




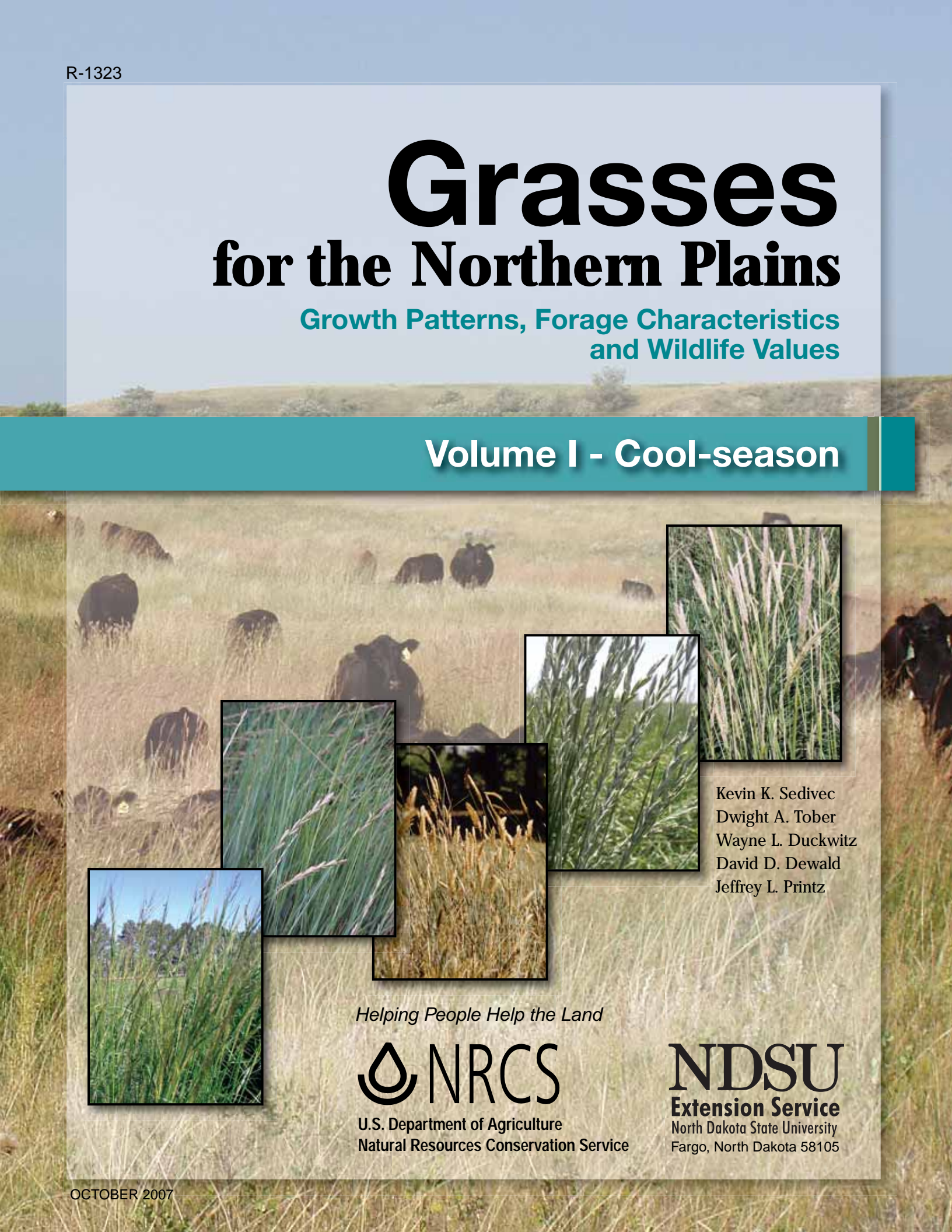


# Grasses for the Northern Plains

Growth Patterns, Forage Characteristics  
and Wildlife Values

Volume I - Cool-season



Kevin K. Sedivec  
Dwight A. Tober  
Wayne L. Duckwitz  
David D. Dewald  
Jeffrey L. Printz

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U.S. Department of Agriculture  
Natural Resources Conservation Service

**NDSU**  
Extension Service  
North Dakota State University  
Fargo, North Dakota 58105

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The authors include **Kevin K. Sedivec**, state Extension rangeland specialist, Department of Animal and Range Sciences, North Dakota State University, Fargo, N.D.; and **Dwight Tober**, plant materials specialist; **Wayne L. Duckwitz**, plant materials center manager; **David D. Dewald**, state biologist; and **Jeffrey L. Printz**, state rangeland management specialist; USDA Natural Resources Conservation Service (NRCS), Bismarck, N.D.

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# Introduction

Grasses commonly are planted as a permanent forage for livestock production, cover type for wildlife habitat and conservation practices for soil protection, providing a major staple in the diets of domestic and wild herbivores, habitat structure for many wildlife species and ground cover to stabilize soils. Both cool- and warm-season grasses are utilized, depending on the resource needs and objectives of the land manager. Cool-season grasses are defined as plants that produce the major portion of their growth during late spring/early summer, with a second growth occurring in late summer or early fall, depending on moisture conditions. Warm-season grasses produce most or all of their growth during the late spring to early fall period. This publication will concentrate on selected cool-season grasses, listing the most pertinent releases adapted to the Northern Plains.

Selection of the proper species and variety is an important step when choosing a grass seeding mixture. Grass species and varieties differ in growth habitat, productivity, forage quality, drought resistance, tolerance to grazing, winter hardiness, seedling vigor, salinity tolerance and many other characteristics. Therefore, selection should be based on the climate, soils, intended use and planned management. Planting the proper selection also can provide long-term benefits and affect future productivity of the stand.

This publication is designed to summarize the growth patterns; forage characteristics, including nutritional value and herbage production; plant performance characteristics, including seedling and plant vigor, weed competition, stand density, stand rating, plant height, disease and seed production; salinity tolerance; fiber content; wildlife values; and the list of varieties suited to the Northern Plains region for a select group of cool-season grasses studied in a field experiment near Hettinger, N.D., and Fort Pierre, S.D. Perennial grasses were studied during a period of eight years beginning in 1990 under different environmental conditions. Recommended seeding rates and specific guidelines can be obtained by consulting your county conservation district, Natural Resources Conservation Service or Extension Service office.



## Grass Species and Varieties

The original study included 101 accessions/ varieties of 33 different species that were evaluated for emergence, weed competition, stand density, plant height, disease, seed production and vigor from 1992 to 1997 at Hettinger, N.D., and 1990 to 1995 at Fort Pierre, S.D. (USDA NRCS 1997). Twenty of these cool-season grasses were selected for further study based upon popularity and future potential at the Hettinger site to study growth patterns, forage characteristics and fiber content from 1995 through 1997 (Table 1). Fourteen were introduced exotic grasses, five native to North America and one introduced native grass-hybrid cross. This second study will be further referenced throughout the remainder of this document as the “Growth Pattern and Nutritional Study (GPNS)”. The USDA PLANTS database was used for taxonomic nomenclature (USDA NRCS 2006a).

## Study Area

This research and demonstration project was conducted on private land (T129, R96, Sec 24, SE1/4) south of Hettinger, N.D., and public land (T5, R31, W1/2SW1/4SE1/4 Sec 5) northwest of Fort Pierre, S.D. All grass species and varieties were planted on a Vebar-Flasher soils series near Hettinger and Promise soil series near Fort Pierre. Vebar-Flasher soils are classified as fine sandy loam complex, slopes 3 percent to 9 percent, shallow, somewhat excessively drained and prone to erosion (Ulmer and Conta 1987). Promise soil is classified as clay with nearly level slope, somewhat poor drainage, moderate levels of organic matter and poor tilth (Borchers 1980).

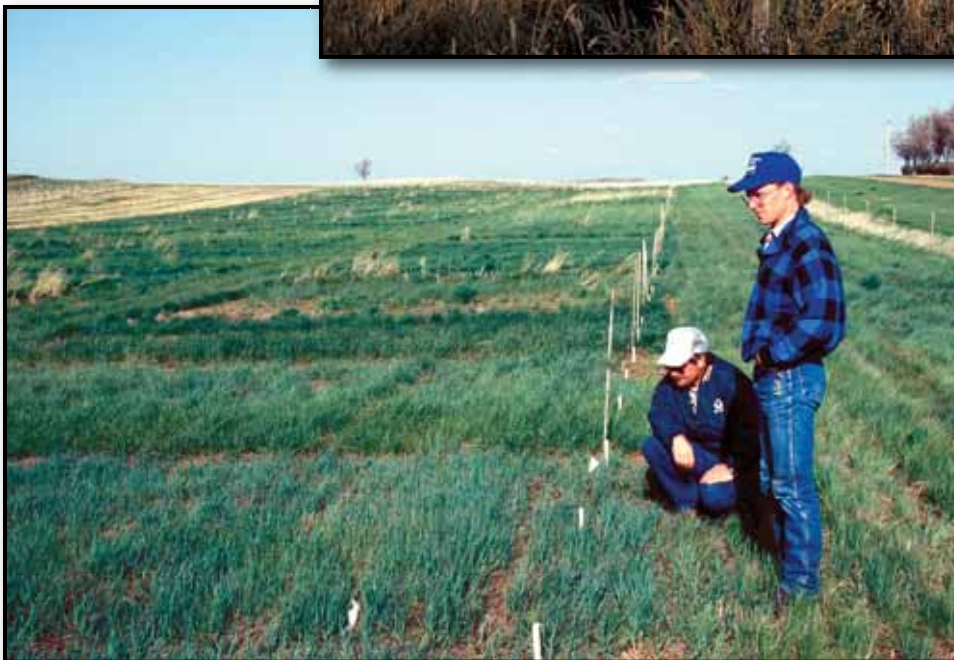
One hundred one different varieties or experimental lines were seeded in 6-foot by 25-foot plots on April 6, 1992, near Hettinger and April 9, 1990, near Fort Pierre

**Table 1. List of grass species and variety of each cool-season grass tested near Hettinger, N.D., 1995-1997.**

Grass Species	Common Name	Release
<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	Slender wheatgrass	Revenue
<i>Pascopyrum smithii</i>	Western wheatgrass	Rodan
<i>Pseudoroegneria spicata</i> ssp. <i>spicata</i>	Bluebunch wheatgrass	Goldar
<i>Pseudoroegneria spicata</i> ssp. <i>spicata</i> / <i>Elytrigia repens</i>	Bluebunch wheatgrass/quackgrass hybrid	NewHy
<i>Thinopyrum elongatum</i>	Tall wheatgrass	Alkar
<i>Thinopyrum intermedium</i>	Intermediate wheatgrass	Manska
<i>Thinopyrum intermedium</i>	Intermediate wheatgrass	MDN-759
<i>Thinopyrum intermedium</i>	Intermediate wheatgrass	Oahe
<i>Thinopyrum intermedium</i>	Intermediate wheatgrass	Reliant
<i>Agropyron cristatum</i>	Crested wheatgrass	Ephraim
<i>Agropyron desertorum</i>	Crested wheatgrass	Nordan
<i>Agropyron cristatum/desertorum</i>	Crested wheatgrass	HyCrest
<i>Leymus cinereus</i>	Basin wildrye	Magnar
<i>Leymus angustus</i>	Altai wildrye	Prairieland
<i>Psathyrostachys junceus</i>	Russian wildrye	Mankota
<i>Psathyrostachys junceus</i>	Russian wildrye	Bozoisky Select
<i>Bromus inermis</i>	Smooth brome grass	Rebound
<i>Bromus inermis</i>	Smooth brome grass	Cottonwood
<i>Bromus biebersteinii</i>	Meadow brome grass	Regar
<i>Nassella viridula</i>	Green needlegrass	Lodorm



**Plots near Fort Pierre,  
South Dakota.**



**Plots near Hettinger,  
North Dakota.**

on three replicates using a randomized complete block design. Seeding rate varied with species but followed recommended seeding rates as specified in the NRCS Technical Guide (USDA NRCS 2006b).

### Climate

North and South Dakota are at the geographic center of North America. This results in a continental climate characterized by continuous air movement and large annual, daily and day-to-day temperature changes. Relative humidity is low and precipitation tends to be irregular in time and distribution.

Approximately 70 percent to 75 percent of the annual precipitation falls during the summer months,

with 50 percent falling during May, June and July in North and South Dakota. A drought is defined as a prolonged period of time receiving less than 75 percent of the average precipitation, causing the plants to suffer from lack of water (Vallentine 1990). Only 1997 was considered a drought year at Hettinger, with 1995 and

1996 above average and 1993 and 1994 slightly below average (Table 2). Drought conditions occurred at Fort Pierre in 1990 and 1994, with 1995 well above average (Table 3). The years 1991, 1992 and 1993 had nearly average rainfall at Fort Pierre.

**Table 2. Monthly precipitation at Hettinger Research Extension Center for 1992-1997.**

Month	1992	1993	1994	1995	1996	1997	Average
January	0.26	0.47	0.59	0.20	0.56	0.05	0.36
February	0.00	0.25	0.15	0.42	0.31	0.18	0.22
March	0.82	0.45	0.57	0.75	0.95	0.32	0.64
April	0.51	0.85	0.95	1.18	1.02	3.68	1.37
May	2.13	1.37	0.80	6.07	5.20	1.16	2.79
June	4.34	4.39	2.39	2.88	2.45	3.79	3.37
July	3.81	4.90	3.02	2.21	0.86	1.16	2.66
August	1.95	0.73	0.34	3.71	0.53	0.73	1.33
September	0.33	0.19	1.39	0.44	4.09	0.25	1.12
October	0.36	0.17	3.94	1.27	0.55	0.89	1.19
November	1.58	0.87	0.61	0.49	1.59	0.39	0.92
December	0.30	0.52	0.06	0.15	0.72	0.05	0.30
<b>Totals</b>	<b>16.39</b>	<b>15.16</b>	<b>14.80</b>	<b>19.77</b>	<b>18.83</b>	<b>12.65</b>	<b>16.27</b>

**Table 3. Monthly precipitation from the official weather station at Fort Pierre, S.D., for 1992-1997.**

Month	1992	1993	1994	1995	1996	1997	Average
January	0.02	0.28	0.72	0.28	0.40	0.40	0.46
February	0.33	1.33	0.62	0.76	0.62	0.33	0.68
March	0.74	0.63	1.23	1.81	0.18	0.98	0.89
April	2.33	2.74	0.27	2.62	1.73	3.37	1.94
May	1.73	6.26	0.65	1.57	1.82	3.74	2.71
June	2.13	3.36	3.69	3.38	2.03	4.42	3.76
July	2.25	0.55	6.04	3.78	3.40	2.28	2.15
August	1.03	1.07	2.42	0.64	1.12	1.74	2.00
September	0.89	0.81	1.41	1.35	0.31	0.92	1.32
October	0.54	1.41	0.29	0.44	3.21	4.82	1.11
November	0.09	0.40	1.33	1.20	0.03	0.56	0.47
December	0.26	0.11	0.20	0.37	0.29	0.16	0.59
<b>Totals</b>	<b>12.34</b>	<b>18.95</b>	<b>18.87</b>	<b>18.20</b>	<b>15.14</b>	<b>23.72</b>	<b>18.08</b>

### Herbage Production from the Growth Pattern and Nutritional Study (GPNS)

Annual herbage production differed ( $P < 0.1$ ) between years for all entries except Russian wildrye, the Bozoisky Select variety. Differences occurred due to variability and timing of year-to-year precipitation. Tall wheatgrass and basin wildrye produced the greatest amount of herbage production in 1995 (Table 4). Total precipitation was 23 percent above the long-term average and growing season precipitation (April to September) was 29 percent above the long-term average in 1995.

The Manska and MDN-759 intermediate wheatgrass varieties were the highest producing grasses in 1996, followed by Altai and basin wildrye (Table 4). Annual and growing season precipitation was slightly above average, 17 percent and 11 percent, respectively, compared with the long-term averages in 1996. The 1996 precipitation

was closest to the long-term average among the three study years. Herbage production for tall and slender wheatgrass, basin wildrye, Russian wildrye (Mankota) and both smooth bromegrass varieties was reduced by 50 percent or more in the nearly average precipitation year, 1996, compared with the wet year, 1995. Although no grass species produced more herbage in the normal moisture year, compared with the wet year, crested wheatgrass (Ephraim) was only 7 percent less productive in 1996, compared with 1995. Bluebunch wheatgrass and Russian wildrye (Bozoisky Select) were lower in herbage production in 1996, compared with 1995, by 14 percent and 17 percent, respectively. All other grass varieties were reduced by 30 percent to 50 percent in 1996, compared with 1995.

**Table 4. Cumulative herbage production pounds per acre (lb/ac) of selected cool-season grasses from the Growth Pattern and Nutritional Study near Hettinger, N.D., in 1995-1997.**

Species	Variety	1995	1996	1997	Mean
Basin wildrye	Magnar	7,332	3,480	4,932	5,248
Tall wheatgrass	Alkar	7,748	3,108	2,892	4,583
Pubescent wheatgrass	Manska	5,840	4,080	2,812	4,244
Altai wildrye	Prairieland	5,172	3,548	3,280	4,000
Intermediate wheatgrass	Reliant	6,132	3,000	2,652	3,928
Crested wheatgrass	Nordan	4,948	3,388	3,252	3,863
Pubescent wheatgrass	MDN-759	5,320	3,720	2,320	3,787
Intermediate wheatgrass	Oahe	5,452	2,840	2,548	3,613
Slender wheatgrass	Revenue	4,988	2,040	2,680	3,236
Bluebunch wheatgrass	Goldar	3,988	3,412	1,920	3,107
Western wheatgrass	Rodan	4,360	2,572	2,292	3,075
Crested wheatgrass	HyCrest	4,492	2,480	2,108	3,027
Meadow bromegrass	Regar	4,428	3,028	1,572	3,009
Crested wheatgrass	Ephraim	3,268	3,028	2,108	2,801
Smooth bromegrass	Cottonwood	4,188	1,988	1,600	2,592
Green needlegrass	Lodorm	3,932	2,080	1,680	2,564
Bluebunch/Quackgrass	NewHy	3,508	2,188	1,720	2,472
Russian wildrye	Bozoisky Select	2,680	2,228	2,228	2,379
Smooth bromegrass	Rebound	3,628	1,680	1,748	2,352
Russian wildrye	Mankota	3,560	1,560	1,480	2,200
LSD ( $P < 0.1$ )		1,532	828	912	

The driest year in the GPNS was 1997. Annual and growing season precipitation was 22 percent and 17 percent below the long-term average, respectively. Basin wildrye and slender wheatgrass were the only species unaffected by the drier conditions, compared with the 1996 cumulative production levels. Basin wildrye and slender wheatgrass cumulative production in 1997, compared with 1996, was 42 percent and 31 percent higher, respectively. The drier conditions had the greatest negative impact on bluebunch wheatgrass (56 percent reduction), meadow brome grass (48 percent reduction), and intermediate wheatgrass Manska and MDN-759 (31 percent and 38 percent reduction).

### Field Evaluation for Plant Characteristics of the Original Study

Each accession/variety was evaluated for stand emergence, weed competition, stand density, plant height, disease, seed production and vigor at Hettinger, N.D., and Fort Pierre, S.D. (Tables 5 and 6). Emergence and stand uniformity evaluations were conducted seven weeks after seeding and rated 1 for excellent, 5 for fair

and 9 when no emergence occurred. Weed competition was rated on July 21, 1992, and Aug. 17, 1993, at Hettinger and Aug. 5, 1990, and Aug. 4, 1991, at Fort Pierre and rated 1 for none, 5 for moderate and 9 for severe. Density estimates (percent of full rows in sample frames) were collected July 21, 1992, and Aug. 17, 1993, at Hettinger and Aug. 14, 1990, and May 21, 1991, at Fort Pierre, with 100 percent equaling a full frame. Stand rating within plot was conducted Aug. 16, 1994; Aug. 30, 1995; July 31, 1996; and July 30, 1997, at Hettinger and Aug. 11, 1994, at Fort Pierre, with rating of 1 excellent, 5 fair and 9 poor. Plant height average (in inches) was recorded Aug. 17, 1993; Aug. 30, 1995; and July 31, 1996, at Hettinger and Aug. 5, 1992; Aug. 4, 1993; and Aug. 1, 1995, at Fort Pierre. Disease problems (primarily stem and leaf rust) were recorded Aug. 17, 1993, at Hettinger and Aug. 5, 1992; Aug. 4, 1993; and Aug. 11, 1994, at Fort Pierre, with a rating of 1 for none, 5 for moderate and 9 for severe. Seed production potential (using number of culms as an indicator) was recorded Aug. 17, 1993; Aug. 16, 1994; and July 31, 1996, at Hettinger and Aug. 5, 1992, and Aug. 4, 1993, with a rating of 1 for excellent, 5 for fair and 9 for poor. Vigor (overall plant health) was recorded Aug. 30, 1995;







**Visual differences between two intermediate wheatgrass varieties at the Hettinger plot.**

July 31, 1996; and July 30, 1997, at Hettinger and Aug. 1, 1995, at Fort Pierre, with a rating of 1 for excellent, 5 for fair and 9 for poor. Herbage production was clipped annually for five consecutive years with a forage harvester at each study site in July and August (USDA NRCS 1997). All samples were weighed with subsamples collected and oven dried at 140 F for 48 hours. Subsamples were weighed to the nearest 0.1 gram and converted to lb/ac.

### **Plant Description, Growth Patterns, Nutritional Quality and Use Potential for the Growth Patterns and Nutritional Study**

These selected cool-season grasses were analyzed for nutritional quality and plant growth pattern. Above-ground biomass yields were estimated for each variety by sampling April 26, May 15, June 1, June 15, July 1, July 20, Aug. 20, Sept. 15 and Oct. 1 in 1995, 1996 and 1997. Standing vegetation was clipped at 0.5 inch from ground level from each subplot of each variety using a 0.25 m<sup>2</sup> frame placed in its designated quadrat as randomly selected for each clipping period. Vegetation was placed into a paper bag with clipping date and

physiological growth stage recorded at each clipping period. All samples were oven dried at 140 F until weight was constant and weighed to the nearest 0.1 gram.

Nutritional quality and forage production were determined from ungrazed, nonmowed cool-season grass clippings at the nine periods throughout the growing season beginning in late April and ending in early October. Each of the grass varieties was tested for dry matter, ash, crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), phosphorus and calcium. All samples were ground through a 1 mm screen in a Wiley mill and analyzed at the North Dakota State University Animal and Range Sciences nutritional laboratory. Dry matter, ash and ADF were determined following standardized procedures (AOAC 1990), NDF using procedures described by Robertson and Van Soest (1982) and CP using the Kjeldahl Auto System II (AOAC 1990). Total digestible nutrients (TDN) were determined for each grass species using the net energy lactation (NEL) formula involving ADF in the model  $[4.898 + (89.796 \times \text{NEL})]$ , where  $\text{NEL} = 1.085 - (0.0124 \times \text{percent ADF})$ . Forage production was determined for each of the grass varieties for each clipping period to determine peak herbage production and time period.

**Table 5. Field evaluation of cool-season grasses used for pasture, rangeland, wildlife habitat and protection of surface and groundwater at Hettinger, N.D., from 1992 to 1997.**

Species/variety	Emergence <sup>1</sup>	Weed Competition <sup>2</sup>		Stand Density <sup>3</sup>		Stand Rating <sup>4</sup>				Plant Height <sup>5</sup>			Disease <sup>6</sup>	Seed Production <sup>7</sup>			Vigor <sup>8</sup>		
	92	92	93	92	93	94	95	96	97	93	95	96	93	93	94	96	95	96	97
<b>Fairway Wheatgrass</b>																			
Parkway	2	2	2	53	75	3	3	2	3	28	21	22	2	2	6	8	4	3	4
Kirk	3	3	2	52	68	3	3	3	2	31	29	25	2	1	4	5	3	2	4
Ephraim	3	4	2	40	59	3	4	3	3	26	25	21	2	3	5	7	4	4	5
Ruff	4	3	2	48	69	3	3	2	2	29	25	17	2	2	5	8	2	3	4
NU-ARS AC2	4	2	2	48	66	3	2	3	2	29	25	19	2	2	5	7	2	4	4
<b>Crested Wheatgrass</b>																			
Summit	3	3	2	45	62	3	4	3	2	30	31	29	2	2	3	4	2	2	3
Nordan	4	4	3	41	66	3	3	3	2	31	33	21	2	2	3	6	3	3	3
<b>Fairway x Crested</b>																			
HyCrest	3	3	2	42	68	3	3	3	3	32	28	29	2	1	4	4	2	3	3
CD-II	3	3	1	40	61	3	4	3	2	28	27	29	2	2	3	5	3	2	4
<b>Intermediate Wheatgrass</b>																			
Chief	3	5	2	52	60	1	2	2	2	42	38	32	2	1	5	5	1	3	2
Clarke	3	3	2	60	75	2	2	3	2	42	33	38	2	2	5	6	2	4	2
Reliant	2	1	1	58	77	1	2	2	2	44	35	33	2	1	5	6	3	3	3
Oahe	2	2	1	56	61	2	2	3	2	42	35	28	2	2	6	7	3	3	3
Slate	1	2	1	64	70	2	1	2	2	43	38	29	2	2	4	7	3	3	3
Haymaker	2	2	2	58	60	1	1	2	2	44	41	28	2	1	3	6	1	3	3
<b>Pubescent Wheatgrass</b>																			
Greenleaf	3	3	2	56	67	2	1	3	2	44	37	27	2	2	7	8	2	3	4
MDN-759	3	2	1	55	64	2	3	4	2	42	35	26	2	2	5	7	3	5	4
Manska	2	2	1	44	63	1	2	3	2	41	33	30	2	2	4	8	2	4	4
<b>Tall Wheatgrass</b>																			
Orbit	3	5	2	49	61	2	2	3	3	48	52	32	2	2	4	5	2	3	4
Alkar	3	5	2	40	66	3	4	4	2	46	47	33	2	2	4	5	3	2	4
Platte	3	4	1	54	63	2	2	3	2	51	45	34	2	2	3	6	2	4	3
<b>Smooth Brome</b>																			
Magna	3	3	1	40	77	1	1	3	2	35	37	24	2	2	5	6	2	4	3
Manchar	3	3	2	42	76	1	4	3	3	32	33	27	2	2	4	5	4	4	4
Rebound	4	3	1	44	80	1	3	2	2	31	35	32	2	3	8	7	3	3	4
Cottonwood	5	3	1	38	80	1	2	2	2	33	37	26	2	3	6	6	2	4	4
Lincoln	3	2	2	44	76	2	2	2	2	30	31	31	2	3	7	7	3	4	5
<b>Meadow Brome</b>																			
Fleet	2	2	1	53	76	1	1	3	2	34	18	23	2	4	8	8	2	4	5
Paddock	3	2	1	54	73	2	2	2	2	32	15	17	2	6	8	8	3	3	5
Regar	3	4	1	33	74	2	2	3	2	29	19	14	2	7	9	8	2	4	6

Table 5. Continued

Species/variety	Emergence <sup>1</sup>	Weed Competition <sup>2</sup>		Stand Density <sup>3</sup>		Stand Rating <sup>4</sup>				Plant Height <sup>5</sup>			Disease <sup>6</sup>	Seed Production <sup>7</sup>			Vigor <sup>8</sup>		
	92	92	93	92	93	94	95	96	97	93	95	96	93	93	94	96	95	96	97
<b>Smooth x Meadow hybrid</b>																			
AC Knowles	4	3	2	8	64	4	3	3	3	34	32	29	2	3	6	6	3	3	5
<b>Russian Wildrye</b>																			
Mayak	5	4	3	40	57	3	3	3	4	40	19	17	2	4	9	8	4	5	5
Swift	5	5	2	26	53	3	3	3	3	40	23	14	2	5	9	7	3	4	5
Cabree	4	3	2	36	63	4	5	4	4	37	13	13	2	3	9	8	4	4	5
Mankota	6	5	3	41	56	4	4	3	3	42	25	24	2	3	8	7	4	4	5
Bozoisky Select	5	4	2	40	56			4	4	46	25	22	2	2	8	8	3	5	5
<b>Altai Wildrye</b>																			
Prairieland	3	3	2	40	66	1	3	4	4	38	23	29	2	8	8	6	3	3	4
Pearl	3	4	2	33	66	3	4	3	6	38	20	29	2	7	7	7	4	2	5
Eejay	3	5	3	31	62	2	2	4	3	38	27	31	2	8	8	8	2	3	4
<b>Basin Wildrye</b>																			
Trailhead	3	2	2	32	72	4	3	3	4	40	33	41	7	7	7	6	3	3	5
Magnar	4	6	2	26	57	3	5	4	4	44	36	43	4	6	6	6	3	2	3
<b>Bluebunch Wheatgrass</b>																			
Goldar	1	4	2	57	79	2	2	2	2	27	14	18	2	7	8	7	3	3	5
Secar	1	3	2	61	80	3	3	2	2	28	28	23	3	6	8	7	4	3	4
NewHy hybrid	3	3	2	53	64	2	2	4	2	38	26	26	2	3	7	5	4	3	3
<b>Green Needlegrass</b>																			
Lodorm	4	6	2	45	67	2	4	3	3	36	35	28	2	2	3	4	2	3	4
SD-93	3	4	2	23	56	4	4	3	3	35	33	28	2	3	3	3	2	2	3
<b>Western Wheatgrass</b>																			
Walsh	4	4	2	50	74	1	1	2	2	24	25	17	2	7	8	8	3	4	5
Rodan	3	4	1	53	79	1	1	3	2	26	22	24	2	6	8	7	2	3	3
Flintlock	3	4	2	36	54	1	1	2	2	31	29	25	2	6	8	7	1	3	3
<b>Slender Wheatgrass</b>																			
Revenue	3	2	2	71	64	2	3	4	5	39	35	31	2	1	1	3	2	3	3
Adanac	2	2	2	69	62	2	2	3	5	37	33	26	3	1	1	3	2	3	5
Pryor	4	3	2	35	50	4	4	4	4	33	33	22	3	2	2	4	3	3	4
Primar	2	2	2	40	62	3	2	4	5	36	33	22	2	2	2	4	2	3	4

<sup>1</sup>Emergence and stand uniformity seven weeks after seeding (May 21, 1992). Rating: 1=excellent, 5=fair, 9=no emergence.

<sup>2</sup>Weed competition (July 21, 1992, and Aug. 17, 1993). Rating: 1=none, 5=moderate, 9=severe.

<sup>3</sup>Density estimate (percent of full rows in sample frames). 100 percent equals full frame (July 21, 1992, and Aug. 17, 1993).

<sup>4</sup>Stand within plot (Aug. 16, 1994; Aug. 30, 1995; July 31, 1996; and July 30, 1997). Rating: 1=excellent, 5=fair, 9=poor.

<sup>5</sup>Plant height average in inches (Aug. 17, 1993; Aug. 30, 1995; and July 31, 1996).

<sup>6</sup>Disease (primarily stem and leaf rust) problems (Aug. 17, 1993). Rating: 1=none, 5=moderate, 9=severe.

<sup>7</sup>Seed production potential, using number of culms as an indicator (Aug. 17, 1993; Aug. 16, 1994; and July 31, 1996). Rating: 1=excellent, 5=fair, 9=poor.

<sup>8</sup>Vigor (overall plant health), (Aug. 30, 1995; July 31, 1996; and July 30, 1997). Rating: 1=excellent, 5=fair, 9=poor.

**Table 6. Field evaluation of cool-season grasses used for pasture, rangeland, wildlife habitat and protection of surface and groundwater at Pierre, S.D., from 1990 to 1995.**

Species/variety	Emergence <sup>1</sup>	Weed Competition <sup>2</sup>		Stand Density <sup>3</sup>		Stand Rating <sup>4</sup>		Plant Height <sup>5</sup>			Disease <sup>6</sup>			Seed Production <sup>7</sup>		Vigor <sup>8</sup>
	90	92	93	90	91	94	95	92	93	95	92	93	94	92	93	95
<b>Fairway Wheatgrass</b>																
Parkway	3	2	1	46	59	3	2	16	28	27	2	2	4	5	2	2
Kirk	2	2	2	46	62	3	3	17	31	28	3	2	4	6	3	2
Ephraim	3	2	2	34	50	4	3	14	27	27	3	2	3	7	4	3
<b>Crested Wheatgrass</b>																
Summit	3	2	1	35	48	4	3	16	30	28	4	2	4	7	2	3
Nordan	3	2	1	35	56	3	3	19	31	30	3	2	3	4	3	2
<b>Fairway x Crested</b>																
HyCrest	3	2	1	34	53	3	3	19	31	34	3	2	3	5	2	2
CD-II	3	1	1	32	56	3	3	21	33	32	2	2	4	5	2	2
<b>Intermediate Wheatgrass</b>																
Chief	3	2	2	37	39	3	2	32	39	39	2	2	4	3	3	2
Clarke	4	3	1	28	31	3	2	30	37	36	2	2	4	3	3	2
Reliant	3	1	2	49	56	3	2	32	39	41	2	2	4	3	3	3
Oahe	3	2	1	46	57	3	1	34	43	41	3	2	4	2	3	2
Slate	4	1	1	44	51	3	2	32	41	41	2	2	5	3	3	2
Haymaker	2	1	1	61	61	3	2	34	43	43	2	2	4	2	3	1
<b>Pubescent Wheatgrass</b>																
Greenleaf	3	2	2	19	35	4	2	32	39	37	2	2	5	3	3	2
MDN-759	3	1	1	39	54	2	2	33	38	41	2	2	4	2	3	2
Manska	2	1	1	45	53	2	2	31	39	39	2	2	4	2	3	2
<b>Tall Wheatgrass</b>																
Orbit	4	3	2	31	33	4	4	30	48	48	1	2	3	5	3	2
Alkar	4	3	1	35	33	3	3	30	43	48	2	2	3	5	3	1
Platte	3	3	1	35	43	4	3	31	43	45	2	2	3	4	3	1
<b>Smooth Bromegrass</b>																
Magna	3	3	1	46	50	3	2	21	33	33	1	2	3	6	3	3
Manchar	3	1	1	46	42	3	3	25	33	27	2	2	3	6	3	5
Rebound	3	2	1	32	41	3	2	25	35	33	1	2	3	8	3	2
Cottonwood	3	1	1	23	50	2	2	17	35	33	1	2	3	8	3	2
Lincoln	3	1	2	42	52	2	2	18	37	33	1	2	3	7	3	3
<b>Meadow Bromegrass</b>																
Fleet	2	2	1	35	53	3	3	24	38	33	2	2	3	7	3	2
Paddock	2	1	1	32	58	4	2	20	36	33	2	2	3	7	5	3
Regar	4	1	2	25	40	5	3	27	39	35	2	2	3	8	3	2
<b>Smooth x Meadow hybrid</b>																
AC Knowles	3	2	2	41	49	4	4	23	35	31	2	2	3	5	3	4

Table 6. Continued

Species/variety	Emergence <sup>1</sup>		Weed Competition <sup>2</sup>		Stand Density <sup>3</sup>		Stand Rating <sup>4</sup>		Plant Height <sup>5</sup>			Disease <sup>6</sup>			Seed Production <sup>7</sup>		Vigor <sup>8</sup>
	90		92	93	90	91	94	95	92	93	95	92	93	94	92	93	95
<b>Russian Wildrye</b>																	
Mayak	3		2	1	30	57	3	3	10	39	36	3	2	3	9	6	3
Swift	3		1	1	29	40	3	3	12	43	33	2	2	3	9	5	3
Cabree	3		2	1	35	49	3	3	11	42	38	2	2	3	9	6	3
Mankota	3		2	1	32	51	3	3	13	45	40	2	2	3	9	4	3
Bozoisky Select	3		1	1	24	45	3	3	13	48	38	2	2	3	9	3	2
<b>Altai Wildrye</b>																	
Prairieland	1		4	4	38	47	5	6	19	42	43	2	2	3	9	3	4
Pearl	2		5	4	38	46	6	6	16	38	41	1	2	3	9	3	4
Eejay	2		7	7	24	20	7	6	18	40	32	2		4	9	3	3
<b>Basin Wildrye</b>																	
Trailhead	7		6	5	3	11	6	6	21	42	43	6	7	6	9	5	5
Magnar	4		4	6	6	19	6	7	21	49	44	3	4	7	9	3	4
<b>Bluebunch Wheatgrass</b>																	
Goldar	3		8	8	24	25	8	9	15	24	20	3	2	5	9	5	2
Secar	6		9	8	0	5	7	7	20	33	33	3	4	3	4	3	2
<b>Green Needlegrass</b>																	
Lodorm	6		5	5	22	38	3	4	27	43	38	1	2	3	4	3	2
SD-93	4		6	6	27	33	4	5	29	36	39	1	2	3	4	3	3
<b>Western Wheatgrass</b>																	
Walsh	4		1	1	50	32	6	5	16	29	23	2	3	6	9	8	4
Rodan	4		2	1	53	32	6	5	16	29	23	2	3	6	9	8	4
Flintlock	4		1	1	36	32	6	5	16	29	23	2	3	6	9	8	4
<b>Slender Wheatgrass</b>																	
Revenue	--		9	--	--	--	8	8	--	0	30	--	0	6	--	0	3
Adanac	3		2	2	45	55	4	4	22	27	34	2	2	4	6	3	2
Pryor	3		2	2	28	56	5	4	26	35	31	2	3	4	6	2	3
Primar	3		1	3	52	49	5	5	26	--	--	2	3	3	3	3	3

<sup>1</sup>Emergence and stand uniformity seven weeks after seeding (May 22, 1990). Rating: 1=excellent, 5=fair, 9=no emergence.

<sup>2</sup>Weed competition (Aug. 5, 1990, and Aug. 4, 1991). Rating: 1=none, 5=moderate, 9=severe.

<sup>3</sup>Density estimate (percent of full rows in sample frames). 100 percent equals full frame (Aug. 14, 1990, and May 21, 1991).

<sup>4</sup>Stand within plot (Aug. 11, 1994). Rating: 1=excellent, 5=fair, 9=poor.

<sup>5</sup>Plant height average in inches (Aug. 5, 1992; Aug. 4, 1993; and Aug. 1, 1995).

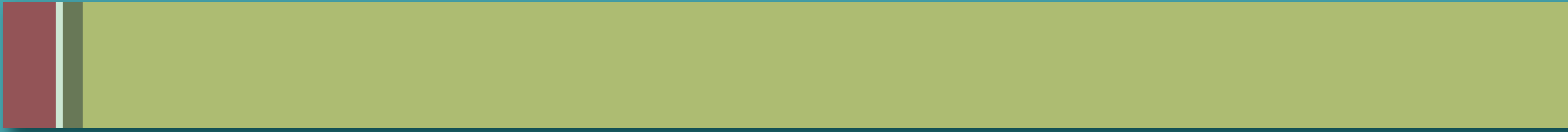
<sup>6</sup>Disease (primarily stem and leaf rust) problems (Aug. 5, 1992; Aug. 4, 1993; and Aug. 11, 1994). Rating: 1=none, 5=moderate, 9=severe.

<sup>7</sup>Seed production potential, using number of culms as an indicator (Aug. 5, 1992, and Aug. 4, 1993). Rating: 1=excellent, 5=fair, 9=poor.

<sup>8</sup>Vigor (overall plant health), (Aug. 1, 1995). Rating: 1=excellent, 5=fair, 9=poor.

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