4	5
08/11/1998	Panicum virgatum	Forestburg	2	33					4	
06/29/1999	Panicum virgatum	Forestburg	2	59					4	18
09/13/1999	Panicum virgatum	Forestburg	2		2	2		2	2	30
06/30/1998	Panicum virgatum	Forestburg	3		6	3	4		2	4
08/11/1998	Panicum virgatum	Forestburg	3	25					4	
06/29/1999	Panicum virgatum	Forestburg	3	41					6	18
09/13/1999	Panicum virgatum	Forestburg	3		2	2		2	2	33
06/30/1998	Schizachyrium scoparium	Badlands	1		7	4	4		4	2
08/11/1998	Schizachyrium scoparium	Badlands	1	16.5					3	
06/29/1999	Schizachyrium scoparium	Badlands	1	25.5					8	5
09/13/1999	Schizachyrium scoparium	Badlands	1		5	5		6	5	24
06/30/1998	Schizachyrium scoparium	Badlands	2		8	4	4		4	2
08/11/1998	Schizachyrium scoparium	Badlands	2	30					4	
06/29/1999	Schizachyrium scoparium	Badlands	2	33					6	10

Table HE-2 (continued)										
Date	Species	Variety	Rep	% Stand	Stand	Vigor	Leaf Stage	Seed Prod.	Weed Comp.	Height (inches)
09/13/1999	Schizachyrium scoparium	Badlands	2		2	3		2	4	18
06/30/1998	Schizachyrium scoparium	Badlands	3		8	4	3		2	2
08/11/1998	Schizachyrium scoparium	Badlands	3	22					4	
06/29/1999	Schizachyrium scoparium	Badlands	3	26.5					6	12
09/13/1999	Schizachyrium scoparium	Badlands	3		5	6		5	7	18
06/30/1998	Schizachyrium scoparium	Camper	1		7	5	3		4	2
08/11/1998	Schizachyrium scoparium	Camper	1	12.5					4	
06/29/1999	Schizachyrium scoparium	Camper	1	29					7	6
09/13/1999	Schizachyrium scoparium	Camper	1		4	4		6	6	25
06/30/1998	Schizachyrium scoparium	Camper	2		8	5	3		3	3
08/11/1998	Schizachyrium scoparium	Camper	2	9.5					6	
06/29/1999	Schizachyrium scoparium	Camper	2	20					7	9
09/13/1999	Schizachyrium scoparium	Camper	2		5	5		5	7	25
06/30/1998	Schizachyrium scoparium	Camper	3		8	4	2		2	2
08/11/1998	Schizachyrium scoparium	Camper	3	18					3	
06/29/1999	Schizachyrium scoparium	Camper	3	25					7	11
09/13/1999	Schizachyrium scoparium	Camper	3		4	4		5	4	22
06/30/1998	Sorghastrum nutans	Holt	1		7	3	3		3	4
08/11/1998	Sorghastrum nutans	Holt	1	12					3	
06/29/1999	Sorghastrum nutans	Holt	1	11					7	6
09/13/1999	Sorghastrum nutans	Holt	1		5	3		3	4	38
06/30/1998	Sorghastrum nutans	Holt	2		8	5	3		4	3
08/11/1998	Sorghastrum nutans	Holt	2	13					4	
06/29/1999	Sorghastrum nutans	Holt	2	19.5					7	17
09/13/1999	Sorghastrum nutans	Holt	2		5	4		5	6	32
06/30/1998	Sorghastrum nutans	Holt	3		7	4	4		2	4
08/11/1998	Sorghastrum nutans	Holt	3	37.5					4	
06/29/1999	Sorghastrum nutans	Holt	3	12					7	14
09/13/1999	Sorghastrum nutans	Holt	3		5	5		6	4	27
06/30/1998	Sorghastrum nutans	Tomahawk	1		8	5	3		4	3
08/11/1998	Sorghastrum nutans	Tomahawk	1	14					4	

Table HE-2 (continued)										
Date	Species	Variety	Rep	% Stand	Stand	Vigor	Leaf Stage	Seed Prod.	Weed Comp.	Height (inches)
06/29/1999	Sorghastrum nutans	Tomahawk	1	6					7	4
09/13/1999	Sorghastrum nutans	Tomahawk	1		7	3		3	6	36
06/30/1998	Sorghastrum nutans	Tomahawk	2		8	5	3		5	4
08/11/1998	Sorghastrum nutans	Tomahawk	2	9.5					4	
06/29/1999	Sorghastrum nutans	Tomahawk	2	7					8	11
09/13/1999	Sorghastrum nutans	Tomahawk	2		7	6		6	8	28
06/30/1998	Sorghastrum nutans	Tomahawk	3		8	4	4		3	3
08/11/1998	Sorghastrum nutans	Tomahawk	3	13.5					5	
06/29/1999	Sorghastrum nutans	Tomahawk	3	11.5					7	12
09/13/1999	Sorghastrum nutans	Tomahawk	3		6	5		3	5	37
06/30/1998	Spartina pectinata	Red River	1		8	3	5		5	5
08/11/1998	Spartina pectinata	Red River	1	0					3	
06/29/1999	Spartina pectinata	Red River	1	0					0	0
09/13/1999	Spartina pectinata	Red River	1		9				9	
06/30/1998	Spartina pectinata	Red River	2		9	0	0		3	0
08/11/1998	Spartina pectinata	Red River	2	0					4	
06/29/1999	Spartina pectinata	Red River	2	0					9	0
09/13/1999	Spartina pectinata	Red River	2		8	6			8	32
06/30/1998	Spartina pectinata	Red River	3		9	0	0		0	0
08/11/1998	Spartina pectinata	Red River	3	1					4	
06/29/1999	Spartina pectinata	Red River	3	0.5					8	0
09/13/1999	Spartina pectinata	Red River	3		8	3		3	6	30

CULTURAL EVALUATIONS

CULTURAL EVALUATION: TECHNICAL REPORT 1998-1999

Study 38C425J

Study Title: Evaluation and increase of needleandthread

Introduction: Needleandthread is a common cool season component in many plant communities in the Northern Great Plains. Seed availability is limited primarily to native harvest, since there are no known released varieties available. Limited work has been done with this species to improve interest to commercial growers. Harvesting and cleaning methods are difficult due to its seed characteristics. Long curly awns, which are sharp and pointed, make harvesting and cleaning large quantities difficult. The long awns are difficult to remove from the seed when cleaning.

Objective: The primary objective is to increase the seed and develop harvesting and cleaning techniques of needleandthread.

Cooperators: The USDA Natural Resources Conservation Service, Plant Materials Center, Bismarck, North Dakota, in cooperation with Ducks Unlimited Canada.

Location: The study is located in panel E-9 on the Bismarck Plant Materials Center, Bismarck, North Dakota.

Soils: Mandan silt loam (see introduction - soils page 4).

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

Assembly: Unprocessed breeder's seed (6.5 lbs) for increase purposes was received from Ducks Unlimited Canada on February 20, 1996, and assigned accession number 9076720. A processing method needed to be established prior to seeding in the field. Several processing methods were tested, using a seed lot harvested from a native stand in Burleigh County, North Dakota. The following table shows the methods tested.

	Oven Drying treatment	Processing treatment
Control	none	none
Method 1	none	hammermill processing
Method 2	drying	hammermill processing

The control included no drying treatment and no processing treatment. The other methods tested included no drying treatment with hammermill processing and drying treatment with hammermill processing.

In the first method, the seed was stored at room temperature and then hammermilled. This method did not sufficiently break the awns from the seed.

The second method involved the seed being processed by oven drying at 50 degrees C for 24 to 48 hours; immediately hammermilled, and then run through a fanning mill using a ¼-inch screen first with 1/8-inch screen for the second run. The RPMs on the mill were reduced and the seed was allowed to feed into the mill at full capacity. The seed was then processed through a small office-size fanning mill using a number 37 top screen and a blank second screen (run through four times).

North Dakota State University Seed Lab conducted the germination tests on each seed sample. The following table shows germination results of the seed samples from the different processing methods.

	% germination	% dormant
Control	76 %	5 %
Method 1 (hammermill, no drying)	69 %	0 %
Method 2 (hammermill, dried)	76 %	1 %

The results indicated that germination was not adversely affected by removing the awns by hammermilling, provided proper methods were used.

Using the results of this study, breeder's seed from Ducks Unlimited Canada was processed by drying the seed in a drying oven at 50 degrees C and immediately hammermilling to remove awns. This resulted in 1.5 pounds of clean breeder seed. The seed was sent in for purity and germination tests on 05/02/96. The test resulted in 89.88% purity, 29% germination, 30% dormant; with a PLS of 53%. This clean seed was used to seed the increase field in panel E-9.

Seeding Date: The field was established May 16, 1996.

Seeding Method: Seed was planted in a firm packed weed-free seedbed at the PMC. Twelve 48-inch rows totaling 0.44 of an acre were planted. The planting rate was approximately 16 seeds per linear foot.

Establishment Results: Initial germination was slow, but seed continued to germinate throughout most of the summer. Plants matured slowly and had low vigor. No seed stocks were produced, however plants did tiller at the end of the growing season. Plants continued to grow and develop during late summer and early fall. Abundant weeds were present in the field and the field was hand weeded twice during the summer and cultivated several times. The field was sprayed with Buctril for broadleaf weed control on June 14 at 1 ½ lb/ac a.i. The field was sprinkler irrigated for five hours in June, twelve hours in August, and eighteen hours in September.

1998

The field was fertilized with 75 pounds of nitrogen and tilled. On April 22, two pints/Ac of Treflan were applied and incorporated. The field was hand rogued on May 27. Seed was harvested June 26 using a Flail Vac seed stripper. The harvest totalled 64.5 bulk pounds and resulted in 14.2 PLS pounds.

1999

The field was fertilized with 84 pounds of nitrogen per acre. Two pints/Ac of Treflan were applied and incorporated on May 21. Two pints/Ac of 2,4-D were applied for broadleaf weed control on May 25. The field was hand weeded on June 15. Individual plants showed signs of yellowing in May and June and resulted in some plant death. Although root rot was not observed in the field, the symptoms may have been caused by very high moisture conditions during the growing season. The overall stand had low vigor and seed production was greatly reduced in 1999. Twenty bulk pounds of seed harvested July 1 resulted in 3 PLS pounds.

CULTURAL EVALUATION: TECHNICAL REPORT 1998-1999

Study 38C426J

Study Title: Prairie restoration study

Introduction: There is growing interest in restoring land to native species. Past land uses have created large acreage of introduced species. Land manager objectives have changed from past land use on some of these acres. The result has been increased interest in techniques in renovating these areas back to a diverse mixture of native species. Technology, including seeding methods and planting dates, needs to be determined in order to develop ecologically sound procedures for prairie restoration.

Objective: The primary objective is to determine establishment and cultural management strategies for the promotion of diverse native prairie plantings. This study will evaluate methods and techniques used in prairie restoration and develop technical guidance that can be used in future restoration activities.

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 on portions of Russ Stuart Wildlife Management Area located in Burleigh County, North Dakota; and Old Johns Wildlife Management Area located in Sheridan County, North Dakota. Study sites are located approximately 30 miles northeast of the city of Wilton, North Dakota. The areas are adjacent to the McClusky Canal and are managed by the North Dakota State Game and Fish Department.

Soils: Soils in the study area are comprised predominantly of 1) Williams and Lehr loam; and 2) Wabek and Arvilla sandy loams.

Major Land Resource Area: The study site is located in Central North Dakota in Major Land Resource Area (MLRA) 53B Central Dark Brown Glaciated Plains.

Climate: The average annual precipitation is 15.47 inches, of which about three-fourths falls during the months of April through September. The average frost-free period is 134 days (April 11 through September 22). About 20 percent of the precipitation comes in the form of snow. The plant hardiness zone is 3, with a minimum mean temperature of -30 to -40 degrees F (see Climatological Information and 1998-1999 Weather Summary, pages 4-6).

Methods and Materials

See the following pages for the 1998 and 1999 Native Prairie Restoration Annual Reports that include study plans and data collection summary.

Prairie Restoration Study Annual Report – 1998

I. Introduction

This is the first year of a projected 5-year cooperative effort to initiate various studies and document information related to prairie restoration technology on land managed by the North Dakota Game and Fish Department. A cooperative agreement has been developed to provide guidelines for the completion of this study. This annual report provides summary information on all activities accomplished in calendar year 1998 related to the prairie restoration study.

First Year Project Summary Comments

- Surprisingly, smooth brome grass sod provided a good no-till seedbed for establishment of the native species.
- Seeding into the Kentucky bluegrass sod was not as successful.
- Seedling vigor of most of the native grass species was enhanced by the no-till approach for the spring/summer seeding date.
- Smooth brome grass control with glyphosate varied depending on soils, and was less successful on the lighter soils.
- Fall application of glyphosate appears to have provided the best smooth brome grass control.
- Sweetclover showed a positive response on the farmstead site.
- The addition of annual or quick-to-establish forbs which flower the first year add interest and attract attention!

II. Russ Stuart WMA Farmstead Site - 4 Acres - Williams Loam

(SW ¼ sec. 3, T. 144 N., R. 78 W., Burleigh County, ND)

This site is part of an abandoned farmstead and is approximately 4 acres in size. The vegetation is primarily introduced perennial grass species consisting of smooth brome grass, Kentucky bluegrass, and crested wheatgrass. Invasive introduced forb species include wormwood sage and Canada thistle. Small populations of native forbs include various vetches, fringed and cudweed sage, yarrow, and prairie rose. Estimated standing oven-dry biomass production is 3,000 to 4,000 pounds per acre. The accumulated litter/mulch layer is 2-3 inches deep in some areas of the field.

Tables 1 through 4 provide summary information on Russ Stuart WMA Farmstead Site treatment rates and dates, seeding percentages of grasses, approximate seeding rates of forbs and legumes, and established species frequency and density.

Table 1. Farmstead Site - Approximately 4 Acres - Williams Loam

Treatment Rates and Dates
Primarily brome grass sod
Burned April 21, 1998 (heavy mulch layer)
2 quarts glyphosate applied May 24, 1998
2 quarts glyphosate applied June 25, 1998
2 acres (west half) seeded July 8, 1998
2 acres (east half) sprayed with 2,4-D/glyphosate mix September 22, 1998
2 acres (east half) seeded October 21, 1998

Table 2. Grasses - Approximate Seeding Percentages - Farmstead

Species	Cultivar/Source	Approx. %
switchgrass	Forestburg	20
big bluestem	Bison	30
Indiangrass	Tomahawk	20
prairie cordgrass	Red River	5
green needlegrass	SD-93	20
Canada wildrye	Mandan	5
slender wheatgrass	NA	trace

Table 3. Forbs & Legumes - Approximate Seeding Rates - Farmstead

Species	PLS gm/ac
purple prairie clover (PMC)	22
Lewis wild flax (Appar)	45
Canada milkvetch (PMC)	45
plains coreopsis (purchased)	11
Maximilian sunflower (PMC)	11
2-grooved milkvetch (PMC)	22
leadplant (PMC)	15
narrow-leaved coneflower (PMC)	9
silky prairieclover (PMC)	8
stiff sunflower (PMC)	22
yellow coneflower (purchased)	22

Table 4. Russ Stuart WMA Farmstead - 2 Acres - Williams Loam - Seeded July 1998
(Transects 200' long with twenty 2.40 square foot quadrats placed systematically every 10 feet)

	Trans 1 Freq. % / Total	Trans 2 Freq. % / Total	Average Freq. % / Total
Grasses			
big bluestem	80/48	85/55	83/51.5
switchgrass	85/68	80/83	83/75.5
unknown grass	35/7	45/18	40/12.5
bromegrass	----	20/4	10/2
bromegrass sod	5/---	---	3/---
bluegrass	5/1	15/8	10/4.5
bluegrass sod	5/---	---	3/---
unknown old	25/6	20/10	23/8
Forbs/Shrubs			
coreopsis	30/7	20/5	25/6.5
yellow coneflower	10/2	10/2	10/2
purple prairieclover	---	10/2	5/1
Canada milkvetch	5/1	15/12	10/6.5
narrow-leaved coneflower	5/3	---	3/1.5
blue flax	30/6	10/2	20/4

<i>Table 4 - Continued</i>	Trans 1 Freq. % / Total	Trans 2 Freq. % / Total	Average Freq. % / Total
prairie rose	5/2	---	3/1
unknown forbs	10/2	10/10	10/6
wild buckwheat	5/1	---	3/.5
bindweed	---	20/14	10/7
skeltonweed	35/15	25/7	30/11
wormwood	30/11	---	15/5.5
sweetclover	85/54	45/21	65/37.5

Farmstead Site Summary - 1998

- Excellent spring burn removed heavy litter/mulch layer.
- Two spring/summer applications of glyphosate resulted in a good perennial grass kill estimated at 90%.
- No-till grass drill performed well seeding into existing sod with 7 native species of grass and 11 native species of forbs and legumes.
- Good to excellent establishment from July seeding on areas of bromegrass sod.
- Poor to fair establishment from July seeding on areas of bluegrass sod.
- Seedling vigor of established species was rated very high with many perennial species producing seed heads in late summer.
- Data collected for the July seeding shows the highest frequency grass species to be switchgrass (83%) and big bluestem (83%) and the highest frequency forb/legume species to be plains coreopsis (25%), blue flax (20%), yellow coneflower (10%), and Canada milkvetch (10%).
- Plains coreopsis (annual) produced many flowers and was very showy.
- Abundant sweetclover seedlings were noted in late summer.
- Weeds (primarily annual) were a problem on the dormant seeding (east 2 acres) and were sprayed September 22 with a 2,4-D/glyphosate mixture prior to the dormant seeding on October 20.

III. Russ Stuart WMA Plot A - 32 Acres - Lehr Loam (S ½ sec. 3, T. 144 N., R. 78 W., Burleigh County, ND)

This site is approximately 32 acres in size. The vegetation is primarily introduced perennial grass species consisting of smooth bromegrass and Kentucky bluegrass. Scattered alfalfa plants are abundant. Invasive introduced forb species include wormwood sage and Canada thistle. Scattered small populations of native species include little bluestem, various vetches, fringed and cudweed sage, yarrow, and prairie rose. Estimated standing oven-dry biomass production is 1,500 to 3,000 pounds per acre. The soils include various mixtures with abundant sandy and gravelly areas. Most of the site was burned in 1997. Some areas that had been unburned showed an accumulated litter/mulch layer of ½ to 1 inch.

Tables 5 through 8 provide summary information on Russ Stuart WMA Plot A treatment rates and dates, seeding percentages of grasses, approximate seeding rates of forbs and legumes, and established species frequency and density.

Table 5. Plot A - Approximately 32 Acres - Lehr Loam

Treatment Rates and Dates
Primarily bromegrass and bluegrass sod, scattered alfalfa
Burned April 21, 1998 (also burned in 1997)
2 quarts glyphosate applied May 24, 1998
2 quarts glyphosate applied June 25, 1998
16 acres (west half) seeded July 8, 1998
16 acres (east half) seeded October 21, 1998

Table 6. Grasses - Approximate Seeding Percentages - Plot A

Species	Cultivar/Source	Approx. %
switchgrass	Forestburg	20
switchgrass	Dacotah	trace
big bluestem	Bison	30
blue grama	Bad River	10
Canada wildrye	Mandan	trace
prairie sandreed	ND-95	5
prairie sandreed	Goshen	trace
sideoats grama	Pierre	trace
sideoats grama	Killdeer	15
thickspike wheatgrass	Critana	trace
slender wheatgrass	Revenue	trace
green needlegrass	Lodorm	15
green needlegrass	SD-93	trace
western wheatgrass	Rosana	trace
little bluestem	Camper	trace
sand bluestem	Garden	trace
Indiangrass	Tomahawk	trace

Table 7. Forbs and Legumes - Approximate Seeding Rates - Plot A

Species	PLS gm/ac
purple prairie clover (PMC)	22
Lewis wild flax (Appar)	45
Canada milkvetch (PMC)	45
plains coreopsis (purchased)	11
Maximilian sunflower (PMC)	11
2-grooved milkvetch (PMC)	22
leadplant (PMC)	15
narrow-leaved coneflower (PMC)	9
silky prairieclover (PMC)	8
stiff sunflower (PMC)	22
yellow coneflower (purchased)	22

Table 8. Russ Stuart WMA (Plot A) - Seeded July 1998 - 16 Acres - Lehr Loam
 (Transects 200' long with twenty 2.40 square foot quadrats placed systematically every 10 feet)

	Trans 1	Trans 2	Trans 3	Trans 4	Trans 5	Trans 6	Average
	Freq.%/Total	Freq.%/Total	Freq.%/Total	Freq.%/Total	Freq.%/Total	Freq.%/Total	Freq.%/Total
Grasses							
big bluestem	95/131	95/118	70/54	85/83	70/68	85/93	85/91.2
switchgrass	60/32	65/24	50/19	25/11	30/10	40/14	45/18.3
blue grama	30/7	55/18	35/14	5/1	10/2	20/7	26/8.2
unknown grass	30/8	55/20	25/6	20/7	35/12	25/7	32/10
sideoats grama	15/3	20/5	5/1	5/1	10/3	5/1	10/2.3
little bluestem	5/1	---	5/1	5/1	---	---	3/.5
sand bluestem	5/1	---	---	---	---	---	.8/.2
wheatgrass	---	---	5/1	---	---	---	.8/.2
bromegrass	20/6	10/2	---	---	---	---	5/1.3
bromegrass sod	30/---	20/---	90/---	95/---	90/---	80/---	68/---
bluegrass	5/1	5/3	---	5/3	---	---	6/1.2
bluegrass sod	---	10/---	5/---	20/---	15/---	---	8/---
unknown old	25/5	---	---	---	---	---	4/.8
Forbs/Shrubs							
coreopsis	5/1	5/1	20/4	5/1	---	---	6/1.2
yellow coneflower	15/3	---	10/2	10/2	5/1	20/4	10/2
purple prairie clover	---	10/2	10/2	---	---	5/1	4/.8
2-grooved milkvetch	5/1	---	---	---	---	---	.8/.2
Canada milkvetch	---	---	5/1	---	---	---	.8/.2
leadplant	---	---	---	5/1	---	---	.8/.2
American vetch	---	5/1	---	---	---	---	.8/.2
unknown forb	5/1	15/3	5/1	5/1	5/3	---	6/1.5
woody forb	---	5/5	---	---	---	---	.8/.8
Canada thistle	---	---	5/1	10/2	---	---	3/.5
sow thistle	---	---	---	10/2	---	---	2/.3
milkweed	---	---	---	---	5/1	---	.8/.2
sweetclover	---	---	---	---	15/3	5/1	3/.7

Plot A Site Summary - 1998

- Spring burn was spotty because of lack of litter/fuel resulting from burning the previous year.
- Two spring/summer applications of glyphosate resulted in only fair perennial grass kill estimated at 50% to 75%. (soils?)
- Alfalfa proved hard to kill with glyphosate with an estimated 50% on first application and 75% on second application.
- No-till grass drill performed well seeding into existing sod with 13 native grass species and 11 native forb/legume species.
- Good to excellent establishment from July seeding on areas of bromegrass sod.
- Poor to fair establishment from July seeding on bluegrass sod.
- Seedling vigor of established species was rated very high with many perennial species producing seed heads in late summer.
- Data collected for the July seeding shows the highest frequency grass species to be big bluestem (91%), switchgrass (18%), and blue grama (8%); and the highest frequency forb/legume species to be yellow coneflower (2%) and plains coreopsis (1.2%).
- Plains coreopsis (annual) produced many flowers and was very showy.
- The dormant seeding (east 16 acres) had a poor control on the bromegrass (estimated 50% kill), but annual weeds were not a problem as on the Farmstead Site.
- Wormwood sage and Canada thistle appear to have increased in abundance.

Prairie Restoration Study Annual Report – 1999

I. INTRODUCTION

The second year of the five-year cooperative prairie restoration study has been completed. This annual report will provide a summary of activities that have occurred in 1999 as part of the cooperative agreement between the North Dakota State Game and Fish Department and the USDA-NRCS Bismarck Plant Materials Center.

II. WORK COMPLETED AND OBSERVATIONS FOR 1999

- A. **Russ Stuart Wildlife Management Area (WMA) Farmstead Site**, 4 acres of Williams loam soils. Legal description is the SW1/4 of 3-144-78 Burleigh County. This site has been split into two test sites. The west half was seeded in July of 1998 and the east half was dormant seeded in October 1998 (see Figure 1). **See Attachment 1 for species frequency on the farmstead site.** Table 1 compares average frequency of selected species for the two seeding dates.

SUMMER SEEDING

- This site had a very high density of sweetclover present in the spring of 1999. A decision was made to apply 2,4-D on a portion of this field in an attempt to reduce sweetclover competition.
- Areas where sweetclover was reduced by spraying had increased numbers of grass seedlings that were more vigorous compared to uncontrolled areas.
- Native forbs showed some tolerance to 2,4-D. This was especially evident for yellow coneflower and Lewis wild flax.
- This site contains a large seed bank of numerous weedy species, which is typical for an old farmstead situation.
- Transect data was taken on 7/22/1999.
- Absinth wormwood and Canada thistle were spot mowed.

DORMANT SEEDING

- Weed competition was severe from numerous weedy species forming a dense canopy.
- Seedling numbers were low for all planted grasses and forbs.
- The site was sprayed with 2,4-D in May to reduce broadleaf weed competition.
- Weed competition was reduced and the canopy opened up after the spray treatment.
- Cool-season species were more prevalent than later warm-season species. Cool-season species emerged before most weeds established. Monitoring will continue to see if warm-season species will establish in the future.
- Seedling counts were completed 7/19/1999.
- Plant vigor and stand were poor at last observation in September of 1999.

Table 1.		
Farmstead Average Frequency Comparisons for Selected Species – 1999		
	July Seeding	October Seeding
Seeded Species		
big bluestem	60%	35%
switchgrass	88%	20%
Canada wildrye	10%	33%
green needlegrass	8%	35%
Invaders		
bromegrass	15%	3%
bluegrass	35%	0%
crested wheatgrass	38%	13%
sweetclover	> 50% ¹	95% ²

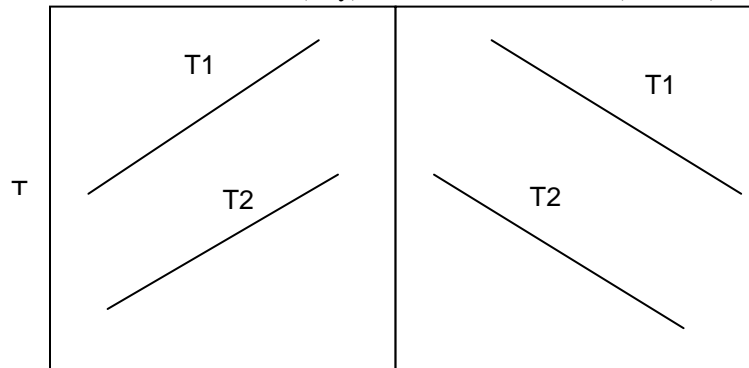
¹consisted of plants in their second year of growth

²high percentage of first year growth

- ❑ Warm-season grasses were favored by spring seeding.
- ❑ Cool-season seeded grasses were favored by dormant seeding
- ❑ Cool-season invader species had higher average frequencies on the spring seeding.
- ❑ Sweetclover showed a dramatic positive response to the dormant seeding.

Figure 1. Transect treatments on Russ Stuart WMA Farmstead site.

1998 summer seeded (July) 1998 dormant seeded (October)



Summer seeded T1:

- burned 4/21/1998
- chemical weed control, 2qt/ac glyphosate 5/24/1998
- 2nd chemical weed control, 2 qt/ac glyphosate 6/25/1998
- seeded using no-till drill 7/8/1998
- stand evaluation 10/01/1998
- first 4 quadrats, chemical weed control (sweetclover), 2 pt/ac 2,4-D 5/27/1999
- stand evaluation 7/21/1999
- spot mowed noxious weeds (wormwood, Canada thistle) 7/22/1999

Summer seeded T2:

- burned 4/21/1998
- chemical weed control, 2qt/ac glyphosate 5/24/1998
- 2nd chemical weed control, 2 qt/ac glyphosate 6/25/1998
- seeded using no-till drill 7/8/1998
- stand evaluation 10/01/1998

- stand evaluation 7/21/1999
- spot mowed noxious weeds (wormwood, Canada thistle) 7/22/1999

Dormant seeded T1 and T2:

- burned 4/21/1998
- chemical weed control, 2qt/ac glyphosate 5/24/1998
- 2nd chemical weed control, 2 qt/ac glyphosate 6/25/1998
- spot sprayed 2,4-D/glyphosate 9/22/1998
- seeded using no-till drill, 10/20/1998
- stand evaluation 7/21/1999
- chemical weed control (sweetclover) 2pt/ac 2,4-D 7/22/1999

- B. Russ Stuart WMA (plot A)** 32 acres Lehr loam soils. Legal description is section 3-144-78 in Burleigh County. This site is split into 2 parts. Part 1 is the west half (16 acres) which was seeded in July 1998 and part 2 is the east half (16 acres) which was dormant seeded in October of 1998 (see Figure 2). **See Attachment 2 for species frequency on the Russ Stuart plot A site.** Table 2 compares average frequency of selected species for the two seeding dates.

PART 1- WEST HALF - SUMMER (JULY) SEEDING

- ❑ Bromegrass regrowth was greater than 50% by late April 1999.
- ❑ Glyphosate was applied in May 1999 to the north half of this field to control bromegrass. This resulted in greater than 75% control of smooth bromegrass by the end of June.
- ❑ The unsprayed half of this field (south half) had bromegrass 3-4' tall and covered greater than 75% of the field by the end of June.
- ❑ Reducing bromegrass competition in May using glyphosate application appeared to increase warm-season species vigor, but also appeared to reduce the cool-season native component.
- ❑ Lewis wild flax and yellow coneflower appeared to tolerate glyphosate.
- ❑ Big bluestem, switchgrass, and sideoats grama were the predominant species on this site.

PART 2- EAST HALF - DORMANT (OCTOBER) SEEDING

- ❑ Bromegrass regrowth was greater than 50% by late April 1999.
- ❑ Glyphosate was applied in May 1999 to the north half of the seeding to reduce bromegrass. Bromegrass was reduced to minimal amounts as a result of spraying.
- ❑ Seedlings could be rowed visually by late July 1999.
- ❑ Bromegrass was greater than 75% in south half of the dormant seeding that was not sprayed with glyphosate.
- ❑ The additional application of glyphosate early in the year appears to have reduced bromegrass competition resulting in a stronger more vigorous stand of seedlings. Cool-season components of the original mix were reduced, as were the forbs, but still were observed in the stands.

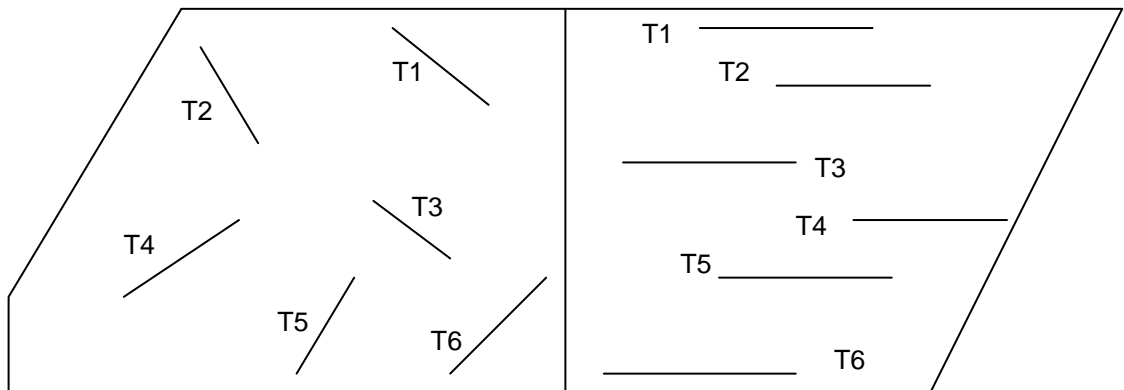
Table 2.		
Russ Stuart Average Frequency Comparisons for Selected Species – 1999		
	July Seeding	October Seeding
Seeded Species		
big bluestem	88%	76%
switchgrass	43%	89%
blue grama	21%	10%
sideoats grama	4%	36%
Canada wildrye	1%	12%
green needlegrass	1%	11%
Canada milkvetch	2%	5%
Lewis wild flax	1%	22%
Maximilian sunflower	1%	9%
yellow coneflower	11%	23%
Invaders		
bromegrass	70%	51%
bluegrass	13%	10%

- ❑ Switchgrass and sideoats grama had substantially higher average frequencies on the dormant seeding.
- ❑ Cool-season seeded species were favored by the dormant seeding.
- ❑ Several of the forb/legume species had substantially higher average frequencies on the dormant seeding.
- ❑ Average frequencies of bromegrass and bluegrass were similar for both planting dates.

Figure 2. Transect Treatments on Russ Stuart WMA Plot A

summer seeded (July) 1998

dormant seeded (October) 1998



Summer seeded (July) 1998 T1 and T2

- burned 4/21/1998
- chemical weed control 2 qt/ac glyphosate 5/24/1998
- chemical weed control 2 qt/ac glyphosate 6/25/1998
- no-till seeded 7/8/1998
- stand evaluation 10/1/1998
- chemical weed control (smooth bromegrass) 2 qt/ac glyphosate 5/8/1999
- stand evaluation 7/20/1999
- mow noxious weeds (Canada thistle) 7/20/1999

Summer seeded (July) 1998 T3-T6

- burned 4/21/1998
- chemical weed control 2 qt/ac glyphosate 5/24/1998
- chemical weed control 2 qt/ac glyphosate 6/25/1998
- no-till seeded 7/8/1998
- stand evaluation 10/1/1998
- stand evaluation 7/20/1999
- mow noxious weeds (Canada thistle) 7/20/1999

Dormant seeded (October) 1998 T1-T3

- burned 4/21/1998
- chemical weed control 2 qt/ac glyphosate 5/24/1998
- chemical weed control 2 qt/ac glyphosate 6/25/1998
- no-till seeded 10/21/1998
- chemical weed control 2 qt/ac glyphosate 5/8/1999
- stand evaluation 7/20/1999
- mow noxious weeds (Canada thistle) 7/20/1999

Dormant seeded (October) 1998 T4-T6

- burned 4/21/1998
- chemical weed control 2 qt/ac glyphosate 5/24/1998
- chemical weed control 2 qt/ac glyphosate 6/25/1998
- no-till seeded 10/21/1998
- stand evaluation 7/20/1999
- mow noxious weeds (Canada thistle) 7/20/1999

- C. **Old Johns Lake, site A** approximately 60 acres. The major soil mapping units are Wabek and Arvilla sandy loams. Wabek consists of very shallow soils and Arvilla consists of shallow to gravel. The location is section 28-145-77 Sheridan County. This site consists primarily of smooth brome grass sod that is low in plant vigor.
- Plans were made to prepare a no-till seedbed.
 - The site was mowed on 9/13/1999 to initiate fall regrowth promoting an effective control of brome grass with a fall application of glyphosate.
 - Due to a killing frost the 9/29/1999, glyphosate was not applied. Plans are to apply it in the spring of 2000.
- D. **Old Johns Lake, site B** approximately 20 acres. Soils are Arvilla sandy loam (shallow to gravel site). It is located in the NE1/4 of Section 21-145-77 Sheridan County. This site is primarily made up of native species with introduced species (smooth brome) found in heavy patches within the site.
- Two qts/ac of glyphosate was applied 5/27/1999 on selected sites (1.8 acres total) to kill introduced species.
 - The 1.8 acres chemically treated and an additional 3.2 acres of existing native vegetation were no-till seeded on 10/26/1999. Ten forb species at the rate of 1 lb/ac of forbs and 4 lb/ac of a native grass mixture were planted.
 - Tables 3 and 4 list species used and percentages of the mix.

Table 3.		
Forbs No-till Seeded at Old Johns Lake Site B, 10/26/1999		
Species	Bulk weight (g)	Percent of Mix
Purple prairieclover	539	20
Lewis wild flax	555	20
Canada milkvetch	269	10
Maximilian sunflower	770	10
Leadplant	320	10
narrow-leaved purple coneflower	377	10
Stiff sunflower	188	5
Stiff goldenrod	227	5
Big flowered penstemon	227	5
Pink flowered beelant	227	5

Table 4.		
Native Grass Mix No-till Seeded at Old Johns Lake Sites A and B, 10/26/1999		
Species	Cultivar/Source	Approx. Mix %
Switchgrass	Forestburg	20
Switchgrass	Dacotah	trace
Big bluestem	Bison	30
Blue grama	Bad River	10
Canada wildrye	Mandan	trace
Prairie sandreed	ND-95	5
Prairie sandreed	Goshen	trace
Sideoats grama	Pierre	trace
Sideoats grama	Killdeer	15
Thickspike wheatgrass	Critana	trace
Slender wheatgrass	Revenue	trace
Green needlegrass	Lodorm	15
Green needlegrass	SD-93	trace
Western wheatgrass	Rosana	trace
Little bluestem	Camper	trace
Sand bluestem	Garden	trace
Indiangrass	Tomahawk	trace

E. Old Johns Lake, site C approximately 15 acres. Soils are primarily Williams-Zahl loams. This site is located in SW1/4 of section 22-145-77 Sheridan County. A no-till seeding of five native shrubs using a sculptured design is being tested at this site. The sculptured design places each species on the landscape where each would likely be found naturally. This planting will help evaluate direct seeding of woody species as another option for addition of a woody component into prairie restoration. A fall seeding was completed in October of 1999 and a spring seeding is planned for 2000.

- Two quarts per acre of glyphosate were applied on 5/27/1999 for site preparation on 0.28 acres. This 0.28 acre was split among five sites within the 15 acres. Introduced species were primarily crested wheatgrass, Kentucky bluegrass, smooth brome grass with some scattered native species. A good kill on all species was achieved except on Kentucky bluegrass. Sideoats grama was still present and showed some degree of tolerance to the glyphosate application.
- Litter was mowed and removed from sites in July 1999.

- ❑ One-half the area of each of the five sites was no-till seeded on 10/26/1999 with one of the five shrub species and 5 lb/ac of a native grass mix.
- ❑ Seedbed moisture was excellent. The Truax no-till drill did an excellent job of seed placement, proper seeding rate and good soil to seed contact.
- ❑ Transects to monitor emergence will be established and data collected.
- ❑ A spring seeding will be completed in 2000 to compare to the success of dormant seeding establishment.
- ❑ Table 5 lists species and seeding rates used.

Table 5.	
Shrubs No-till Seeded at Old Johns Lake Site C, 10/26/1999	
Species	Seeding rates lb/ac
Western Snowberry	4.0
Prairie Rose	4.5
Leadplant	1.3
Buffaloberry	4.2
Chokecherry	26.0

III. SUMMARY

Although more time is needed to make any recommendations from this project, some basic observations can be made from the first two years of this study.

- ❑ It appears that initial chemical seedbed preparation with glyphosate relies on many climatic variables. It may require multiple applications over a two-year period to achieve the desired seedbed.
- ❑ Based on visual estimates, it appears that crested wheatgrass is the easiest to control followed by smooth brome grass and Kentucky bluegrass being the most difficult. This may be due to the chemical application timing or other factors. These are the three main introduced species that we have encountered so far.
- ❑ Smooth brome grass appears to present the most competition during establishment due to its aggressive rhizome system, increased height and shading effects over Kentucky bluegrass and crested wheatgrass. Smooth brome grass will probably also be the most competitive of the three species on the established native stand over the long term.
- ❑ Degree of control of introduced species will ultimately be a management decision with consideration to how much money the land manager is willing to spend for seedbed preparation and what percentage of introduced species, if any, the land manager is willing to accept as part of the final stand.
- ❑ Management after establishment will be needed to keep introduced species under control. Fire, mowing, chemical alternatives and grazing could be used alone or in combination to manage established stands to the desired species mix and composition.
- ❑ Warm-season grass establishment favors summer seeding over fall dormant seeding.
- ❑ Management becomes more complex as the diversity of species increases. There may be times when selection of certain types of plants (warm vs. cool, grasses vs. forbs) is acceptable and more economical to use. Using a diverse mix of native warm-season grasses will give

you an excellent option of controlling introduced cool-season grasses with glyphosate but you sacrifice species diversity.

- ❑ By using no-till seeding methods, it appears that the window of seeding dates is somewhat increased. Minimal soil disturbance appears to place seed in a more opportune microenvironment increasing the chances of establishment.
- ❑ Future monitoring of these sites is needed to gain further insight into prairie restoration techniques.

Attachment 1.																									
Russ Stuart WMA (Plot A)																									
32 acres Lehr Loam																									
2.2 ft ² quadrats																									
Seeding	Collection	Tran-																					TO-	%	
Date	Date	sect	Species	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'	160'	170'	180'	190'	200'	TAL	freq
07/08/98	07/20/99	1	big bluestem	5	3	6	6	10	11	13	5	8	2		1	6	4	2	6	3	6	2	2	101	95
07/08/98	07/20/99	2	big bluestem	4	5		8		3	4	2	2	3	3	3	3	8	4	7	6	4	6	1	76	90
07/08/98	07/20/99	3	big bluestem	3	6	2	5		8	5	4	13	1	4	2	4			1	3	6		2	69	80
07/08/98	07/20/99	4	big bluestem	7	4	3	1	1	2	7	4	3	4	8	1	6	7	9	5	8	3	4	5	92	100
07/08/98	07/20/99	5	big bluestem	1	2	3	1	2	4	4	6	4	1	4	4	5	7	4	1	7	8	2	6	76	100
07/08/98	07/20/99	6	big bluestem		1		1	1	1	2	6	4	6			5	2			2	3			34	60
10/21/98	07/20/99	1	big bluestem	5	1	2	2	3	2	2	1	5	2	2	1		3			1		2	3	37	80
10/21/98	07/20/99	2	big bluestem	1	5			1	7	5	2	1		1	1		3	2		2	4	3	4	42	75
10/21/98	07/20/99	3	big bluestem	2	2	1	2			1	2				1		1	2	2	1	1			18	60
10/21/98	07/20/99	4	big bluestem	3	2	3	4	4	7		1	6	2	4	3	6	6	5	2	5	5	12	2	82	95
10/21/98	07/20/99	5	big bluestem		6	6	4		1		1	9		2	2	4	5	4	5	5	1	3	2	60	80
10/21/98	07/20/99	6	big bluestem	6	5		4	2	3	7			8		1	1		1	2		1	3		44	65
07/08/98	07/20/99	2	blue grama	1						1											1			3	15
07/08/98	07/20/99	3	blue grama		2							2											1	5	15
07/08/98	07/20/99	4	blue grama											1						2				3	10
07/08/98	07/20/99	5	blue grama	2		2	2	1	1	1								1				2	1	13	45
07/08/98	07/20/99	6	blue grama	1	2	1	1			1			1			1						1		9	40
10/21/98	07/20/99	1	blue grama									1	2		1								1	5	20
10/21/98	07/20/99	2	blue grama										1											1	5
10/21/98	07/20/99	3	blue grama					1					2			3								6	15
10/21/98	07/20/99	4	blue grama																					0	0
10/21/98	07/20/99	5	blue grama		1											1								2	10
10/21/98	07/20/99	6	blue grama			1		1																2	10
07/08/98	07/20/99	2	bluegrass-old			1																		1	5
07/08/98	07/20/99	3	bluegrass-old	1																				1	5
07/08/98	07/20/99	4	bluegrass-old				1						1			1								3	15
07/08/98	07/20/99	5	bluegrass-old					1	1	1	1													4	20
07/08/98	07/20/99	6	bluegrass-old	1		1			1	1							1			1				6	30

Seeding	Collection	Tran-																						TO-	%	
Date	Date	sect	Species	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'	160'	170'	180'	190'	200'	TAL	freq	
10/21/98	07/20/99	1	bluegrass-old							1														1	5	
10/21/98	07/20/99	4	bluegrass-old				2	1	1			1	1												6	25
10/21/98	07/20/99	5	bluegrass-old				1		1		1						2								5	20
10/21/98	07/20/99	6	bluegrass-old				1	2																	3	10
07/08/98	07/20/99	1	bromegrass-old	1	1		1	1	1						1	1									7	35
07/08/98	07/20/99	2	bromegrass-old			1			1			1	1	1		1	1	1	1	1	1	1	1	1	13	65
07/08/98	07/20/99	3	bromegrass-old	1		1		1	1	1		1	1	1	1	1	1		1	1	1	1	1	1	16	80
07/08/98	07/20/99	4	bromegrass-old	1	1	1	1	1	1		1	1	1	1	1	1	1		1		1			1	16	80
07/08/98	07/20/99	5	bromegrass-old	1		1	1	1	1	1	1	1		1	1	1	1	1			1	1			15	75
07/08/98	07/20/99	6	bromegrass-old			1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	17	85
10/21/98	07/20/99	1	bromegrass-old		2	0.1		0.1					0.1	0.1			0.1									30
10/21/98	07/20/99	2	bromegrass-old				0.2	0.4		0.2			0.4	0.2		0.1	0.1			0.1			0		45	
10/21/98	07/20/99	3	bromegrass-old						0					0.1		0.2	0.3	0.3	0.3	0.3	0.2	0.5			45	
10/21/98	07/20/99	4	bromegrass-old			0.1	0.1		0.1			0.1	1	1	0.1		1		1						45	
10/21/98	07/20/99	5	bromegrass-old		6		2	0.1	0.1	0.3					0.1		0.1	0.2	0.2		1	4			55	
10/21/98	07/20/99	6	bromegrass-old	0.1	1	0.8		6	5	0.1	0.1	0.5	0.1	0.1	0.6	0.3	0.7	0.2	0.2			0.6	0.8		85	
07/08/98	07/20/99	5	Canada wildrye			1																			1	5
10/21/98	07/20/99	1	Canada wildrye	1																					1	5
10/21/98	07/20/99	4	Canada wildrye			1										3		1	1	1					7	25
10/21/98	07/20/99	5	Canada wildrye				2	1		1	5			2											11	25
10/21/98	07/20/99	6	Canada wildrye					1	1				2					2							6	20
07/08/98	07/20/99	5	green needlegrass			1																			1	5
10/21/98	07/20/99	4	green needlegrass				1	1							1	1	3	1		1		1			10	40
10/21/98	07/20/99	5	green needlegrass													2									2	5
10/21/98	07/20/99	6	green needlegrass						1	1										3	1				6	20
07/08/98	07/20/99	4	Indiangrass																		1				1	5
10/21/98	07/20/99	2	Indiangrass								1														1	5
10/21/98	07/20/99	4	Indiangrass				1																		1	5
10/21/98	07/20/99	5	Indiangrass								1						1								2	10
07/08/98	07/20/99	4	little bluestem							1			1												2	10
10/21/98	07/20/99	1	little bluestem									1		1							1				3	15
10/21/98	07/20/99	2	little bluestem	1																					1	5
07/08/98	07/20/99	3	other	1																					1	5

Seeding	Collection	Tran-																						TO-	%	
Date	Date	sect	Species	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'	160'	170'	180'	190'	200'	TAL	freq	
07/08/98	07/20/99	6	other							1														1	5	
07/08/98	07/20/99	6	other	1	6																				7	10
10/21/98	07/20/99	2	other	1			2		3	1	1	2						2	1	1	3	1	1		19	60
10/21/98	07/20/99	3	other					3	1		4	3				1	1		1		1				15	40
10/21/98	07/20/99	5	other					2	8	4	2														16	20
10/21/98	07/20/99	1	prairie sandreed												1										1	5
10/21/98	07/20/99	5	prairie sandreed																1					1	2	10
10/21/98	07/20/99	6	prairie sandreed	1																					1	5
07/08/98	07/20/99	2	sideoats grama														2								2	5
07/08/98	07/20/99	4	sideoats grama				1																		1	5
07/08/98	07/20/99	5	sideoats grama	1			1																		2	10
07/08/98	07/20/99	6	sideoats grama					1					1												2	10
10/21/98	07/20/99	1	sideoats grama		1	6					1		2	1	2		1	2			1				17	45
10/21/98	07/20/99	2	sideoats grama			5				1	1	2		1	2		1								13	35
10/21/98	07/20/99	3	sideoats grama		2						1			1	1		1	1		1					8	35
10/21/98	07/20/99	4	sideoats grama				1	1					1	1	1	1	1	1				1			9	45
10/21/98	07/20/99	5	sideoats grama		6	1	1			3	2	1			3										17	35
10/21/98	07/20/99	6	sideoats grama		1					1	1			1											4	20
07/08/98	07/20/99	1	switchgrass				3		1	3	2	2			2				1		2	2			18	45
07/08/98	07/20/99	2	switchgrass		2		4		5			1	3		2	1	1		1	1	1				22	55
07/08/98	07/20/99	3	switchgrass	2			2	1	1			1	1	1		1									10	40
07/08/98	07/20/99	4	switchgrass		1			1	2			2	1			1	1						1		10	40
07/08/98	07/20/99	5	switchgrass	1		1				2	1					1				1			3	2	12	40
07/08/98	07/20/99	6	switchgrass	1					1		2		1		1	1	1	1							9	40
10/21/98	07/20/99	1	switchgrass	8	1	2	5	2	4	7	4	11	3	4	6	5	5	5		12	3	2	8		97	95
10/21/98	07/20/99	2	switchgrass	6	5	4	3	1	7	3	4	12	3	3	9	2	1	4	2			2	7		78	90
10/21/98	07/20/99	3	switchgrass	3	5	3	7		6	1	4				7			1	6	4	2	1	2		52	70
10/21/98	07/20/99	4	switchgrass	2	1	3	3	4	3	7	1	7	7	3	1	2	2	4	5	9	6	4	3		77	100
10/21/98	07/20/99	5	switchgrass	12	2	5	4	4	5	6	8	6	3	4	8	7	5	6	1	5	2	5	1		99	100
10/21/98	07/20/99	6	switchgrass	4	5	1	4	5	2	5	3	1	5	1			1	2	1	3		3			46	80
07/08/98	07/20/99	4	unknown				1																		1	5
07/08/98	07/20/99	5	unknown	1																					1	5
10/21/98	07/20/99	1	unknown-new	1								1		1								1			4	20

Seeding	Collection	Tran-																					TO-	%	
Date	Date	sect	Species	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'	160'	170'	180'	190'	200'	TAL	freq
10/21/98	07/20/99	2	unknown-new				1																	1	5
10/21/98	07/20/99	4	unknown-new	1	1		2	2			2	3	2		1	1	2	2	2	3	1	2		27	75
10/21/98	07/20/99	5	unknown-new										1		1									2	10
10/21/98	07/20/99	6	unknown-new	1																				1	5
07/08/98	07/20/99	3	wheatgrass														1		1	1	1			4	20
07/08/98	07/20/99	4	wheatgrass		1																			1	5
10/21/98	07/20/99	1	wheatgrass				2																	2	5
10/21/98	07/20/99	3	wheatgrass							1					3	1					1			6	20
10/21/98	07/20/99	4	wheatgrass	0.1				0.1		1	0.1												1		25
10/21/98	07/20/99	5	wheatgrass		1						1													2	10
10/21/98	07/20/99	6	wheatgrass		1				1		0.5										1				20
10/21/98	07/20/99	4	black samson																		1			1	5
10/21/98	07/20/99	5	black samson						1															1	5
10/21/98	07/20/99	6	black samson										1											1	5
07/08/98	07/20/99	4	Canada milkvetch														1							1	5
10/21/98	07/20/99	1	Canada milkvetch														1							1	5
10/21/98	07/20/99	5	Canada milkvetch	1																			1	2	10
10/21/98	07/20/99	6	Canada milkvetch				1	1										1						3	15
07/08/98	07/20/99	6	Canada milkvetch										1											1	5
07/08/98	07/20/99	6	Lewis wild flax				1																	1	5
10/21/98	07/20/99	4	Lewis wild flax				1	1				1		2	1	1	2	1		1	1	1		13	55
10/21/98	07/20/99	5	Lewis wild flax		1		2		5	1		1			3	1	2		2					18	45
10/21/98	07/20/99	6	Lewis wild flax	1				2		1		2	1					2						9	30
07/08/98	07/20/99	5	maximilian sunflower		1																			1	5
10/21/98	07/20/99	2	maximilian sunflower																					1	5
10/21/98	07/20/99	3	maximilian sunflower		1																			1	5
10/21/98	07/20/99	4	maximilian sunflower	1			2						1								2			6	20
10/21/98	07/20/99	5	maximilian sunflower			1				1									1					3	15
10/21/98	07/20/99	6	maximilian sunflower					1															1	2	10
10/21/98	07/20/99	1	other-clover				0.2																		5
10/21/98	07/20/99	5	other-sweetclover										0.8	0.2	0.1				0.1	0.3			0.3		30
10/21/98	07/20/99	1	plains coreopsis												1		2							3	10
10/21/98	07/20/99	3	plains coreopsis													1								1	5

Seeding	Collection	Tran-																						TO-	%
Date	Date	sect	Species	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'	160'	170'	180'	190'	200'	TAL	freq
10/21/98	07/20/99	4	plains coreopsis						1	3	1	1												6	20
10/21/98	07/20/99	5	plains coreopsis			1									1								1	3	15
10/21/98	07/20/99	6	plains coreopsis																		1			1	5
07/08/98	07/20/99	1	purple prairieclover								1													1	5
07/08/98	07/20/99	2	purple prairieclover															1						1	5
07/08/98	07/20/99	3	purple prairieclover						1															1	5
07/08/98	07/20/99	4	purple prairieclover													1								1	5
07/08/98	07/20/99	5	purple prairieclover										1											1	5
10/21/98	07/20/99	5	stiff sunflower					1																1	5
10/21/98	07/20/99	6	stiff sunflower					1															1	2	10
10/21/98	07/20/99	5	two-grooved milkvetch										1											1	5
07/08/98	07/20/99	2	yellow coneflower											2										2	5
07/08/98	07/20/99	3	yellow coneflower		1		1	1					1											4	20
07/08/98	07/20/99	4	yellow coneflower							1	1													2	10
07/08/98	07/20/99	5	yellow coneflower	1							1					1								3	15
07/08/98	07/20/99	6	yellow coneflower							1				1		1								3	15
10/21/98	07/20/99	1	yellow coneflower		1		1	1																3	15
10/21/98	07/20/99	2	yellow coneflower	1																				1	5
10/21/98	07/20/99	3	yellow coneflower						1										1					2	10
10/21/98	07/20/99	4	yellow coneflower		2		2			3	1	1			1		1				1			12	40
10/21/98	07/20/99	5	yellow coneflower	1					1	1	1			1			1	1				1		8	40
10/21/98	07/20/99	6	yellow coneflower	1				2					1					2				1		7	25

Attachment 2.																									
Farmstead																									
2 acres Williams loam																									
2.2 ft ² quadrats																									
Seeding	Collection	Tran-																				TO-			
Date	Date	sect	Species	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'	160'	170'	180'	190'	200'	TAL	%
07/08/98	07/22/99	1	big bluestem			3	2		5		1	1	2	3	3	3	2		2	2	2		5	36	70
07/08/98	07/22/99	2	big bluestem	1	1					4	1			2	1			1	1			1	4	17	50
10/21/98	07/19/99	1	big bluestem					3	1			2			1		1	4	1		1	1	1	16	50
10/21/98	07/19/99	2	big bluestem	4		2			2	3						2			1	4		1		19	40
07/08/98	07/22/99	1	bluegrass-old	2		1				1								1	1					6	25
07/08/98	07/22/99	2	bluegrass-old		2%	1	1		1							20%	5%	1	1	80%					45
10/21/98	07/19/99	1	bluegrass-old																					0	0
10/21/98	07/19/99	2	bluegrass-old																					0	0
07/08/98	07/22/99	1	bromegrass-old			1							1			1	40%					2			25
07/08/98	07/22/99	2	bromegrass-old																				1	1	5
10/21/98	07/19/99	1	bromegrass-old																					0	0
10/21/98	07/19/99	2	bromegrass-old				1																	1	5
07/08/98	07/22/99	1	Canada wildrye	1								1			1									3	15
07/08/98	07/22/99	2	Canada wildrye						1															1	5
10/21/98	07/19/99	1	Canada wildrye					4		1					3	1	1	2	1	3		2	1	19	50
10/21/98	07/19/99	2	Canada wildrye				1		1										1					3	15
07/08/98	07/22/99	1	green needlegrass			1		1	1															3	15
07/08/98	07/22/99	2	green needlegrass																					0	0
10/21/98	07/19/99	1	green needlegrass					1	2	1		1	1	1	1			1				1		10	45
10/21/98	07/19/99	2	green needlegrass	1	1					2									1				1	6	25
07/08/98	07/22/99	1	Indiangrass		1			1													1			3	15
07/08/98	07/22/99	2	Indiangrass								1													1	5
10/21/98	07/19/99	1	Indiangrass										1		3	2							1	7	20
10/21/98	07/19/99	2	Indiangrass		1			1																2	10
07/08/98	07/22/99	2	other-blue grama																					0	0
10/21/98	07/19/99	1	other-blue grama																					0	0
10/21/98	07/19/99	2	other-blue grama																					0	0
07/08/98	07/22/99	1	other-crested	1	1	1			1	4	2	2									1		3	16	45

Seeding	Collection	Tran-																					TO-	%	
Date	Date	sect	Species	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'	160'	170'	180'	190'	200'	TAL	freq
07/08/98	07/22/99	2	other-crested	1	4	3							2	3	1									14	30
10/21/98	07/19/99	1	other-crested																					0	0
10/21/98	07/19/99	2	other-crested				1									1	3		1		1			7	25
07/08/98	07/22/99	2	other-quack			2	3																	5	10
10/21/98	07/19/99	2	other-quack																					0	0
07/08/98	07/22/99	2	other-wheatgrass													25	10	15	3		6			59	25
10/21/98	07/19/99	2	other-wheatgrass																					0	0
07/08/98	07/22/99	1	prairie cordgrass																					0	0
07/08/98	07/22/99	2	prairie cordgrass																					0	0
10/21/98	07/19/99	1	prairie cordgrass																					0	0
10/21/98	07/19/99	2	prairie cordgrass																					0	0
07/08/98	07/22/99	1	slender wheatgrass																					0	0
07/08/98	07/22/99	2	slender wheatgrass																					0	0
10/21/98	07/19/99	1	slender wheatgrass							2		1		1		1								5	20
10/21/98	07/19/99	2	slender wheatgrass																					0	0
07/08/98	07/22/99	1	switchgrass	1	3	3	10	2	6	3	1	1	3	2	3	4		3	1	1	2		2	51	90
07/08/98	07/22/99	2	switchgrass	1	9	12	1	10	6	3	3	2	5		3	3	2	1	4		1		4	70	85
10/21/98	07/19/99	1	switchgrass					1							2				2		2			7	20
10/21/98	07/19/99	2	switchgrass			2										1					3	2		8	20
07/08/98	07/22/99	1	Unknown new grass																					0	0
07/08/98	07/22/99	1	Unknown new grass																					0	0
07/08/98	07/22/99	1	Unknown new grass																					0	0
07/08/98	07/22/99	2	Unknown new grass							3														3	5
07/08/98	07/22/99	2	Unknown new grass																			1		1	5
10/21/98	07/19/99	1	Unknown new grass													2								2	5
10/21/98	07/19/99	1	Unknown new grass																					0	0
10/21/98	07/19/99	1	Unknown new grass																					0	0
10/21/98	07/19/99	2	Unknown new grass		1																			1	5
10/21/98	07/19/99	2	Unknown new grass						1						2									3	10
10/21/98	07/19/99	2	Unknown new grass										1			1	1		1	1	1	1	1	8	40
07/08/98	07/22/99	2	unknown-sideoats?						2															2	5
10/21/98	07/19/99	2	unknown-sideoats?																					0	0
07/08/98	07/22/99	1	other																					0	0

Seeding	Collection	Tran-																					TO-	%		
Date	Date	sect	Species	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'	160'	170'	180'	190'	200'	TAL	freq	
07/08/98	07/22/99	2	other																					0	0	
10/21/98	07/19/99	1	other																						0	0
10/21/98	07/19/99	2	other																						0	0
07/08/98	07/22/99	1	sweetclover																						0	0
07/08/98	07/22/99	2	sweetclover																						0	0
10/21/98	07/19/99	1	sweetclover %	10	25	90	95	10	40	80	50	40	60	70	80	20	55	50	50	30	75	50	5		100	
10/21/98	07/19/99	2	sweetclover %	20	70	50	60	50	5	0	0	0	5	3	0	0	0	0	10	0	10				90	
07/08/98	07/22/99	1	2-grooved milkvetch																						0	0
07/08/98	07/22/99	2	2-grooved milkvetch																						0	0
10/21/98	07/19/99	1	2-grooved milkvetch																						0	0
10/21/98	07/19/99	2	2-grooved milkvetch																						0	0
07/08/98	07/22/99	1	black samson																						0	0
07/08/98	07/22/99	2	black samson																						0	0
10/21/98	07/19/99	1	black samson						1																1	5
10/21/98	07/19/99	2	black samson																1						1	5
07/08/98	07/22/99	1	Canada milkvetch				1																		1	5
07/08/98	07/22/99	2	Canada milkvetch																						0	0
10/21/98	07/19/99	1	Canada milkvetch																						0	0
10/21/98	07/19/99	2	Canada milkvetch																						0	0
07/08/98	07/22/99	1	leadplant																						0	0
07/08/98	07/22/99	2	leadplant																						0	0
10/21/98	07/19/99	1	leadplant																						0	0
10/21/98	07/19/99	2	leadplant																						0	0
07/08/98	07/22/99	1	Lewis wild flax		1		2												1	1			1		6	25
07/08/98	07/22/99	2	Lewis wild flax																						0	0
10/21/98	07/19/99	1	Lewis wild flax	2				2		2												1			7	20
10/21/98	07/19/99	2	Lewis wild flax							1													1		2	10
07/08/98	07/22/99	1	maximilian sunflower																						0	0
07/08/98	07/22/99	2	maximilian sunflower																						0	0
10/21/98	07/19/99	1	maximilian sunflower												1										1	5
10/21/98	07/19/99	2	maximilian sunflower																1		1				2	10
07/08/98	07/22/99	1	other																						0	0
10/21/98	07/19/99	1	other																						0	0

Seeding	Collection	Tran-																						TO-	%
Date	Date	sect	Species	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'	160'	170'	180'	190'	200'	TAL	freq
07/08/98	07/22/99	1	other-blue grama									1						1						2	10
07/08/98	07/22/99	2	other-sage	1										1										2	10
07/08/98	07/22/99	1	plains coreopsis																					0	0
07/08/98	07/22/99	2	plains coreopsis		1																			1	5
10/21/98	07/19/99	1	plains coreopsis					1																1	5
10/21/98	07/19/99	2	plains coreopsis																				1	1	5
07/08/98	07/22/99	1	purple prairieclover								1					1								2	10
07/08/98	07/22/99	2	purple prairieclover																					0	0
10/21/98	07/19/99	1	purple prairieclover																					0	0
10/21/98	07/19/99	2	purple prairieclover																					0	0
07/08/98	07/22/99	1	silky prairieclover																					0	0
07/08/98	07/22/99	2	silky prairieclover																					0	0
10/21/98	07/19/99	1	silky prairieclover																					0	0
10/21/98	07/19/99	2	silky prairieclover																					0	0
07/08/98	07/22/99	1	stiff sunflower																					0	0
07/08/98	07/22/99	2	stiff sunflower																					0	0
10/21/98	07/19/99	1	stiff sunflower																					0	0
10/21/98	07/19/99	2	stiff sunflower																					0	0
07/08/98	07/22/99	1	yellow coneflower									1										1		2	10
07/08/98	07/22/99	2	yellow coneflower					1	1		1													3	15
10/21/98	07/19/99	1	yellow coneflower																					0	0
10/21/98	07/19/99	2	yellow coneflower						1															1	5

CULTURAL EVALUATION: TECHNICAL REPORT 1998-1999

Study 38C427J

Study Title: Late flowering alfalfa seed increase

Introduction: This study focuses on the development of seed production of late flowering alfalfa *Medicago sativa* ssp. *falcata*. Traditionally, conventional alfalfa types have resulted in haying periods coinciding with critical nesting periods. Optimum forage quality also dictated that haying be completed during a narrow time frame. Late flowering alfalfa is a yellow flowering alfalfa that retains its forage quality longer into the growing season. If a reliable seed source can be developed, land managers will have the option to extend their haying season. This would give nesting birds and other wildlife the required time to hatch and rear their young before the forage is removed and also allow for high quality forage.

Objective: The study objective is to develop methods that increase seed production of yellow flowering alfalfa. The indeterminate flowering characteristics of late flowering alfalfa makes seed production inconsistent. This has resulted in limited use because of high seed costs and limited seed availability in comparison to conventional alfalfa varieties.

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

Location: The study is located in panel E-7 at the Plant Materials Center, Bismarck, North Dakota.

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

Soils: Mandan silt loam (see Introduction – Soils, page 4).

Climate: The annual precipitation is 15.47 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 1998-1999 weather summary, pages 4-6).

Methods and Materials

Planting Plan: Breeder seed was obtained from South Dakota State University. This seed was assigned accession number 9082613. A 1.2-acre seed increase block was established at the Bismarck PMC on May 29, 1998.

Site Preparation: The field was fallowed in 1997 and herbicide was applied in the fall of 1997 for quackgrass control. On May 19, 1998, 2 pints of trifluralin per acre were applied and incorporated into the soil. The field was firmly packed immediately prior to seeding.

Planting Method: The field was seeded using a Truax grass drill that had been modified into a two-row planter with 42-inch row spacing.

Planting Date: May 29, 1998.

Weed Control: The field was hand weeded on July 16, 1998.

Irrigation: The field was not irrigated in 1998 or 1999.

Evaluations and measurements: Initial establishment of the field was excellent. In 1999, a comparison was done to see if clipping had an effect on the flowering period. The east two rows were mechanically clipped June 5th leaving a stubble height of 4 inches. Regrowth was slow and plants did not produce more seed than the unclipped rows. Above average moisture conditions during the growing season kept the alfalfa very lush and vegetative with limited seed production. A decision was made not to harvest the field in 1999 because of the limited seed production.

Future work will be completed on clipping dates in an attempt to minimize the flowering period. It is possible that the June clipping completed in 1999 may have been initiated too late to allow for sufficient vegetative regrowth and initiation of flowering.

It appears that a method to alter the plant's growth cycle will have to be developed through clipping or other means to force the plant to initiate flowering in a controlled time frame. This would allow for seed to be harvested when a majority of the seed in the field is mature.

CULTURAL EVALUATION: TECHNICAL REPORT 1998-1999

Study 38C429B

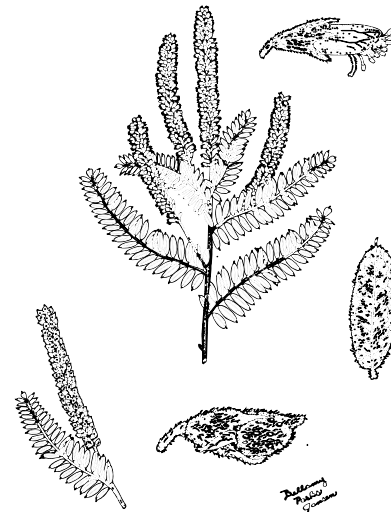
Study Title: Leadplant increase

Introduction: Leadplant (*Amorpha canescens*) is a hardy, semi-woody perennial legume. The species is native to the Great Plains region from south central Canada to central Texas. It is a component of the tall grass prairie growing in association with big and little bluestem. The name leadplant is derived from the gray color of the leaves. Some of the other names given the species are 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: A primary objective is to develop a northern hardy leadplant source for public release. This goal is achieved only after the following objectives are met: propagation, seed production, and evaluation of growth habit.

Cooperators: USDA Natural Resources Conservation Service, Plant Materials Center, Bismarck, North Dakota; and the North Dakota Association of Soil Conservation Districts, Lincoln-Oakes Nursery, Bismarck, North Dakota.

Description: Leadplant is a semi-woody, shrubby perennial. It grows from 1-3+ feet tall and has 1-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. Leadplant is deep rooted.

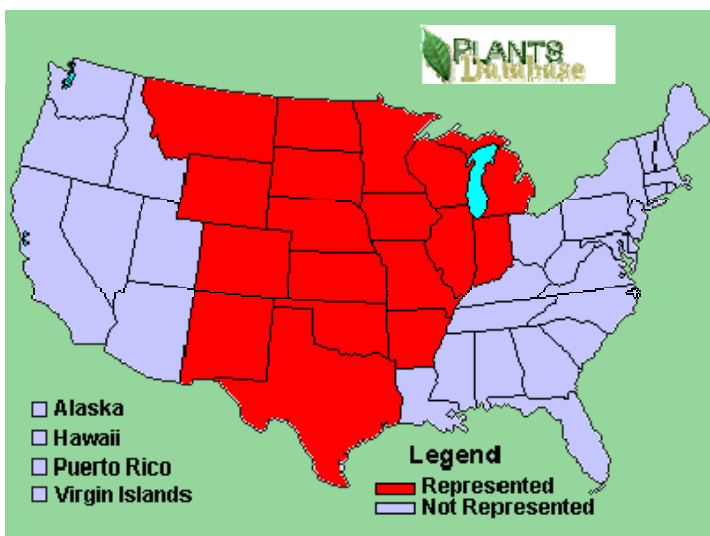


Location: Field D-10 Plant Materials Center, Bismarck, North Dakota. An 8-foot fence to reduce deer predation encloses the area.

Soils: Mandan silt loam (see Introduction-Soils, page 4).

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 1500 to 3000 ft.

Climate: The average annual precipitation is 15.47 inches, of which about three-fourths falls from 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). About 20 percent of the annual precipitation comes in the form of snow. Plant hardiness zone is 3b, with a minimum mean temperature of -30 to -40 degrees F (see Climatological Information and 1998-1999 Weather Summary, pages 4-6).



Distribution: Leadplant 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. It is distributed from southeast Montana to southwest Ontario and western Illinois and south to north Texas and northeast New Mexico, then north through eastern Colorado and Wyoming (Johnson and Larson 1999) It is present on well-managed, silty and sandy sites.

USDA, NRCS 1999. The PLANTS database (Http:\plants.usda.gov/plants) National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Methods and Materials

Assembly: The seed used to establish field D-10 was collected from selected locations in North Dakota. The table below lists the collection sites. Seeds from these collections were bulked together prior to planting. This bulked lot of seed was accessioned as 9076705.

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

The majority of the 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. Once the seed was cleaned, the bulk amount of the clean lot was 34 pounds.

Propagation:

Transplants: 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 were also planted without inoculant. Visual observations showed no differences for seedlings with or without inoculant. Seedlings from flats were transplanted to conetainers filled with a peat, perlite, and vermiculite potting mix. Seedlings were then transplanted to Field D10 on 5/20/98. Plants were spaced 2 feet apart within each row. Each row was 100-foot long, and spaced 42 inches apart.

Seeding: 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. Prior to seeding the field, 2 pt/ac of Treflan™ was applied and incorporated on 5/19/98. Seed was scarified as was done for greenhouse planting. No inoculant was used. The seeding failed to produce an adequate stand of leadplant.

Cuttings: Attempts were made in 1996 to propagate leadplant by hardwood cuttings. Cuttings were made on February 7, 1996 at the Burleigh County site of 16-137-78. 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. These were planted in the mist bed with misting set for every 5 minutes. Perlite was used as growth medium and the ends were dipped in Dip and Grow solution. Cuttings failed to leaf out or produce roots. Cuttings were removed in April from the mist bed and disposed.

Seed Counts: Seeds were counted out by hand. Seeds were weighed using a Mettler scale at the ARS station at Mandan, ND.

Seed Lot: SWC-95-9076705	No hull	Hull attached
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

Maintenance: Field D10 has been hand weeded and roto-tilled when possible. No chemical other than Treflan used at establishment has been applied. Plants were clipped to a 2-4 inch stubble height in 1999.

Results and Conclusions

Seedlings transplanted to the field in 1998 have established. Plants flowered in 1999. Weeds have been a severe problem in this field, particularly in mid and late summer. Plants reached a height of approximately one foot in 1999. Plants of this species appear to be hardy, slow growers. We anticipate a harvest of seed in 2001. Harvesting techniques and weed control measures will be evaluated in the following years of the study.

References

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

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Stubbendieck, James and Elverne C. Conard. 1989. *Common Legumes of the Great Plains*. University of Nebraska Press, Lincoln.

Sedivec, Kevin K. and William T. Barker. 1997. *Selected North Dakota and Minnesota Range Plants*. NDSU Extension Service, North Dakota State University, Fargo.EB-69.

Moerman, Daniel E. 1998. *Native American Ethnobotany*. Timber Press, Portland, Oregon.

CULTURAL EVALUATION: TECHNICAL REPORT 1998-1999

Study 38C430C

Study Title: Silky prairieclover increase

Introduction: Silky prairieclover, *Dalea villosa* (Nutt.)Spreng. is a native, perennial legume. Previously it was named *Petalostemon villosus*. Other common names include hairy prairieclover, casmu hoholhota (Lakota) . It grows most commonly on sandy soils. It is palatable to livestock. Deer and pronghorn are known to use it. Its infrequency is suspected to be the result of its good palatability. Birds and rodents eat the seed. Lakota used the roots as a laxative; leaves and blossoms were eaten for swelling of the throat. Species for planting on sandy sites are limited. Silky prairie clover could be an important component in revegetation and stabilizing of these sites. The structure and color of the species gives it potential in landscaping.

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

Cooperators: USDA Natural Resources Conservation Service, Plant Materials Center, Bismarck, North Dakota; and the North Dakota Association of Soil Conservation Districts, Lincoln-Oakes Nursery, Bismarck, North Dakota

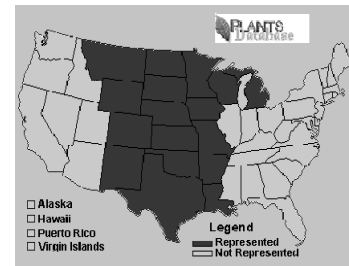
Location: Field D-10 Plant Materials Center, Bismarck, North Dakota. An 8-ft. fence to reduce deer predation encloses the area.

Soils: Mandan silt loam (see Introduction-Soils, page 4).

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 1500 to 3000 ft.

Climate: The average annual precipitation is 15.47 inches, of which about three-fourths falls from 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). About 20 percent of the annual precipitation comes in the form of snow. Plant hardiness zone is 3b, with a minimum mean temperature of -30 to -40 degrees F (see Climatological Information and 1998-1999 Weather Summary, pages 4-6).

Distribution: It grows most commonly in sandy soils of prairies, stream valleys, open woodlands, and fringes of blowouts throughout the Great Plains. The map shows distribution of silky prairie clover in the United States. The specie also grows northward to southern Manitoba and Saskatchewan.



USDA, NRCS 1999. The PLANTS database ([Http://plants.usda.gov/plants](http://plants.usda.gov/plants)) National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Description: The plant grows from 8-14 inches tall. The plant develops from red orange roots and has a branching crown. Stems and leaves are covered with soft hairs, giving the plant a gray-green color. The leaves are alternate and odd pinnately compound with 11 to 21 leaflets. The inflorescence is a spike that can be up to 4 inches long. The flowers are pale rose to rose purple.



Stubbendieck and Conard 1989

Methods and Materials

Assembly: The seed used to establish field D-10 was collected from selected locations in North Dakota. The table below lists the collection sites. Seeds from these collections were bulked together prior to planting. This bulked lot of seed was accessioned as 907874.

List of Collection Sites	
County	Location
Ransom	Sheyenne Grassland 33-135N-53W 10-135N-52W (Richland Co.) 6-134N-53W
Morton	Morton Co. Game Management Area 27-137N-81W
McHenry	J. Clark Salyer National Wildlife Refuge Sandhills Trail Denbigh Forest 36-156N-78W
Sioux	14-132N-83W-John Erickson land

The majority of seed has been collected in Sioux County. A large portion of the seed has also been collected at the various sites in Ransom County. The collection sites in these counties were sand dunes. Seed was collected from 1995-1997 at the various locations. Approximately 15 pounds (after cleaning) of seed was collected.

Propagation:

Transplants: Seed was mechanically scarified using a tabletop scarifier. Scarification was minimal. After scarifying, seed was planted into flats in the greenhouse in February and March of 1998. No seed inoculant was used for the greenhouse or the field planting. Seedlings were transplanted to four rows in field D10 on 5/20/98. Plants were spaced 1 foot apart within the 100-foot length of row. Space between the rows was 42 inches. Transplants were also planted in 1999 to replace plants that died in the transplanted rows and to enhance stands within the seeded rows.

Seeding: Rows were seeded adjacent to the transplanted seedling on 6/16/98, using a two-row modified Truax drill. Twenty rows were seeded. Rows were 42 inches apart and 100 foot long. Seed was scarified with the same method as for greenhouse planting. Inoculant was not used. Seed was run through the legume box of the drill that was calibrated to seed approximately 40 seeds bulk/linear foot. No herbicide was applied prior to planting.

Seed Counts:

Seeds were counted out by hand. Seeds were weighed using a Mettler scale at the ARS station at Mandan, ND. Counting of this single lot was used as a general indicator of seeds/pound for the species. The following table shows seed weights and number of seeds per pound.

Seed Lot: SWC-95-9076704	
1000 seeds	1.787 g
1000 seeds	1.779 g
Average seeds per pound	254400 seeds/pound

Maintenance: Field D10 has been hand weeded and rototilled when possible. No chemical has been applied to this planting. Irrigation to establish planting was used in 1998 and 1999.

Harvest: 1999-Seed production was minimal in 1999. Seed was hand stripped and processed. Less than 200 grams of clean seed was harvested

Results/Conclusion

Based on our collection sites, silky prairieclover grows well in sandy soils. It does not appear to compete well with weed competition. Establishment of plants from seed is slow. The seedcoat is hard and permeability to water is limited. Scarification appears to increase germination. Based on the rowed field situation at the PMC, establishment is slow.

Field D-10 will be maintained with anticipation of seed production in the coming growing seasons. Plants will be monitored for any disease or insect problems.

References

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

Van Bruggen, Theodore. 1976. *The Vascular Plants of South Dakota*. The Iowa State University Press, Ames IA.

Johnson, James R. and Gary E. Larson. 1999. *Grassland Plants of South Dakota and the Northern Great Plains*. South Dakota State University, College of Agriculture and Biological Sciences, South Dakota Agricultural Experiment Station, B 566 (rev).

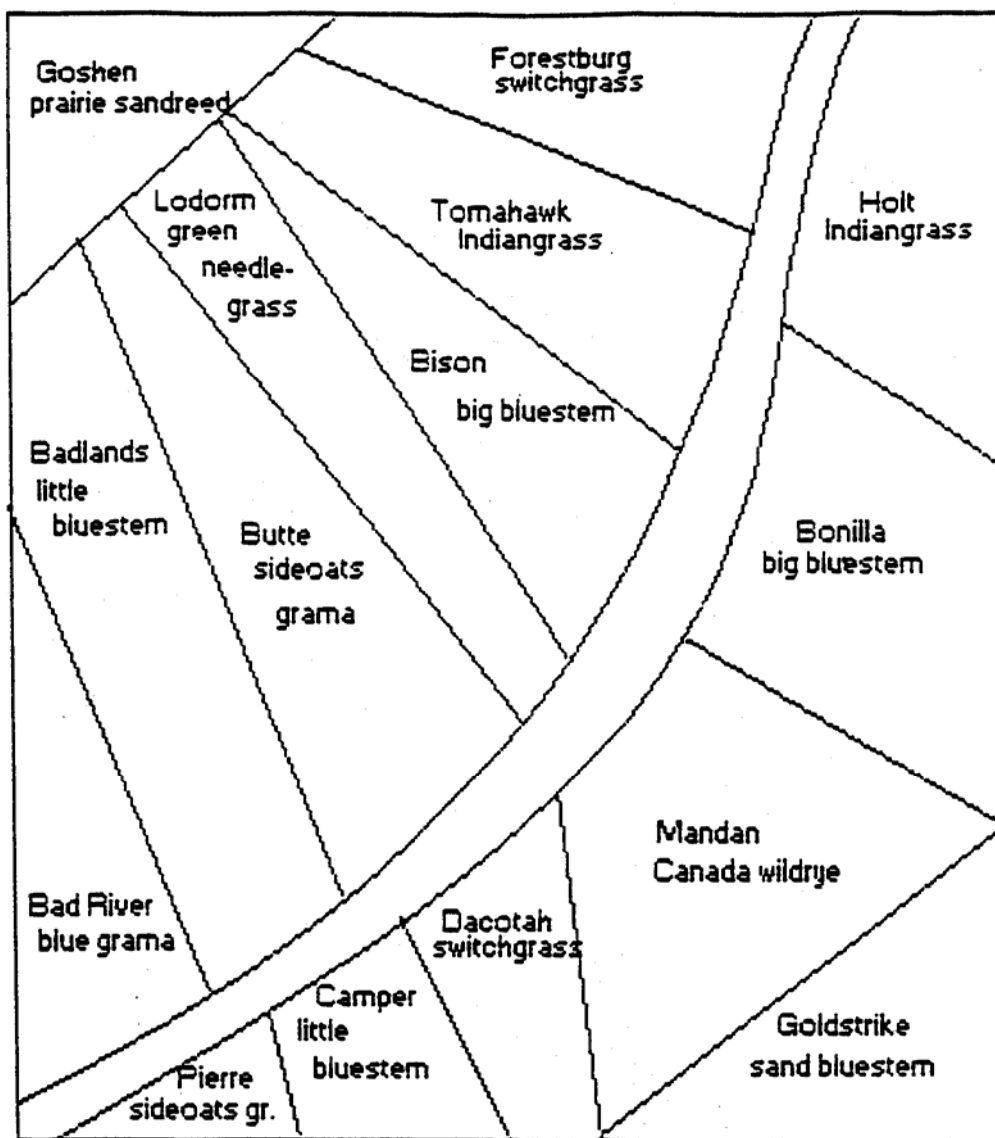
Stubbendieck, James and Elverne C. Conard. 1989. *Common Legumes of the Great Plains*. University of Nebraska Press, Lincoln.

Moerman, Daniel E. 1998. *Native American Ethnobotany*. Timber Press, Portland, Oregon.

CULTURAL EVALUATION: TECHNICAL REPORT - 1998-1999

Grass Garden Demonstration

A native grass garden demonstration was planted in June 1997 on the south end of A Panel at the Bismarck PMC. Vegetative plant material was hand dug from seed fields or evaluation plots and transplanted to the grass garden. Some species were grown from seed in cone-tainers. Individual plants were space planted and mulched with wood chips. The purpose of the grass garden is to demonstrate the natural beauty of many native grass species and provide accent plants (spaced plants) for public viewing and consideration for use in prairie landscaping. The figure below shows the garden layout.



SELECTION AND INCREASE

The
UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
and
MINNESOTA
AGRICULTURAL EXPERIMENT STATION
and
NORTH DAKOTA
AGRICULTURAL EXPERIMENT STATION
and
SOUTH DAKOTA
AGRICULTURAL EXPERIMENT STATION

ANNOUNCE THE RELEASE OF SELECTED CLASS

RED RIVER “NATURAL” GERMPLASM PRAIRIE CORDGRASS

The United States Department of Agriculture, Natural Resources Conservation Service (NRCS, formerly the Soil Conservation Service); the Minnesota Agricultural Experiment Station; the North Dakota Agricultural Experiment Station; and the South Dakota Agricultural Experiment Station announce the naming and release of selected class Red River natural germplasm prairie cordgrass, *Spartina pectinata* Link.

This prairie cordgrass selection has been assigned NRCS accession number 9069159 and given a Plant Introduction (PI) number of 599561. Red River germplasm prairie cordgrass has been developed to provide an adapted seed source with a relatively broad genetic base for use in the North Central and Northern Plains Region of the United States. Primary use is for wetland restoration and enhancement and streambank stabilization. Secondary uses include windstrip barriers, filter strips, riparian buffers, and prairie landscaping.

ORIGIN/SELECTION: Red River germplasm prairie cordgrass is a composite of 4 accessions (Table 1) selected from an evaluation nursery of 20 accessions. All accessions were vegetatively collected by USDA Soil Conservation Service personnel in September and October, 1990. Plants were collected from North Dakota, South Dakota, and Minnesota (USDA 1992-1993). A description of the collection site was documented from each accession. Clonal material of each accession was propagated and transplanted to a spaced-plant evaluation nursery containing three replicates of three plant clones in a randomized complete block design.

The initial evaluation nursery contained 180 individual plants representing 20 different accessions. A small wetland was constructed on a low area in a seed production field at the Bismarck Plant Materials Center. Water from an irrigation system was used to flood the area on a regular basis. Data collection in 1992 and 1993 included vigor, rate of spread, plant height, foliage abundance, seed production, and phenology. A seedling emergence study was also conducted in 1992 to compare germination and seedling vigor qualities among accessions (USDA 1992-1993).

Phenotypic variation among accessions was evident. Significant variation was noted in plant height, leaf width, stem coarseness, leaf abundance, and phenology. Four accessions were selected to represent the Red River germplasm. Two of the accessions originated from the Red River Valley bordering North Dakota and Minnesota.

Selected accessions rated comparable to the nursery mean for vigor and width of spread (Table 2). Overall, plant height was greater than the nursery mean for three of the four accessions. Phenology varied slightly for the four selected accessions but was generally within a range of 5 to 7 days. This was about a week earlier than the nursery mean. Three of the four accessions were rated high for seed production. Visual observations indicated all four accessions were generally more leafy compared to the nursery average. Distinctive differences were noted throughout the nursery for coarseness of leaf and stem material. Two of the accessions were relatively fine-leaved, and one had coarser leaves.

Three of the selected accessions were collected from fairly typical wetland sites with similar associated species. Accession 9063068 was the exception. It was collected from a saline area growing in association with more salt tolerant species (Table 1).

Clonal material was propagated from the four selected accessions and transplanted to an isolated seed production field in 1994. The field is approximately 2 acres with 15 rows spaced 10 feet apart. Seed harvested from this field will be considered Generation 1 parent seed.

PLANT DESCRIPTION: Prairie cordgrass is one of the tallest grasses native to North America. It varies in height from 4 to 10 feet and occupies wet soils throughout the prairie region of North America. Prairie cordgrass is a warm-season species with long, coarse leaves, thick stems, and scaly rhizomes. Leaf blades may be up to 30 inches long with sharp points on the margin (Johnson and Nichols 1982). The inflorescence is a spike. The number of spikes can vary from 10 to 30. Red River germplasm prairie cordgrass does not differ significantly from the general plant description of the species; however, plants may be somewhat leafier and have improved seed production when compared to the typical Northern Plains ecotype. Moderate variation in plant size and coarseness of leaf is to be expected in the Red River germplasm.

Red River germplasm prairie cordgrass varies in height from 5 to 7 feet. Plant color is a uniform dark green with yellowing of the leaves beginning in late summer. Phenology is fairly uniform and may vary from 5 to 10 days. Average first anthesis at Bismarck, North Dakota, is mid to late July.

SITE DESCRIPTION: The collection area of the 4 selected accessions includes parts of two Major Land Resource Regions: the Northern Great Plains Spring Wheat Region and the Central Feed Grains and Livestock Region (USDA 1981). Within these two regions, selected plants originated from the following Major Land Resource Areas: 56 (Red River Valley of the North) and 102A (Rolling Till Prairie).

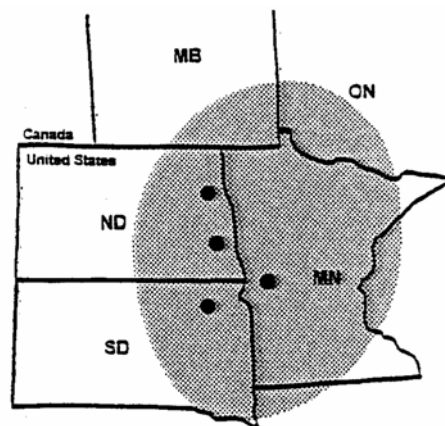
The climate of the area is temperate with temperature extremes being the normal. Winter temperatures of -40° F may occur in the northern part of this region. Killing frosts often occur in late May. The average annual temperature varies from about 40 to 52° F. More than one-half of the average annual precipitation falls during the growing season. Precipitation in winter is snow. The freeze-free period of this area varies from 105 to 140 days. Elevation is relatively flat in the Red River Valley area and grades into more rolling terrain outside of the valley.

Associated wet meadow species include whitetop (*Scolochloa festucacea*), slough sedge (*Carex atherodes*), northern reedgrass (*Calamagrostis stricta*), maximilian sunflower (*Helianthus maximiliana*), big bluestem (*Andropogon gerardii*), and switchgrass (*Panicum virgatum*).

PLANT PERFORMANCE: There are no commercial varieties of prairie cordgrass; therefore, the nursery mean was used as a standard of comparison. Compared to more northern germplasm, Red River germplasm prairie cordgrass can be expected to perform comparably in plant vigor and establishment. Seed production and leafiness were rated higher for the selected accessions compared to the nursery mean. Phenology was rated about a week earlier than the nursery mean.

Seed production fields at the Bismarck Plant Materials Center have been established from rhizome material harvested from the parent plants. Rhizome material with about a 12" stem intact was planted using a tree planter. Vigor and establishment was good to excellent. One field was harvested for a small amount of seed the year of planting. A production field in Minnesota was established from seed with good emergence and seedling vigor (Kaste 1996).

The 4 collection sites of Red River germplasm prairie cordgrass are indicated on the following map. The projected primary area of adaptation is shaded.



SEED PRODUCTION CONSIDERATIONS: Experience at the Bismarck Plant Materials Center has shown that wide row spacing is beneficial for seed production of prairie cordgrass. A row spacing of 10 feet has worked well, with regular cultivation between the rows. A 2-acre field has yielded about 150-200 pounds of clean seed per year.

Seed is harvested by straight combining in early October, after the leaf material has dried down as much as possible. Seed shattering has not been a problem. Flooding is generally not required, but irrigation is desirable for maximum production.

Prairie cordgrass can be harvested with a standard combine with a straight header. Higher cylinder RPM's (1200) are necessary for threshing the seed. Fan speeds should be reduced to avoid blowing the seed over the sieves. Prairie cordgrass leaves and stems are very fibrous, and combining should be done during dry conditions.

RELEASE JUSTIFICATION: There are no commercial varieties available for prairie cordgrass. Common seed of northern origin prairie cordgrass has been in limited supply. Red River germplasm prairie cordgrass has been developed to meet the increased need for a northern

origin prairie cordgrass to be planted as a wet meadow species for wetland restoration and enhancement and streambank stabilization.

AVAILABILITY OF PLANT MATERIALS: Generation 1, or parent seed, of Red River germplasm prairie cordgrass is available from the USDA-NRCS Plant Materials Center, 3308 University Drive, Bismarck, North Dakota 58504-7564. Limited quantities of Generation 2 seed will be available from commercial vendors beginning in the fall of 1997. Certification is limited to two generations.

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REFERENCES:

Johnson, J.R., and J.T. Nichols. 1982. Plants of South Dakota Grasslands. South Dak. Agr. Expt. Sta. Bul. 566, Brookings, SD.

Kaste, Paul. 1996. Personal communication. Seed grower. Fertile, Minnesota.

Tober, D.A., R.J. Haas, M.J. Knudson, and N.K. Jensen. Evaluation and seed production of prairie cordgrass (*Spartina pectinata*) and whitetop (*Scolochloa festucacea*) in the Northern Great Plains. p. 13. *In*: Abstracts SRM 50th Ann. Mtg., Rapid City, SD, Feb 16-21, 1997.

USDA Natural Resources Conservation Service, Bismarck Plant Materials Center. 1992-1993. Technical Report, Part 1 of 2, Grasses, forbs and legumes. pp. 45-49.

USDA Soil Conservation Service. 1981. Land Resources Regions and Major Land Resource Areas of the United States. Agr. Handb. 296. U.S. Gov. Print. Office, Washington, D.C.

Table 1. Selected plants comprising Red River germplasm prairie cordgrass.

Accession Number	County/State Collected	Major Land Resource Area	Average Annual Precip. (inches)	Site Information	Associated Plant Species	Legal Description	Collector
9063065	Cass Co., ND	56	19.45	wet road ditch	<i>Andropogon gerardii</i> , <i>Typha</i> sp.	sec 35, T. 143 N., R. 52 W.	Russ Haas
9063068	Grand Forks Co., ND	56	18.34	saline area	<i>Kochia scoparius</i> , <i>Hordeum jubatum</i>	sec. 6, T. 151 N. R. 51 W.	Russ Haas
9063072	Grant Co., MN	102A	21.66	wet area	<i>Andropogon gerardii</i> , <i>Helianthus maximiliana</i> , <i>Solidago</i> sp.	sec. 17, T. 128 N., R. 44 W.	Russ Haas
9063082	Day Co., SD	102A	19.38	upper edge of wetland	N/A	sec. 23, T. 121 N., R. 56 W.	Mark Washechek

Table 2. Data collected in 1992 and 1993 from initial evaluation nursery with three replications and twenty accessions.

Accession	Year	Origin	Vigor ¹	Width of Spread (inches)	Phenology ²	Height (inches)	Comments
9063065	1992	Cass Co., ND	4.0	----	4.0	----	N/A
9063065	1993	Cass Co., ND	----	41	5.0	76	Excellent seed production, fine leaf, very leafy
9063068	1992	Grand Forks Co, ND	5.3	----	4.0	----	N/A
9063068	1993	Grand Forks Co, ND	----	39	5.0	66	Excellent seed production, very leafy
9063072	1992	Grant Co., MN	4.7	----	3.0	----	N/A
9063072	1993	Grant Co., MN	----	37	4.2	78	Good seed production, very leafy
9063082	1992	Day Co., SD	3.5	----	3.5	----	N/A
9063082	1993	Day Co., SD	----	39	3.5	76	Very leafy, coarser leaf
Nursery Range	1992/93	ND-SD-MN	2.3-6.7	20-51	2.0-5.0	54-82	N/A
Nursery Mean	1992/93	ND-SD-MN	4.5	40	3.1	71	N/A

¹ 2=Highest; 6=Lowest

² 1=Vegetative; 2=Jointing; 3=First emergence of inflorescence, 10 culms or more; 4=First anthesis, 10 culms or more; 5=50 percent anthesis; 6=First seed ripe; 7=50 percent of seed ripe; 8=Seed mature; 9=Complete dormancy. 1992 phenology collected on July 17, and 1993 phenology collected on July 30.

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Date

SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION
SOUTH DAKOTA STATE UNIVERSITY
DEPARTMENT OF PLANT SCIENCE

AND

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

ANNOUNCE THE RELEASE OF SUNNYVIEW BIG BLUESTEM

'Sunnyview' big bluestem (*Andropogon gerardii* Vitman) was developed by the South Dakota Agricultural Experiment Station, Brookings, South Dakota, and released in cooperation with the USDA-NRCS, Plant Materials Center, Bismarck, North Dakota.

Sunnyview originated from seed collections made from native prairies in southeastern (Union County) South Dakota. It was formed by one cycle of phenotypic selection followed by a cycle of family selection. Sunnyview is comprised of about 30 plants from each of 15 half-sib families. Nine of those families are from open-pollinated spaced plants that were selected for vigor, leafiness, seed yield, and fertility of the pedicellate spikelet. The others are from a 6-genotype polycross comprised of parents selected for the same criteria. The entire nursery of about 450 plants was harvested in bulk to produce breeder's seed.

Sunnyview is later maturing than cultivars of more northern origin (e.g. 'Bison' and 'Bonilla'), but reaches anthesis about 12 days before 'Pawnee' and about 25 days before 'Kaw' at Brookings, South Dakota. The same phenological relationships among these cultivars have also been observed at other locations in the northern Great Plains.

Sunnyview is vigorous, leafy, and winterhardy. It demonstrated excellent forage production and persistence in six trials conducted in South Dakota, North Dakota, and Minnesota from 1983 through 1989. Averaged across 24 location-years, Sunnyview produced 4732 ± 604 kg ha⁻¹ compared with 3308 ± 461 kg ha⁻¹ for Bison, 3385 ± 454 kg ha⁻¹ for Bonilla, and 4108 ± 469 kg ha⁻¹ for Pawnee. Mean concentration of total N in herbage of Sunnyview ranged from 19 g kg⁻¹ prior to heading to < 10 g kg⁻¹ at the dough stage of seed development. This was similar to N levels in herbage of 'Sunburst' switchgrass, but less than for "Oahe" intermediate wheatgrass [*Thinopyrum intermedium* (Host) Barkworth & D.R. Dewey], 'Regar' meadow bromegrass (*Bromus*

riparius Roem), which had total N concentrations of approximately 30 g kg⁻¹ and 12 g kg⁻¹ at those same stages of development, respectively.

The morphological characteristic that separates Sunnyview from other big bluestem cultivars is a high percentage of partially to completely hermaphroditic plants. In clonal nurseries of eight randomly-selected genotypes planted in good seed production environments, seed set in pedicellate spikelets was about 70% compared to 80% in sessile spikelets. However, in more xeric environments, seed set was about 40% in sessile and only about 23% in pedicellate spikelets. Caryopses produced in pedicellate spikelets are lighter than those from sessile spikelets of the same plant. The difference is genotype dependent and ranged from 24 to 92% heavier for caryopses from sessile spikelets.

The primary area of adaptation for Sunnyview is USDA Plant Hardiness Zones 3 and 4 between 42° and 49° N latitude and 95° and 100° W longitude. This area includes parts of the major Land Resource Areas: (1) Central Black Glaciated Plains, (2) Southern Black Glaciated Plains, (3) Red River Valley of the North, (4) Rolling Till Prairie, (5) Loess Uplands and Till Plains, (6) Central Iowa and Minnesota Till Prairies, and (7) Iowa and Missouri Deep Loess Hills.

Breeder seed of Sunnyview will be maintained at the South Dakota Agricultural Experiment Station. Foundation seed will be maintained and distributed by the Foundation Seed Stocks Division, South Dakota State University. Certified seed will be grown exclusively from the foundation generation.

Marc Sufley 4/21/98
Director Date
Ecological Sciences Division
Natural Resources Conservation Service
Washington, D.C.

Dean Fisher 4-6-98
State Conservationist Date
Natural Resources Conservation Service
Huron, South Dakota

Scott Hoop Jr 3/19/98
State Conservationist Date
Natural Resources Conservation Service
Bismarck, North Dakota

T. A. Chalich 2-17-98
Director Date
Agricultural Experiment Station
Brookings, South Dakota

SEED PRODUCTION

Accession: 'Bison' (NDG-4, 9005667, PI-477994)													
Name/Species: big bluestem, <i>Andropogon gerardii</i>													
Location: Field E-8													
Year of Establishment: 1997													
Origin/Source: Oliver County, North Dakota; USDA, ARS, Mandan, North Dakota													
Prod.		Cert.	Seed		Bulk (lbs)						Other		
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date	Notes
1998	Foundation	980067-1	9808345	3.04	248.0	95.60	87	0	4.26	0.14	0	03/24/1999	
1999	Foundation	990863-1	9904487	1.76	279.5	90.13	90	0	9.86	0.01	0	01/26/2000	
1999	Foundation	990863-1	9903569	1.28	165.0	93.62	88	0	6.35	0.03	0	01/12/2000	Plateau

Accession: 'Bonilla' (SD-27, PI-315658)													
Name/Species: big bluestem, <i>Andropogon gerardii</i>													
Location: Field D-10													
Year of Establishment: 1987													
Origin/Source: Morton County; USDA, ARS, Mandan, North Dakota													
Prod.		Cert.	Seed		Bulk (lbs)						Other		
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date	
1988	Foundation	1764	M35857	1.40	320.0	97.04	74	1	2.96	0.00	0.00	03/27/1989	
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	01/17/1991	
1991	Foundation	2135	N18291	1.40	118.0	93.76	77	0	6.24	0.00	0.00	01/27/1992	
1992	Foundation	1053-1	P08550	1.42	175.0	92.16	73	0	7.83	0.00	0.00	01/12/1993	
1993	Foundation	3067-1	9303772	1.42	165.0	95.07	72	0	4.93	0.00	0.00	02/28/1994	
1994	Foundation	940232-1	9406903	1.42	276.5	93.34	82	1	6.64	0.00	0.02	01/31/1995	
1995	Foundation	950194-1	9514495	1.42	124.5	97.35	89	0	2.64	0.01	0.00	04/22/1996	
1996	Foundation	960049-1	9609264	1.42	242.0	85.85	78	0	14.14	0.01	0.00	03/18/1997	
1997	Foundation	970037-1	9709197	1.42	180.5	92.18	83	1	7.82	0.00	0.00	03/13/1998	
1998	Foundation	980059-1	9803403	1.42	298.0	97.22	88	1	2.78	0.00	0.00	01/05/1999	
1999	Foundation	990858-1	9910452	1.42	237.5	94.58	87	0	5.42	0.00	0.00	04/27/2000	

Accession: 9069118												
Name/Species: twogrooved milkvetch, <i>Astragalus bisulcatus</i>												
Location: Field D10												
Year of Establishment: 1994												
Origin/Source: North Dakota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1995	Common		9508566	0.05	17.0	94.50	8		5.47	0.03	0	02/06/1996
1996	Common		9604736	0.05	26.5	98.73	5		1.01	0.26	0	12/19/1996
1997	Common		9711335	0.05	31.5	90.39	8		9.52	0.09	0	04/02/1998
1998	removed											

Accession: 9069117												
Name/Species: Canada milkvetch, <i>Astragalus canadensis</i>												
Location: Field D10												
Year of Establishment: 1994												
Origin/Source: North Dakota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1995	Common		9507025	0.05	27.0	95.61	3		4.39	0.00	0.00	02/06/1996
1996	Common			0.10	82.0	97.04	5		2.84	0.12	0.00	12/19/1996
1997	Common		9711334		61.5	93.66	11		6.33	0.01	0.00	04/03/1998
1998	removed											

Accession: Pierre (SD-251, PI-476980)												
Name/Species: sideoats grama, <i>Bouteloua curtipendula</i>												
Location: Field E-9												
Year of Establishment: 1977												
Origin/Source: Stanley County; Ft. Pierre, South Dakota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	Test
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Date
1978	Common		H20314	2.40	24.0	89.45	63		10.54		0.01	05/01/1979
1979	Common		I7089	2.40	899.0	88.58	76		11.41	0.01		04/18/1980
1980	Foundation	1020	J7932	1.00	125.0	96.36	69		3.63	0.01		05/11/1981
1981	Foundation	1177	J20193	1.00	346.0	96.74	80		3.24	0.01	0.01	03/25/1982
1982	Foundation	1160	J36814	1.00	344.0	97.43	56		2.55	0.01	0.01	03/24/1983
1983	Foundation	1498	K11299	1.00	520.0	97.85	82	1	2.13	0.01	0.01	04/12/1984
1984	Foundation	1643	K27724	1.00	248.0	98.78	88		1.20	0.01	0.01	04/15/1985
1985					No harvest							
1986	Common		L22863	1.00	123.0	98.77	87	1	1.23	0.00	0.00	03/24/1987
1987	Foundation	16797	M16481	1.00	192.0	93.11	64	1	6.89	0.00	0.00	04/20/1988
1988	Foundation	1777	M29887	1.00	218.0	97.8	77	1	2.18	0.02	0.00	01/03/1989
1989	Foundation	92011	N11668	0.90	129.0	99.34	61	0	0.66	0.00	0.00	01/17/1990
1990	Foundation	1666	N8366	1.10	572.0	98.06	92	0	1.93	0.01	0.00	04/16/1991
1991	Foundation	2143	N20087	1.10	273.5	97.85	80	0	2.13	0.02	0.00	02/28/1992
1992	Foundation	1049-1	P09603	1.10	229.0	93.28	83	0	6.70	0.00	0.02	02/04/1993
1993	Foundation	3062-1	9308492	1.10	113.0	94.19	71	0	5.81	0.00	0.00	04/27/1994
1994	Foundation	940238-1	9411461	1.09	100.0	96.57	68	0	3.43	0.00	0.00	03/21/1995
1995	Foundation	950191-1	9508544	1.09	234.5	97.69	75	0	2.29	0.02	0.00	02/21/1996
1996	Foundation	960044-1	9607307	1.09	186.0	98.43	81	0	1.57	0.00	0.00	02/20/1997
1997	Foundation	970044-1	9711274	1.09	92.5	90.16	88	0	9.84	0.00	0.00	03/19/1998
1998	Foundation	980056-1	9809152	1.09	174.5	96.45	85	0	3.55	0.00	0.00	03/30/1999
1999	Foundation	990860-1	990860-1	1.09	218.5	93.00	81	4	6.96	0.02	0.02	12/14/1999

Accession: Bad River ecotype (9063064)												
Name/Species: blue grama, <i>Bouteloua gracilis</i>												
Location: Field D-11												
Year of Establishment: 1992												
Origin/Source: Haakon County; Philip, South Dakota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1993	Common		9311846	1.4	13.0	90.14	54	0	9.86	0.00	0.00	05/19/1994
1994	Common		9414480	1.4	26.5	96.25	83	0	3.70	0.00	0.05	05/11/1995
1995	Select (G2)	950187-1	9510001	1.4	229.0	93.88	92	1	6.02	0.05	0.05	03/13/1996
1996	Select (G2)	960038-1	9606989	1.4	63.0	84.86	88	0	15.04	0.05	0.05	02/21/1997
1997	Select (G2)	970035-1	9707327	1.4	175.5	95.75	96	0	4.15	0.05	0.05	03/02/1998
1998	Select (G2)	980060-2	9805427	1.4	189.5	94.62	98	0	5.28	0.05	0.05	03/12/1999
1999	Select (G2)	990866-2	990866-2	1.4	57.0	91.14	97	0	8.86	0.00	0.00	04/28/2000

Accession: Bad River ecotype (9063064)												
Name/Species: blue grama, <i>Bouteloua gracilis</i>												
Location: Field D-8												
Year of Establishment: 1995												
Origin/Source: Haakon County; Philip, South Dakota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	Test
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Date
1997	Select (G2)	970035-2	9707324	1.94	172.5	94.7	98	0	5.05	0.20	0.05	03/02/1998
1998	Select (G2)	980060-1	9805428	1.94	113.5	95.05	96	0	4.85	0.00	0.00	03/04/1999
1999	Select (G2)	990866-1	9912265	1.94	80.5	90.99	96	0	8.60	0.37	0.04	04/18/2000

Accession: Bismarck germplasm (9076759)												
Name/Species: narrow-leaved purple coneflower, <i>Echinacea angustifolia</i>												
Location: Field D-11												
Year of Establishment: 1997(seeded Oct.)												
Origin/Source:												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1999	Select (G1)	990872-1	9907471	0.56	13.50	88.97	20	54	11.02	0.01	0.00	03/01/2000

Accession: Mandan' (9058908)												
Name/Species: Canada wildrye, <i>Elymus canadensis</i>												
Location: Field E-11												
Year of Establishment: 1994/1995												
Origin/Source: Morton County, North Dakota; USDA, ARS, Mandan, North Dakota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1994	Foundation	940241-1	9412265	0.61	84	97.59	77		2.4	0.01	0.00	03/24/1995
1995	Foundation	950188-1	9509586	0.61	313	99.39	94		0.59	0.02	0.00	03/13/1996
1996	Foundation	960046-1	9606063	1.04	696	98.77	92		1.22	0.01	0.00	01/23/1997
1997	Foundation	970045-1	9703540	1.04	350	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	03/01/1999
1999	Foundation	990864-1	9905684	1.04	269.5	97.37	82		2.62	0.01	0.00	02/22/2000

Accession: 'Reliant' (Mandan-1813, PI-556987)												
Name/Species: intermediate wheatgrass, <i>Elytrigia intermedia</i>												
Location: Field D-7												
Year of Establishment: 1989												
Origin/Source: USDA, ARS, Mandan, North Dakota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1990	Foundation	1673	N12763	0.92	397.00	99.39	94		0.61	0.00	0.00	06/27/1991
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	02/02/1993
1993				0.92	No harvest (hail damage)							
1994	Foundation	940234-1	9407584	0.92	96.50	97.33	98		2.67	0.00	0.00	02/06/1995
1995	Foundation	950192-1	9510849	0.92	286.50	97.39	85	0	2.59	0.01	0.01	03/12/1996
1996	Foundation	960048-1	9606991	0.92	218.50	93.51	92	0	6.49	0.00	0.00	02/13/1997
1997	Foundation	970039-1	9705284	0.92	383.00	98.73	98	0	1.27	0.00	0.00	01/14/1998
1998	Foundation	981858-1	9806829	0.92	360.00	98.09	97	0	1.91	0.00	0.00	02/26/1999
1999	Foundation	990856-1	9906202	0.92	260.00	96.55	96		3.44	0.00	0.01	02/22/2000

Accession: 'Manska' (Mandan-2781, PI-562527)												
Name/Species: pubescent wheatgrass, <i>Elytrigia intermedia</i>												
Location: Field E-6												
Year of Establishment: 1990												
Origin/Source: USDA, ARS, Mandan, North Dakota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1991	Foundation	2142	N16913	1.29	667.5	98.04	93	0	1.95	0.01	0.00	03/04/1992
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	01/26/1996
1996	Foundation	960040-2	9606988	1.29	311.0	95.16	88	0	4.83	0.01	0.00	02/13/1997
1997	Foundation	970034-1	9706070	1.29	606.5	98.22	97	0	1.78	0.00	0.00	01/27/1997
1998	Foundation	980065-2	9804229	1.29	386.0	98.71	95	0	1.28	0.01	0.00	01/21/1999
1999	Foundation	990865-1	9902645	1.29	519.5	96.99	98	0	3.00	0.01	0.00	12/20/1999

Accession: 'Manska' (Mandan-2781, PI-562527)												
Name/Species: pubescent wheatgrass, <i>Elytrigia intermedia</i>												
Location: Field D-11												
Year of Establishment: 1993												
Origin/Source: USDA, ARS, Mandan, North Dakota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
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	02/05/1995
1996	Foundation	960040-1	9606990	1	181.0	98.69	92	0	1.31	0	0.00	02/13/1997
1997	Foundation	970034-2	9707325	1	317.5	97.59	97	0	2.41	0	0.00	03/02/1998
1998	Foundation	980065-1	9804481	1	255.0	98.19	96	0	1.79	0.01	0.01	01/28/1999
1999	Foundation	990865-2	9902843	1	340.5	97.86	97	0	2.14	0.00	0.00	12/22/1999

Accession: ND-3651 (9008065)												
Name/Species: Maximilian sunflower, <i>Helianthus maximiliani</i>												
Location: Field D-11												
Year of Establishment: 1983/1985												
Origin/Source: Hughes County, South Dakota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1983	Common		K11447	0.05	3.5	97.03	18		2.90	0.00	0.07	04/27/1984
1984	Common		K31783	0.05	6.0	91.85	23		4.76	3.39	0.00	05/31/1985
1985	Common		L9742	0.63	15.0	79.29	41		20.51	0.71	0.03	04/21/1986
1986	Common		L28597	0.63	8.0	78.05	20		18.21	3.68	0.06	04/02/1987
1987	Common		M20825	0.63	13.0	71.82	6		27.99	0.15	0.04	05/20/1988
1988	Common		N17895	0.70	1.3	99.46	11		0.54	0.00	0.00	04/03/1990
1989	Common		N20601	0.70	4.5	62.66	5		37.24	0.06	0.04	05/04/1990
1990					0.0							
1991	Common		P03393	0.70	86.5	92.12	65 (TZ)		7.02	0.86		07/29/1992
1992	Common		P17831	0.70	31.0	88.38	1	47	11.03	0.59	0.00	05/11/1993
1993	Common		9312790	0.70	40.5	83.14	1	18	16.57	0.29	0.00	06/13/1994
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	03/25/1996
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	03/02/1998
1998	Common		9811399	0.70	96.5	94.27	30	64	5.26	0.47	0.00	04/13/1999
1999	Select (G1)	990870-1	9909471	0.70	26.0	98.45	18	39	0.68	0.86	0.01	03/20/2000

Accession: 9047233												
Name/Species: stiff sunflower, <i>Helianthus pauciflorus</i>												
Location: Field E-8												
Year of Establishment: 1986												
Origin/Source: Composite of nine accessions of stiff sunflower collected in North Dakota and South Dakota.												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
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	gms.						
1990	Common		N2325	0.13	3.0	97.65			2.33	0.02	0.00	12/26/1990
			N5143				93 TZ					02/07/1991
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	04/16/1993
1993	Common		9404402	0.23	7.0	58.92	1	6	40.84	0.23	0.01	12/06/1994
1994	Common		9416737	0.23	5.0	40.52	0	68	59.33	0.15	0.00	05/25/1995
1995	Common		9507024	0.23	32.0	85.58	0	59	14.30	0.12	0.00	02/06/1996
1996	Common		9609261	0.23	11.0	69.29	3	84	30.57	0.14	0.00	03/11/1997
1997	Common		9705357	0.23	14.0	58.98	4	42	41.02	0.00	0.00	01/28/1998
1998	Common		9803106	0.23	4.0	85.82	10	79	14.06	0.12	0.00	12/01/1998
1999	Select (G1)	990871-1	9908078	0.23	12.0	92.53	11	70	7.20	0.27	0.00	03/08/2000

Accession: 'Dacotah' (NDG-965-98, PI-478002)												
Name/Species: switchgrass, <i>Panicum virgatum</i>												
Location: Field A-8												
Year of Establishment: 1989												
Origin/Source: Burleigh County; Bismarck, North Dakota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1990	Foundation	1655	N7234	1.14	259.0	99.98	71	2	0.02	0.00	0.00	04/04/1991
1991	Foundation	2133	N19044	1.14	761.0	99.96	92	0	0.02	0.02	0.00	02/11/1992
1992	Foundation	1046-1	P12117	1.14	378.0	99.96	83	1	0.02	0.02	0.00	03/16/1993
1993	Foundation	3061-1	9302062	1.14	137.5	99.96	74	0	0.01	0.03	0.00	02/01/1994
1994	Foundation	940228-1	9409811	1.14	248.5	99.96	85	0	0.01	0.03	0.00	03/01/1995
1995	Foundation	950183-1	9514496	1.14	467.5	99.95	81	2	0.03	0.02	0.00	04/23/1996
1996	Foundation	960041-1	9609263	0.91	105.0	99.93	75	8	0.02	0.05	0.00	03/19/1997
1997	Foundation	970033-1	9703539	0.50	28.0	96.01	69	1	3.92	0.05	0.02	12/22/1997
1998	Removed (Fusarium root rot)											

Accession: 'Rodan' (Mandan-456, PI-477993)												
Name/Species: western wheatgrass, <i>Pascopyrum smithii</i>												
Location: Field D-11												
Year of Establishment: 1993												
Origin/Source: Morton County: USDA, ARS, Mandan, North Dakota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1993				1.47								
1994	Foundation	940231-1	9408851	1.47	165.0	91.22	91	0	8.76	0.01	0.01	02/21/1995
1995	Foundation	950186-1	9515474	1.47	152.5	89.01	75	1	10.99	0.00	0.00	05/08/1996
1996	Foundation	960050	9607306	1.47	178.5	87.68	71	3	12.32	0.00	0.00	02/20/1997
1997	Foundation	970036-1	9710312	1.47	102.0	92.77	82	1	7.23	0.00	0.00	03/23/1998
1998	Foundation	980066-1	9805429	1.47	59.5	88.40	74	2	11.6	0.00	0.00	03/02/1999
1999	Foundation	990859-1	9901983	1.47	372.5	95.19	89	2	4.80	0.01	0.00	12/14/1999

Accession: 'Mankota' (Mandan-1808, PI-556988)												
Name/Species: Russian wildrye, <i>Psathyrostachys juncea</i>												
Location: Field E-7												
Year of Establishment: 1989												
Origin/Source: USDA-ARS, Mandan, North Dakota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1990	Foundation	1672	N12762	0.90	61.0	97.01	81	0	2.99	0.00	0.00	06/27/1991
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	01/27/1993
1993	No Harvest	Hail Damage										
1994	Foundation	940240-1	9415075	0.90	85.0	98.19	86	0	1.81	0.00	0.00	05/11/1995
1995	Foundation	950190-1	9513273	0.90	162.0	96.27	89	0	3.68	0.00	0.05	03/28/1996
1996	Foundation	960043-1	9606064	0.90	192.0	98.94	93	0	1.06	0.00	0.00	01/16/1997
1997	Foundation	970041-1	9707326	0.90	286.5	99.57	94	0	0.43	0.00	0.00	03/02/1998
1998	Foundation	980062-1	9905046	0.90	248.0	98.13	91	0	1.87	0.00	0.00	01/31/2000
1999	Foundation	990862-1	9905685	1.05	273.0	97.69	90	0	2.31	0.00	0.00	02/10/2000

Accession: 'Badlands' ecotype (ND-4115, 9036131)												
Name/Species: little bluestem, <i>Schizachyrium scoparium</i>												
Location: Field E-13 (adjacent to breeder's block)												
Year of Establishment: 1989												
Origin/Source: western North Dakota and western and central South Dakota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1990	Common		N8367	0.90	28.0	87.89	79	0	12.11	0.00	0.00	04/16/1991
1991	Common		P03212	0.90	78.5	64.08	59	0	35.92	0.00	0.00	05/28/1992
1992	Common		P16680	1.04	199.5	95.86	87	0	4.14	0.00	0.00	05/06/1993
1993	Common		9307613	1.04	83.0	93.94	78	0	6.06	0.00	0.00	04/13/1994
1994	Select (G2)	no tags	9415448	1.04	81.5	95.82	81	0	4.18	0.00	0.00	05/08/1995
1995	Select (G2)	9508543	9508543	1.04	60.0	87.14	67	0	12.84	0.02	0.00	02/21/1996
1996	Select (G2)	960047-1	9606987	2.17	113.0	86.11	75	0	13.85	0.02	0.02	02/18/1997
1997	Select (G2)	970040-1	9705283	2.17	221.5	93.87	80	0	6.13	0.00	0.00	01/23/1998
1998	Select (G2)	980064-1	9810818	2.17	53.0	66.21	72	0	33.75	0.02	0.02	04/19/1999
1999	Select (G2)	990861-1	9911692	2.17	210.0	74.00	70	0	25.98	0.00	0.02	05/01/2000
*1992 and 1993 harvest is a composite of field and 340 plant breeder's block												

Accession: 'Tomahawk' (ND-444, PI-478006)												
Name/Species: Indiangrass, <i>Sorghastrum nutans</i>												
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												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1981	Common		J22004	2.1	105.0	98.42	52	2	1.21	0.37		04/06/1982
1982	Common		J36789	2.1	371.0	97.78	87		0.13	2.09		03/23/1983
1983	Common		K14524	2.1	350.0	94.70	78	2	5.23	0.07		04/24/1984
1984	Common		K27728	2.1	535.0	98.19	78	8	1.67	0.07	0.07	04/08/1985
1985	Common	(gr.1)	L5477	2.1	158.0	98.97	92	1	0.96		0.07	03/04/1986
		(gr.2)	L9740		39.0	66.27	85		33.56		0.17	04/30/1986
1986	Common		L24835	2.1	306.0	93.25	67	12	6.74	0.01	0.00	04/14/1987
1987	Foundation		M20157	2.1	55.0	97.84	83	2	2.06	0.00	0.10	05/31/1988
1988	Foundation	1779	N0859	2.5	285.0	97.50	91	0	2.54	0.00	0.00	04/14/1989
1989	Foundation	92016	N13244	2.5	570.0	99.92	93	0	0.07	0.00	0.01	02/13/1990
1990	Foundation	1670	N3775	2.5	392.0	99.05	94	0	0.94	0.00	0.01	02/12/1991
1991		2145	N24194	2.5	243.5	99.98	93	1	0.01	0.00	0.01	04/16/1992
1992	Foundation	1050-1	P15260	2.5	242.0	98.96	84	1	1.02	0.01	0.01	04/26/1993
1993	Foundation	3065-1	9312026	2.5	240.5	98.06	76	2	1.88	0.03	0.03	05/25/1994
1994	Foundation	940237-1	9416108	2.5	226.6	98.29	92	1	1.69	0.02	0.00	05/25/1995
1995	Foundation	950185-1	9510002	0.55	86.5	97.54	87	2	2.46	0.00	0.00	03/12/1996
1996	Foundation	960045-1	9609262	0.55	153.5	97.80	87	2	2.19	0.01	0.00	03/18/1997
1997	Foundation	970042-1	9706071	0.55	146.5	93.77	82	2	6.23	0.00	0.00	01/29/1998
1998	Foundation	980063-1	9803880	0.55	100.0	95.15	59	26	4.85	0.00	0.00	01/12/1999
1999	Foundation	990857-1	9901982	0.55	107.0	97.34	95	2	2.64	0.01	0.01	12/14/1999

Accession: 'Red River' germplasm (9069159)												
Name/Species: prairie cordgrass, <i>Spartina pectinata</i>												
Location: West 40												
Year of Establishment: 1994												
Origin/Source: North Dakota, South Dakota, and Minnesota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1994	Common		9414422	2.2	10.5	84.66	41		15.30	0.04	0.00	05/09/1995
1995	Common		9515497	2.2	143.5	94.03	18	2	5.97	0.00	0.00	05/02/1996
1996	Select (G1)	960039-1	9604745	1.8	180.0	82.06	10	0	17.94	0.00	0.00	01/03/1997
1997	Select (G1)	C0011577	SGI97W40	1.8	35.5	60.71	65	14	39.23	0.00	0.06	03/05/1998
1998	Select (G1)	980061-1	9810058	1.8	32.0	81.25	6	87	18.73	0.01	0.01	04/05/1999
1999	Common		9906234	1.8	3.0	75.69	4	33	23.77	0.51	0.03	02/23/2000

Accession: 'Red River' germplasm (9069159)												
Name/Species: prairie cordgrass, <i>Spartina pectinata</i>												
Location: Field E-12												
Year of Establishment: 1997												
Origin/Source: North Dakota, South Dakota, and Minnesota												
Prod.		Cert.	Seed		Bulk (lbs)						Other	
Year	Seed Class	No.	Lab No.	Acres	Quantity	Purity	Germ.	Dorm.	Inert	Weed	Crop	Test Date
1998	Select (G1)	980061-1	9810056	5.65	78.5	83.06	23	13	16.92	0.01	0.01	04/05/1999
1999	Select (G1)	990867-2	9909378	5.65	465.5	94.38	18	58	5.61	0.01	0.00	03/28/2000

STAFFING

STAFFING: TECHNICAL REPORT 1998-1999

PERMANENT POSITIONS

Dwight A. Tober, Manager (1998)
Wayne L. Duckwitz, Manager (1999)
Michael J. Knudson, Forester
Nancy K. Jensen, Agronomist
Earl G. Aune, Biological Technician/Foreman
Rachel H. Bergsagel, Biological Technician/IRM
Dorothy A. Glatt, Biological Aid (1998)
Melissa A. Reep, Secretary

1998 SEASONAL POSITIONS:

Jack J. Biesterfeld, WAE, Biological Aid
Michael D. Bellon, WAE, Biological Aid
Jennifer R. Harmon, WAE, Biological Aid
Loren B. Grad, WAE, Biological Aid

1999 SEASONAL POSITIONS:

Jack J. Biesterfeld, WAE, Biological Aid
Michael D. Bellon, WAE, Biological Aid
AriAnna Oswald, WAE, Biological Aid
Darrell Oswald, WAE, Biological Aid

INFORMATION

Registration of 'Sunnyview' Big Bluestem

'Sunnyview' big bluestem (*Andropogon gerardii* Vitman) (Reg. no. CV-11, PI 603289) was developed by the South Dakota Agricultural Experiment Station and released in cooperation with the USDA-NRCS, Plant Materials Center, Bismarck, ND, in 1992. It was developed using one cycle of phenotypic selection followed by a cycle of family selection. Sunnyview is comprised of approximately 30 parent plants from each of 15 half-sib families. Nine of these families are from open-pollinated spaced plants that were selected for vigor, leafiness, seed yield, and perfect pedicellate spikelets. The others are progenies from a 6-genotype polycross comprised of parents selected for the same criteria. The source nurseries were first-generation progenies of plants from native prairies in southeastern South Dakota (Union County). Sunnyview was tested as SD-43.

Sunnyview differs from other big bluestem cultivars by having a high percentage of plants that produce hermaphroditic pedicellate spikelets. Hermaphroditic plants have two perfect spikelets at each rachis node, whereas only the sessile spikelet is perfect in andromonoecious plants. Consequently, hermaphroditic plants have a higher potential number of caryopses per spikelet than andromonoecious types. In eastern South Dakota, eight randomly selected genotypes of Sunnyview averaged 70% caryopsis set in pedicellate spikelets, compared with 80% in sessile spikelets. At a more xeric location in central South Dakota, however, caryopsis set was 40% in sessile and 23% in pedicellate spikelets. Caryopses produced in pedicellate spikelets are lighter than those from sessile spikelets of the same plant. The difference in caryopsis weight is genotype dependent and ranged from 24 to 92% heavier for caryopses from sessile spikelets (4). There is genetic variation for caryopsis weight within Sunnyview, and a strong positive correlation exists among weights of caryopses from the two spikelet types on the same plant. Consequently, the range in weights of caryopses from the two spikelet types overlaps.

Sunnyview demonstrated excellent forage production and persistence in six trials conducted in South Dakota, North Dakota, and Minnesota. Averaged across 24 location-years (6), Sunnyview produced $4732 \pm 604 \text{ kg ha}^{-1}$, compared with $3308 \pm 461 \text{ kg ha}^{-1}$ for 'Bison' (2), $3385 \pm 454 \text{ kg ha}^{-1}$ for 'Bonilla' (3), and $4108 \pm 469 \text{ kg ha}^{-1}$ for 'Pawnee' (8) big bluestem.

Mean concentration of total N in herbage of Sunnyview ranged from 19 g kg^{-1} prior to heading to $< 10 \text{ g kg}^{-1}$ at the dough stage of seed development. This was similar to N levels in herbage of 'Sunburst' (5) switchgrass (*Panicum virgatum* L.), but less than for 'Oahe' (9) intermediate wheatgrass [*Thinopyrum intermedium* (Host) Barkworth & D.R. Dewey] and 'Regar' (1) meadow brome-grass (*Bromus riparius* Rehmman), which had total N concentrations of approximately 30 and 12 g kg^{-1} at those same respective stages of development (7).

The primary area of adaptation for Sunnyview is USDA Plant Hardiness Zones 3 and 4 between 42° and 49° N latitude and 95° and 100° W longitude. This area includes parts of the Central Black Glaciated Plains, Southern Black Glaciated Plains, Red River Valley of the North, Rolling Till Prairie, Loess Uplands and Till Plains, Central Iowa and Minnesota Till Prairies, and Iowa and Missouri Deep Loess Hills (10). Sunnyview is later in maturity than cultivars of more northern origin (e.g., Bison and Bonilla), but reaches anthesis approximately 12 d before Pawnee and 25 d before 'Kaw' (1) at Brookings, SD.

Breeder seed of Sunnyview will be maintained at the South Dakota Agricultural Experiment Station. Foundation seed will be maintained and distributed by the Foundation Seed Stocks Division, South Dakota State University. Certified seed will be grown exclusively from the foundation generation. Small quantities of seed for experimental purposes will be available from the corresponding author.

A. BOE,* J. G. ROSS, R. J. HAAS, AND D. A. TOBER (11)

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