

Performance Of Seeded Native And Introduced Grasses In Western North Dakota

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A species evaluation trial involving 21 accessions of cool-season grasses (Table 1) was seeded at the Dickinson Experiment Station in the spring of 1972. The plots were 12 by 25 feet in a randomized block design with 4 replications. The seeding was done with a Planet Jr. hand drill on summerfallow which had been duckfooted and harrowed both ways before seeding.

The study site was located on an area with a 3 per cent slope to the south which had previously been used for small grain trials. The soil on the study site was Morton sandy loam. Emergence of the grasses was generally good, but a very heavy growth of pigeon grass (*Setaria viridis*)

developed during the course of the summer. The area was mowed several times, but the growth of the seeded grasses was retarded, and it appeared that some of the less well-adapted and less vigorous grasses would not become established. Accordingly a second seeding on a similar site, using the same planting plan, was made on August 17, 24 and 25. Emergence from this seeding was very good, but growth of some of the varieties was slow, and the seeding as a whole went into the winter with a rather poor cover. While the spring seeding was slow to recover from the competition of the pigeon grass, the stands did fill in and in the last four years of the trial resembled the fall seeded plots.

Table 1. Grass varieties seeded at Dickinson in 1972.

Grass variety	Scientific name	Supplying source	Place produced
Montana wheatgrass	<i>Agropyron albicans</i>	SCS-PMC ^{1/}	Bismarck nursery
Mandan 456 western wheatgrass	<i>Agropyron smithii</i>	SCS-PMC	Bismarck nursery
Topar pubescent wheatgrass (Mandan)	<i>Agropyron trichophorum</i>	SCS-PMC	Bismarck nursery
Meadow brome PM-195	<i>Bromus biebersteinii</i>	SCS-PMC	Bismarck nursery
Green stipagrass	<i>Stipa viridula</i>	SCS-PMC	Bismarck nursery
Basin wildrye (Mandan)	<i>Elymus cinereus</i>	SCS-PMC	Bismarck nursery
Altai wildrye (Mandan)	<i>Elymus angustus</i>	SCS-PMC	Bismarck nursery
Altai wildrye (Sask.)	<i>Elymus angustus</i>	Res. Station	Swift Current, Sask.
Mandan 404 smooth brome	<i>Bromus inermis</i>	ARS ^{2/}	Mandan station
Nordan crested wheatgrass	<i>Agropyron desertorum</i>	ARS	Mandan station
Vinall Russian wildrye	<i>Elymus juncea</i>	ARS	Mandan station
Lincoln smooth brome	<i>Bromus inermis</i>	Commercial	Dickinson station
Mandan ricegrass	<i>Stiporyzopsis caduca</i>	ARS	Mandan station
Indian ricegrass	<i>Oryzopsis hymenoides</i>	ARS	Mandan station
Lodorm green needlegrass	<i>Stipa viridula</i>	ARS	Mandan station
Mandan Canadian wildrye	<i>Elymus canadensis</i>	ARS	Mandan station
Topar pubescent wheatgrass (Pullman)	<i>Agropyron trichophorum</i>	SCS-PMC	Pullman, Wash.
Sodar streambank wheatgrass	<i>Agropyron riparium</i>	SCS-PMC	Pullman, Wash.
Basin wildrye (Pullman)	<i>Elymus cinereus</i>	SCS-PMC	Pullman, Wash.
Sheep fescue	<i>Festuca ovina</i>	SCS-PMC	Pullman, Wash.
Durar hard fescue	<i>Festuca ovina</i> var. <i>duriuscula</i>	SCS-PMC	Pullman, Wash.

^{1/} Soil Conservation Service - Plant Material Center.

^{2/} Agricultural Research Service.

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Because of the early poor stands on the spring seeding the fall seeded plots were harvested in subsequent years and the data reported here are from those plots. The plots were harvested during July by clipping five 20x20 inch frames per plot. The plants were clipped to the height of the crown of the bunch grasses and ground level on the sod-formers except for Basin and Altai wildrye plots, which were clipped at a height of 6 inches. The forage samples were oven dried to 66°C and oven dry weights recorded.

Results:

The yields in 1973 were low, reflecting the immature condition of the stands and the low precipitation, 2.3 inches below normal. Eight of the varieties had such poor stands that they were not harvested. While both accessions of Altai wildrye (*Elymus angustus*) were harvested, it was apparent later that these plots were badly infested with slender wheatgrass (*Agropyron trachycaulum*). The wheatgrass was removed by hoeing and the physical disturbance of the plots from this activity so thinned the stand of Altai that it was not harvested again for two years. The highest yielding variety in 1973 was Topar pubescent wheatgrass (Mandan) (*Agropyron trichophorum*) with a total dry matter production of 3514 lbs/acre, 1337 lbs/acre above the second highest producer, Nordan crested wheatgrass (*Agropyron desertorum*) (see Table 2).

The average production in 1974 was twice that of 1973 with meadow brome (*Bromus biebersteinii*) being the highest producer with 5355 lb/acre. Lincoln brome (*Bromus inermis*), the second highest producing grass, yielded 5000 lbs/acre, nearly 1/2-ton more than the next highest producer, Topar pubescent wheatgrass (Mandan), which yielded 4041 lbs/acre.

In 1975 the average production of all varieties at 3549 lbs/acre was the highest of any year of the trial. These high yields were no doubt the result of better stand densities as well as the above average precipitation (1.88 inches above the 80-year average) (see Table 3). Meadow brome was again the high yielder with 5666 lbs/acre followed closely by basin wildrye (*Elymus cinereus*) with 5284 lbs/acre. Other varieties yielding over 2 ton/acre were Topar pubescent wheatgrass (Mandan), Lincoln brome, and Topar pubescent wheatgrass (Pullman) with yields of 4997, 4278 and 4252 lbs/acre, respectively.

Average yields in 1976, at 2195 lbs/acre, were significantly lower than in 1974 and 1975. Altai wildrye (Sask.), Altai wildrye (Mandan), and Basin wildrye (Pullman) all yielded over 2 ton/acre with 4412, 4258 and 4005 lbs/acre, respectively. Meadow brome, the high producer from the previous two years, yielded 3182 lbs/acre. Both varieties of Altai wildrye yielded quite high but they had not been harvested in 1974 and 1975 and this provided an opportunity for stand improvement and increased plant vigor.

Table 2. Average yields of grass varieties seeded at Dickinson in 1972 (lbs/acre).

Species	1973	1974	1975	1976	1977	1978	6-Yr. avg.
Meadow brome PM-195	- ^{1/}	5355a	5666a	3182b	2299a	3274a	3881a
Altai wildrye (Sask.)	1517bcde ^{2/}	-	-	4412a	-	-	2965ab
Basin wildrye (Mandan)	-	-	5284ab	3416ab	1510abc	1698bc	2924b
Topar pubescent wht. gr. (Mandan)	3514a	4041abc	4997ab	2056c	1600abc	1464bc	2898b
Altai wildrye (Mandan)	1950bc	-	-	4258a	2346a	949c	2812b
Basin wildrye (Pullman)	-	-	3705abc	4005ab	1614abc	1147bc	2487b
Lincoln smooth brome	1504bcde	5000ab	4278abc	1490c	1343abc	1312bc	2378b
Topar pubescent wht. gr. (Pullman)	1630bcd	3629abc	4252abc	1693c	930c	1482bc	2210b
Durar hard fescue	1104cdef	3794abc	2301c	1983c	1694ab	2161b	2102b
Sodar streambank wht. gr.	821def	3804abc	3691abc	1546c	1708ab	1438bc	2097b
Nordan crested wht. gr.	2177b	2484bc	3838abc	1805c	1037bc	1238bc	2080b
Mandan 404 smooth brome	1614bcde	3772abc	3586bc	1384c	987bc	1246bc	2025b
Mandan Canada wildrye	1420bcde	3927abc	2871bc	1384c	797c	588c	1972b
Lodorm green needlegrass	-	2417c	3317bc	1781c	1356abc	1005c	1952b
Sheep fescue	-	2345c	2270c	1765c	1332abc	2099bc	1942b
Vinall Russian wildrye	459f	3912abc	2765bc	1449c	998bc	1908bc	1828b
Green stipagrass (SCS)	-	1850c	2697c	1757c	1202abc	1248bc	1807b
Montana wht. gr.	705ef	3657abc	2723c	1433c	1468abc	1161bc	1779b
Mandan 456 western wht. gr.	1370bcde	2689bc	3080bc	1352c	1152bc	1099bc	1751b
Indian ricegrass	-	-	-	-	-	-	-
Mandan ricegrass	-	-	-	-	-	-	-
Yearly average	1522c ^{3/}	3512a	3549a	2195b	1370c	1543c	2282

^{1/} Varieties not harvested due to poor stand.

^{2/} Yields in the same column followed by the same letter are not significantly different at the 95% level.

^{3/} Yearly averages followed by the same letter are not significant at the 95% level.

Table 3. Monthly and total precipitation at the Dickinson Experiment Station (inches) during the period 1972-1978 and 80-year average.

	1972	1973	1974	1975	1976	1977	1978	80-Yr. avg.
January	0.50	0.10	0.05	T	0.66	0.44	0.25	0.43
February	0.21	0.42	0.08	0.25	0.07	0.36	0.39	0.41
March	0.69	0.39	0.38	1.66	0.30	1.31	0.09	0.72
April	1.27	3.21	2.82	4.25	2.11	0.13	1.81	1.46
May	5.09	1.30	4.15	3.34	1.42	2.60	3.99	2.37
June	4.29	3.04	2.00	4.27	3.74	5.38	2.10	3.57
July	2.72	0.91	1.50	0.64	0.75	1.08	2.41	2.17
August	2.90	0.47	0.90	0.54	0.40	1.52	2.01	1.72
September	0.74	2.23	0.56	0.80	1.77	5.78	2.56	1.23
October	1.56	0.67	0.52	1.42	0.65	2.16	0.29	0.84
November	0.04	0.31	1.02	0.32	0.14	1.09	1.34	0.51
December	0.75	0.48	0.17	0.22	0.67	1.28	0.39	0.40
Total	20.76	13.53	14.15	17.71	12.68	23.13	17.63	15.83

Average yields in 1977 were the lowest of the 6 year trial, due mainly to the low precipitation in the fall of 1976 and April through the first 3 weeks of May, 1977. Altai wildrye (Mandan) was the highest yielding variety with 2346 lbs/acre, while meadow brome was second with 2299 lbs/acre. All other varieties harvested yielded well below 1 ton/acre.

Average yields in 1978 improved over 1977 but not as much as might have been expected due to the high precipitation in the fall of 1977. The age of the stand may have had an adverse effect on some varieties. Meadow brome was the highest producing variety with 3274 lbs/acre, which was 1113 lbs/acre greater than the second highest producer, Durar hard fescue (*Festuca ovina* var. *duriuscula*) with 2161 lbs/acre.

The 6-year average for the trial shows Topar pubescent wheatgrass (Mandan) to be the highest producer with 2898 lbs/acre followed by Lincoln smooth brome and Topar pubescent wheatgrass (Pullman) with 2378 and 2210 lbs/acre, respectively. Meadow brome yielded an average of 3881 lbs/acre but was only harvested 5 years of the trial. The low yielding varieties were Montana wheatgrass (*Agropyron albicans*) and Mandan 456 western wheatgrass (*Agropyron smithii*) with 1779 and 1751 lbs/acre, respectively.

Discussion:

The meadow brome seed for our trial was produced at the Soil Conservation Service Plant Material Center (SCS-PMC) in Bismarck. While this selection of meadow brome was never released, the same selection was released at the SCS-PMC in Pullman, Washington and named Regar. Regar or meadow brome is a large robust bunchgrass introduced from Turkey. It has good regrowth following cutting or grazing providing adequate soil moisture is available. Its palatability to livestock is good although probably less so than smooth brome. Meadow brome can be seeded with alfalfa as well as red clover. (Hafenrichter, A. L. et al 1968).

The second highest yielding variety was Altai wildrye (Sask.). Because of the problem with slender wheatgrass,

which apparently was included in the original seed lot, this variety was harvested only 2 years of the trial. The Altai wildrye (Mandan) was harvested 4 years and although the average yield was less, had a better stand in 1977 and 1978. Altai wildrye is a winter-hardy, drought-tolerant, long-lived perennial grass introduced from Siberia. Altai wildrye was found to be similar to Russian wildrye (*Elymus junceus*) in protein content throughout the season (Lawrence 1971). The major advantage of Altai wildrye is the erect, stiff basal leaves which may project above shallow snow and remain erect in deep snow, forming a bridge across the plants, thus allowing cattle to remove the snow with their muzzles and graze the foliage underneath (Lawrence 1977).

Altai wildrye seed for the trial was obtained from both the Canadian Department of Agriculture Research Station at Swift Current, Saskatchewan and from the SCS-PMC, Bismarck. The material at Bismarck was grown from seed obtained from Swift Current.

Two selections of basin wildrye were included in the trial. One selection was from the SCS-PMC Pullman, Washington and the other from the SCS-PMC, Bismarck. Basin wildrye is a large, robust, native bunchgrass which has a high tolerance for saline soils. Both selections took three years to become well enough established to warrant harvesting.

Of the two varieties of smooth brome, Lincoln was the highest producer in all years except 1973 when Mandan 404 produced slightly more forage. Smooth brome is one of the most widely seeded introduced grasses in the United States. A native of Europe and Asia, it is a leafy sod-forming perennial best adapted to areas above 15 inches annual precipitation. Smooth brome can be seeded alone or with other grasses or legumes for hay or pasture. Because it is a late maturing cool-season grass smooth brome is less well adapted to grazing systems which utilize native range than is crested wheatgrass.

Mandan 404 smooth brome was released by the Northern Great Plains Research Center at Mandan. It is not as high a forage producer as Lincoln but tests have shown it to be more palatable and generally higher in protein than Lincoln.

Pubescent wheatgrass is a long-lived, introduced, drought tolerant sod grass. Topar was released in 1953 at the SCS-PMC in Pullman, Washington from plant materials introduced from Russia. It is a late maturing grass best suited to well drained soils. Pubescent wheatgrass resembles and is closely related to intermediate wheatgrass, but shows considerable pubescence on the heads and seeds.

The characteristics of crested wheatgrass are well-known in the northern plains. This cool-season bunchgrass is native to eastern Russia, western Siberia and central Asia. It is long-lived, drought tolerant, and withstands heavy grazing well. It is best adapted to well drained soils in areas with 9 to 15 inches annual precipitation, starts growing early, and is ready to graze before native grasses. It is because of this early growth that crested wheatgrass is so useful to supplement native range in a two or three-pasture rotational grazing system. Nordan crested wheatgrass was released cooperatively by the Northern Great Plains Research Center, Mandan and the North Dakota Agricultural Experiment Station. It is a uniform, erect variety which yields good quantities of high quality seed.

Of the two varieties of fescue in the trial, Durar was the highest producer. Although only the above ground production was measured in this trial, the below ground root production is more important in both hard and sheep fescue (*Festuca ovina*). These grasses are best suited for erosion control plantings when little utilization by grazing animals is expected or desired. Both varieties of fescue are low-growing, long-lived bunchgrasses with low palatability to livestock. Between the two, sheep fescue is the shorter but has abundant root production. Hafenrichter et al., (1968) reported the quantity of hard fescue roots to be 19,020 lbs/acre compared to Manchar smooth brome 4740 lbs/acre, crested wheatgrass 7510 lbs/acre, and Greenar intermediate wheatgrass (*Agropyron intermedium*) 10,090 lbs/acre.

Streambank wheatgrass (*Agropyron riparium*) is a cool-season, sod-forming grass native to the western United States. Utilized mainly for erosion control it is drought resistant and alkali tolerant. Sodar was released at the SCS-PMC, Pullman, Washington from material collected in Grant County, Oregon.

Canada wildrye (*Elymus canadensis*) is a large, short lived perennial bunchgrass native throughout much of the United States. The variety Mandan was selected by the Northern Great Plains Research Center at Mandan and released in 1946 in cooperation with the North Dakota Agricultural Experiment Station. Mandan wildrye has more and softer leaves, shorter culms, and is longer lived than the common Canada wildrye.

Green needlegrass (*Stipa viridula*) is a native bunchgrass of the central United States. It is a palatable, nutritious, cool-season grass which remains green until late summer. Lodorm and Green Stipagrass are selections made at the Northern Great Plains Research Center, Mandan from green needlegrass. Lodorm is superior to Green Stipagrass due to its low seed dormancy. Both selections have similar forage and seed yields.

Russian wildrye is an introduced, early growing, cool-season bunchgrass. It is adapted to areas where crested wheatgrass does well, although unlike crested its seedling vigor is low and establishment is difficult. Russian wildrye is used primarily for grazing and affords its best advantage when used in combination with introduced and/or native grasses in a rotational grazing system. In this type of a system Russian wildrye is generally utilized as late season pasture because of its higher protein content at that time. Although used in late season Russian wildrye begins growth several days to a week before crested wheatgrass; however, at this time cattle prefer crested wheatgrass to Russian wildrye.

Vinall Russian wildrye was selected at the Northern Great Plains Research Center for its increased seed production. In an 8 year test Vinall produced 55 per cent more seed than common Russian wildrye (Schaaf and Rogler, 1960).

Western wheatgrass is a native, drought tolerant, sod-forming grass. A major component of much of the native rangeland in North Dakota, western wheatgrass had a wide distribution from Wisconsin to Central Washington south to New Mexico and Texas. Mandan 456 was selected for its vigorous growth, leafiness, and rust resistance.

The production of several of the varieties could be attributed to a few large plants rather than an even, uniform stand. Meadow brome was the most obvious of these with several very large plants contributing to its high production while the overall stand was poor. Basin and Altai wildrye, also large bunchgrasses, had similar open stands. Green needlegrass stands were slow to develop but did provide good cover by the third year. Intermediate and pubescent wheatgrass developed good stands early but deteriorated somewhat toward the end of the trial. Canadian wildrye stands were very good for the first 2 years but then began to deteriorate. The stands of western wheatgrass continued to improve throughout the trial, while those of the two ricegrasses were poor from the beginning.

LITERATURE CITED

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