

# Nutrient Composition of Selected Cool-Season Grasses Near Hettinger, North Dakota

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Cool-season grasses are commonly planted in North Dakota for spring, early summer, and fall pastures, hayland, wildlife habitat, roadside right-of-ways, and set aside acres. Meeting the nutritional requirements of domestic livestock is the key to optimizing performance on and off pasture. Crude protein (CP) content and acid detergent fiber (ADF) are two measures of feed quality which can be used to evaluate feed value of cool season forages. Knowing the nutritional content of these cool-season grasses can be used by livestock producers to obtain optimum quality and production of hay and improved management during the grazing season.

Ranchers in North Dakota, surrounding states, and Canadian provinces have indicated a need for improved cool-season grasses for additional pasture land and hayland that best complement native rangeland. To meet this need, nutritional content of the grasses, production potential, and best use based on plant phenology and production are needed to address these concerns. With such knowledge and the potential to improve cattle performance on a regional basis, a need has developed to determine the nutrient content and forage production potential of selected cool-season grasses in the Northern Great Plains region.

This project was conducted on private land south of Hettinger, North Dakota, from 1995 through 1997. All grass species and cultivars were planted on a fine sandy loam, somewhat excessively drained soil prone to erosion. One hundred and one different varieties or experimental lines were seeded on April 6, 1992. Twenty-five grasses were selected in 1994 to be analyzed for nutrient quality and forage production. A total of 18 grass species will be tested encompassing 25 cultivars.

The cool-season grass species differed in amount and timing of peak production, and levels of nutrient content. Yearly forage production differed for each cultivar. The results will be discussed below.

**Forage Production** - Although 25 cool-season grasses were selected for this trial, 21 were tested for herbage production potential. When yearly rankings are composited into a three-year total index (ex. pubescent wheatgrass Manska: 2+2+2=6 versus basin wildrye Magnar:

4+3+1=8), pubescent wheatgrass (Manska) ranked first among the 21 cultivars for herbage production (Table 1, page 7). In terms of herbage production, not accounting for timing of peak production, both cultivars of pubescent wheatgrass (Manska, MND-759), basin wildrye (Magnar), tall wheatgrass (Alkar), and intermediate wheatgrass (Oahe) achieved the highest production potential among the 21 grass species/cultivars. Herbage production varied between years, with production greatest in 1995 and lowest in 1997. Precipitation in April-September was 26.9% above and 17% below normal in 1995 and 1997, respectively. Precipitation in April-September was 9.1% above normal in 1996.

Herbage production alone should not be used to select a grass species to plant. Date of peak herbage production (Table 1) and amount of time at peak production must be looked at to best analyze a specific use of a grass species. For example, crested wheatgrass (Nordon) ranked seventh overall in production and reached peak production in early July when forage quality is moderate. Tall wheatgrass (Alkar) ranked third overall in production, but reached peak production in mid September when forage quality is very low. Although tall wheatgrass produces a high tonnage of herbage, it does not achieve that level of production until late in the season when forage quality is poor.

**Nutritional Quality** - Twenty cool-season grasses were analyzed for nutritional quality. To optimize livestock performance, producers would like nutrient content of the grass to remain high throughout the grazing season or harvest grass stands for hay at optimum time for quality and production. These goals should be achievable once nutrient content is determined and correlated with production.

All grass cultivars declined steadily in CP content throughout the spring and summer (Table 2, page 7). Since most cool-season grasses show a second growth period in late summer, nutritional quality should improve with new secondary growth. All grass species met the minimum nutrient requirements of a 1200 lb lactating cow (average calving mid March with 20 lb peak milk) through early June. Only altai and Russian wildrye maintained quality until July and only Russian wildrye (Mankota) maintained adequate levels of CP throughout the grazing season.

When reviewing these nutritional quality results, quality can only be assessed for hay and not actual grazing quality for pasture. Livestock can selectively graze to obtain higher quality than shown in this data; however, hay quality will be accurate since clipping was conducted similar to a haying operation. Comparison among grass species can be conducted and selection for grazing or haying useable since all grass species were collected and analyzed with the same manner.

Harvest efficiency should be the goal of any producer putting up hay. To achieve an efficient harvesting system, producers should put up hay to optimize quality and quantity. An efficient grass would be classified as a grass that reaches peak production early in the growing season when quality is highest. Low efficiency grasses are those that reach maximum production when quality is low. All selected cool-season grasses were analyzed for pounds of protein produced per acre to determine maximum CP harvested (Table 3, page 8).

Basin wildrye produced the greatest amount of protein per acre among all grasses with 283 lbs/acre in early July. Most grasses peaked on the July 1 clipping period; however, altai and Russian wildrye, and tall wheatgrass peak into late July. With further review, only altai and Russian wildrye had a moderate CP content in late July while the CP in tall wheatgrass fell to 5.5% in late July (Table 2).

Most grasses showed a similar CP content at each clipping period throughout the collection period with some exceptions. Only Russian, altai and basin wildrye were at or near the minimum CP requirement for a 1200 lb lactating cow (average calving mid March with 20 lb peak milk) after July 1. Only Russian wildrye (Mankota) maintained minimum CP requirements throughout the collection period. In terms of herbage production, not accounting for timing of peak production, both cultivars of pubescent wheatgrass (Manska, MND-759), basin wildrye (Magnar), tall wheatgrass (Alkar), and intermediate wheatgrass (Oahe) achieved the highest production potential among the 21 grass species/cultivars. Of those five, only basin wildrye reached peak production when forage quality was good. Crested wheatgrass (Nordon), basin wildrye (Magnar), and Russian wildrye (Bozoisky Select) had the highest protein produced per acre in late April and May. Basin wildrye, pubescent wheatgrass (Manska), and crested wheatgrass (Nordon) had the highest protein produced/acre in June and early July. Altai wildrye (Prairieland) and basin wildrye had the highest protein produced per acre in late July and

August. Altai, basin, and Russian wildrye (Mankota) had the highest protein produced per acre in September and October.

**Summary** - Most grasses had a similar CP content at each clipping period throughout the collection period with some exceptions. Only Russian, altai, and basin wildrye were at or near the minimum CP requirement for a 1200 lb lactating cow (average calving mid March with 20 lb peak milk) after July 1. Only Russian wildrye (Mankota) maintained minimum CP requirements throughout the collection period. In terms of herbage production, not accounting for timing of peak production, both cultivars of pubescent wheatgrass (Manska, MND-759), basin wildrye (Magnar), tall wheatgrass (Alkar), and intermediate wheatgrass (Oahe) achieved the highest production potential among the 21 grass species/cultivars. Of those five, only basin wildrye reached peak production when forage quality was good. Crested wheatgrass (Nordon), basin wildrye (Magnar), and Russian wildrye (Bozoisky Select) had the highest protein produced per acre in late April and May. Basin wildrye, pubescent wheatgrass (Manska), and crested wheatgrass (Nordon) had the highest protein produced per acre in June and early July. Altai (Prairieland) and basin had the highest protein produced/ acre in late July and August. Altai, basin, and Russian wildrye (Mankota) had the highest protein produced/acre in September and October.

Table 1. Peak herbage production (lb/ac) and ranking among 21 select cool-season grasses, Hettinger, ND, 1995-1997.

Grass Species (cultivar)	Peak Herbage Production (lb/ac)				Yearly Ranking Peak				Date of Production
	1995	1996	1997	Mean	1995	1996	1997	Rank	
Pubescent wheatgrass (Manska)	4603	2664	2045	3104	2	2	2	1	mid August
Basin wildrye (Magnar)	4296	2581	2760	3212	4	3	1	2	early July
Tall wheatgrass (Alkar)	4778	2117	1804	2899	1	8	6	3	mid September
Intermediate wheatgrass (Oahe)	4475	2380	1635	2830	3	6	7	4	mid August
Pubescent wheatgrass (MDN-759)	3732	2785	1520	2679	6	1	9	4	late July
Altai wildrye (Prairieland)	3428	2222	2005	2552	8	7	3	6	mid August
Crested wheatgrass	3273	2497	1868	2546	11	4	4	7	early July

(Nordon)										
Intermediate wheatgrass (Reliant)	3872	2381	1382	2545	5	5	11	8	mid September	
Western wheatgrass (Rodan)	3217	1723	1831	2257	12	13	5	9	late July	
Slender wheatgrass (Revenue)	3703	1525	1569	2266	7	16	8	10	late July	
Crested wheatgrass (Hycrest)	3338	1753	1458	2183	10	12	10	11	late July	
Bluebunch wheatgrass (Goldar)	3003	1920	1258	2060	13	9	13	12	late July	
Meadow brome grass (Regar)	3420	1835	1096	2117	9	11	18	13	early July	
Smooth brome grass (Cottonwood)	2861	1629	1351	1947	15	14	12	14	mid August	
Bluebunch/Quackgrass (RS-1)	2790	1617	1186	1864	17	15	16	15	late July	
Green needlegrass (Lodorm)	2619	1474	1203	1765	18	17	15	16	mid August	
Crested wheatgrass (Ephraim)	2266	1879	906	1684	21	10	19	16	late July	
Smooth brome grass (Rebound)	2846	1326	1098	1757	16	20	17	18	late July	
Russian wildrye (Bozoisky)	2210	1210	1209	1543	22	21	14	19	late July	
Beardless wildrye (Shoshone)	1971	1364	641	1325	23	19	21	20	mid August	
Russian wildrye (Mankota)	1713	1038	826	1192	24	22	20	21	mid August	

Table 2. Crude protein (%) content by date for 20 select cool-season grasses near Hettinger, ND, 1995-1997.

Plant Species	Date										
	4/26	5/15	6/1	6/15	7/1	7/24	8/24	9/14	10/3	11/2	12/2
Pubescent wheatgrass (Manska)	20.0	18.3	12.6	9.3	7.2	4.4	3.2	2.9	2.3	N/A	N/A
Basin wildrye (Magnar)	23.1	20.4	14.8	10.9	8.7	6.8	5.1	4.8	4.2	5.0	3.1
Tall wheatgrass (Alkar)	19.0	16.7	12.1	9.4	7.7	5.5	3.8	3.6	2.6	N/A	N/A
Intermediate wheatgrass (Oahe)	20.2	17.8	12.9	8.8	6.9	4.2	3.1	2.8	2.4	N/A	N/A

Pubescent wheatgrass (MDN-759)	21.2	18.0	13.1	9.4	7.3	4.6	3.5	2.9	2.4	N/A	N/A
Altai wildrye (Prairieland)	17.9	17.8	14.6	10.7	9.1	7.5	5.8	5.7	4.8	3.2	3.3
Crested wheatgrass (Nordon)	20.7	16.9	13.5	9.4	6.4	4.4	3.6	3.3	2.5	N/A	N/A
Intermediate wheatgrass (Reliant)	21.5	19.7	12.7	9.3	7.7	4.8	3.3	2.8	2.4	N/A	N/A
Western wheatgrass (Rodan)	18.9 1	5.7	12.8	9.9	7.7	5.6	4.8	4.3	2.7	N/A	N/A
Slender wheatgrass (Revenue)	24.2	20.0	15.7	11.5	8.6	5.6	4.1	3.7	2.9	N/A	N/A
Crested wheatgrass (Hycrest)	19.1	16.3	11.9	8.6	6.4	4.5	3.7	3.6	2.7	N/A	N/A
Bluebunch wheatgrass (Goldar)	17.6	19.6	15.3	11.0	8.6	6.1	4.7	4.6	4.0	N/A	N/A
Meadow brome grass (Regar)	17.5	16.1	11.0	8.6	6.7	5.0	3.9	3.9	3.5	3.0	3.0
Smooth brome grass (Cottonwood)	19.9	15.8	11.4	9.1	7.4	5.7	4.6	4.2	3.7	N/A	N/A
Bluebunch/Quackgrass (RS-1)	21.7	18.9	14.2	10.4	7.7	5.6	4.3	4.2	3.3	N/A	N/A
Green needlegrass (Lodorm)	18.8	17.4	13.6	9.7	7.6	6.1	4.6	4.2	3.2	N/A	N/A
Crested wheatgrass (Ephraim)	19.8	17.8	13.4	9.6	8.1	5.7	4.5	4.2	3.2	N/A	N/A
Smooth brome grass (Rebound)	18.6	16.0	12.4	9.8	7.6	6.1	4.7	4.5	3.7	3.7	N/A
Russian wildrye (Bozoisky)	21.5	18.9	15.2	11.5	10.6	9.0	7.4	7.1	6.5	5.7	4.9
Russian wildrye (Mankota)	23.0	20.5	16.1	11.5	11.1	9.4	7.1 7.	9 7.0	6.8	N/A	

Table 3. Protein produced (lbs) per acre for 20 select cool-season grasses near Hettinger, ND, 1995-1997.

Plant Species	Date									
	4/26	5/15	6/1	6/15	7/1	7/24	8/24	9/14	10/3	
Pubescent wheatgrass (Manska)	27	87	114	156	<b>166</b>	110	99	75	55	
Basin wildrye (Magnar)	53	112	148	176	<b>283</b>	170	103	79	91	
Tall wheatgrass (Alkar)	18	51	56	<b>122</b>	127	126	95	91	70	

Intermediate wheatgrass (Oahe)	29	78	93	122	<b>149</b>	103	85	65	43
Pubescent wheatgrass (MDN-759)	29	89	108	133	<b>156</b>	121	83	66	48
Altai wildrye (Prairieland)	35	78	90	143	<b>158</b>	<b>166</b>	145	101	71
Crested wheatgrass (Nordon)	43	103	123	<b>149</b>	159	104	86	63	48
Intermediate wheatgrass (Reliant)	29	98	91	135	<b>169</b>	98	74	69	53
Western wheatgrass (Rodan)	34	68	79	<b>121</b>	<b>144</b>	115	90	84	52
Slender wheatgrass (Revenue)	27	89	97	109	<b>144</b>	119	78	63	54
Crested wheatgrass (Hycrest)	45	76	84	121	112	95	62	57	27
Bluebunch wheatgrass (Goldar)	43	94	<b>130</b>	136	121	119	80	81	59
Meadow brome grass (Regar)	42	72	99	113	<b>142</b>	96	57	62	51
Smooth brome grass (Cottonwood)	49	73	110	<b>137</b>	<b>133</b>	100	84	62	53
Bluebunch/Quackgrass (RS-1)	28	52	78	103	<b>117</b>	97	68	58	43
Green needlegrass (Lodorm)	31	66	73	<b>110</b>	<b>118</b>	91	78	68	51
Crested wheatgrass (Ephraim)	35	69	88	78	<b>112</b>	87	63	64	35
Smooth brome grass (Rebound)	36	72	87	105	<b>120</b>	109	58	55	41
Russian wildrye (Bozoisky)	59	107	87	77	<b>118</b>	<b>105</b>	83	77	61
Russian wildrye (Mankota)	47	88	112	116	<b>109</b>	100	84	88	67
Bold print indicates at or near peak, italics indicates highest yield per clipping period.									