

REPORT OF GRASS AND LEGUME INVESTIGATIONS 1961 CROP SEASON

BY WARREN C. WHITMAN, Botanist

HAY YIELDS FROM GRASS PLOTS AND GRASS-ALFALFA MIXTURE PLOTS

Intermediate and pubescent wheatgrass plots: The 1961 hay yields from the intermediate-pubescent wheatgrass plots seeded in 1954 are given in Table 1. Table 2 gives the average yields of the intermediate and pubescent wheatgrass varieties in this trial over the 7-year period, 1955-1961. The data given in Table 1 show the composition of the 1961 yields in terms of seeded grass, other grass, and weeds. The "other grass" consists almost entirely of invading crested wheatgrass. As the data of Table 1 show, there have been rather extensive invasions of crested-wheatgrass into the plots. Especially heavy invasions have taken place in the plots of North Dakota pubescent and Ree wheatgrass.

Table 1. Composition of 1961 Forage Yields from Intermediate-Pubescent Wheatgrass Plots Seeded in 1954.				
Variety	Dry-Weight Yield - Lbs./Acre			
	Grass	Other Grass	Weeds	Total Production
N. Dak. Pubescent Whtgr.	822	247	11	1080
M2-10820	753	96	40	889
Ree Wheatgrass	545	260	35	840
Pubescent Wheatgrass	553	105	10	668
A-12496	535	92	32	659
N. Dak. Intermediate	379	94	85	558
Nebraska 50	326	---	106	432
Average	559	128	46	733

Table 2. Hay Yields from Intermediate-Pubescent Wheatgrass Plots Seeded in 1954							
	Oven-Dry Weight - Lbs./Acre						7-Year Average Yield -

Variety	1955	1956	1957	1958	1959	1960	1961	Lbs/Acre
Ree Wheatgrass	3419	1484	2332	1815	1511	1513	840	1845
M2-10820	2724	1329	2290	2006	1435	1636	889	1758
N. Dak. Pubescent	2580	1308	1905	1794	1580	1605	1080	1693
Nebraska 50	3299	1296	2200	1879	1348	1320	432	1682
N. Dak. Intermediate	2839	1385	2214	1735	1490	1431	558	1665
Pubescent Whtgr.	3131	1355	1979	1494	1481	1422	668	1647
A-12496	2647	1409	2017	1449	1231	1306	659	1531
Average	2948	1367	2134	1739	1439	1462	733	1689

All intermediate and pubescent stands in the trial show serious stand loss, with none of the varieties showing more than a 50 per cent stand in the 1961 season, and most varieties averaging about a 25-35 per cent stand. The relatively low plot yields obtained in the 1961 season are primarily the result of drought, but stand deterioration has had an important influence in reducing yields. The average yield of 559 pounds per acre of seeded grass for all varieties is the lowest average yield for the 7-year period of the trial.

The average plot yields (Table 2) show that the intermediate wheatgrass and pubescent wheatgrass varieties have yielded remarkably well for the period of the trial. Despite the low yields of the 1961 season, all varieties have averaged over 3/4-ton of hay for the 7-year period. Stand deterioration is now so serious, however, that it is doubtful whether the varieties will continue adequate production to merit retaining the trial. There seems to be little difference in total production between the intermediate and the pubescent wheatgrass varieties.

New Intermediate Wheatgrass Plots: The 1961 yields of hay from the new intermediate wheatgrass trial are given in Table 3. As yet the stands show little invasion by other grass, and the proportion of weeds in the stands is not excessively high. However, the stands do show serious deterioration, and only a few of the plots have over a 50 per cent stand on them.

The range in yield of seeded grass on the plots this year was from 690 pounds per acre for Idaho #4 to 357 pounds for Amur (A-13046). It is doubtful whether the differences in yield have any significance as between varieties. More likely they reflect slight differences in soil moisture. The average yield of the varieties in the 1961 season was only about one-third of last year's average yield.

The three-year average yields (1959-1961) are given in Table 4. While generalization from the present data is hardly justified, it does seem that Amur and Greenar have been less productive in this trial than most of the other varieties. However, the range in average yields for the three-year period is only from 983 pounds per acre to 1262 pounds per acre. The three-year average yield for all varieties of a little over one-half ton per acre is relatively low for young stands of intermediate wheatgrass. South Dakota #20 has been consistently among the better producers throughout the period of the trial.

Table 3. Composition of 1961 Forage Yields from Intermediate Wheatgrass Plots Seeded in 1958.

Variety	Dry-Weight Yield - Lbs./Acre			Total Production-Lbs/Acre
	Grass	Other Grass	Weeds	
Idaho #4	690	5	33	728
A-12496	657	---	---	657
South Dakota #20	642	---	---	642
N. Dak. Intermediate	460	3	23	486
Idaho #3	410	---	76	486
Nebraska 50	466	5	8	479
Amur (A-13046)	357	1	91	449
Greenar	397	---	14	411
Ree Wheatgrass	365	7	3	375
Average	494	2	28	524

Table 4. Hay Yields from Intermediate Wheatgrass Plots Seeded in 1958.

Variety	Dry-Weight Yield - Lbs./Acre			
	1959	1960	1961	3-Year Average Yield
South Dakota 20	1282	1863	642	1262
Idaho #3	1207	2033	486	1242
Idaho #4	1044	1545	728	1106
Nebraska 50	1151	1639	479	1090
N. Dak. Intermediate	1145	1629	486	1087
Ree Wheatgrass	1269	1522	375	1055
A-12496	860	1560	657	1026

Greenar	1187	1474	411	1024
Amur	1142	1359	449	983
Average	1143	1625	524	1097

Uniform Bromegrass Trial: The hay yields for 1961 of the 14 strains of smooth bromegrass included in the uniform bromegrass trial are given in Table 5. The seven-year average yields for all strains in the trial are given in Table 6. These plots were seeded in 1953 and most of the plots have suffered some stand damage, especially if the last two years. Stands of Lyon, Fischer, and Kuhl seem to have suffered especially severely. Stands on most of the plots, however, are better than 65 per cent. Invasion of other grass and weeds has been relatively slight so far.

The average production of seeded grass for all brome varieties was 375 pounds per acre this year. The range in production this year was from a high of 443 pounds per acre for Manchar to a low of 287 pounds for Canadian commercial. These are the lowest yields obtained so far in the trial and reflect both the effects of the drought season and the deteriorating stands on the plots. Differences in yield between the northern and southern types were not consistent this year.

The data of Table 6 show that on the basis of the seven-year average the southern-type strains have been slightly more productive than the northern-type strains, Lincoln, Fischer, Achenbach, and Oklahoma synthetic are at the top of the list, and the four northern types, Manchar, Mandan 404, Homesteader, and Canadian commercial are at the bottom of the list.

The range in average productivity is not great, however, varying only from 931 pounds per acre for Canadian to 1182 pounds per acre for Lincoln.

Variety	Dry-Weight Yield - Lbs./Acre			Total Yield- Lbs./Acre
	Grass	Other Grass	Weeds	
Oklahoma Synthetic	429	4	28	461
Fischer	375	---	86	461
Manchar	443	---	5	448
Elsberry	408	---	30	438
Lincoln	353	6	73	432
Bin 12	413	---	3	416

Lancaster	384	1	20	405
Homesteader	373	1	28	402
Kuhl	376	---	25	401
Lyon	287	1	106	394
Achenbach	360	---	29	389
Mandan 404	377	---	8	385
Martin	379	---	5	384
Canadian com.	287	5	35	327
Average	375	1	34	410

Table 6. Hay Yields from Bromegrass Plots Seeded in 1953.

Variety	Dry-Weight Yields - Lbs./Acre							7-Year Average Yield- Lbs./Acre
	1954	1955	1957	1958	1959	1960	1961	
Lincoln	1606	1498	1459	1260	906	1115	432	1182
Fischer	1637	1414	1408	1239	849	1111	461	1160
Achenbach	1702	1463	1318	1159	734	1247	389	1145
Oklahoma Synthetic	1363	1426	1614	1190	789	1135	461	1140
Elsberry	1190	1548	1537	1184	952	1010	438	1123
Bin 12	1289	1326	1380	1206	1007	1071	416	1099
Lancaster	1275	1476	1397	1142	864	1095	405	1093
Lyon	1380	1511	1417	1140	707	1042	394	1084
Kuhl	1334	1352	1486	1107	704	1088	401	1067
Martin	1247	1335	1160	1179	951	986	384	1035
Manchar	1241	1478	1132	1126	746	1057	448	1033
Mandan 404	1261	1359	1226	1069	865	991	385	1022
Homesteader	1214	1433	1319	1099	677	1000	402	1021
Canadian Com.	1122	1287	1095	920	774	990	327	931

Average	1347	1421	1353	1144	823	1067	410	1081
---------	------	------	------	------	-----	------	-----	------

New Crested Wheatgrass Plots: Yields of hay (oven-dry weight) from the plots in the new crested wheatgrass trials are given in Table 7. This trial was seeded in 1958, and the first yields were taken in 1959. The stands in this trial are in excellent condition, containing little or no invading grass and only negligible amounts of weeds. One variety, A-1770, which was seeded initially in the trial, failed to make satisfactory stands on any of the plots, and has not been included. Turkish Fairway is the only variety that seems to have little adaptation to the area, and this variety has been consistently low yielding.

With the yield of Turkish Fairway excluded, the range in yields for the 1961 season was from 770 pounds per acre for South Dakota #15 to 905 pounds per acre for Nebraska 3576 Fairway. The average yield for all varieties was 810 pounds per acre, which is over twice the yield of seeded grass from the brome plots (Table 5) and almost 30 per cent more than the average yield of seeded grass from the intermediate wheatgrass plots (Table 3). All the adapted varieties of crested wheatgrass show an average yield for the three-year period of over one-half ton per acre. Generally speaking, the Fairway varieties have yielded as well as the varieties of the standard type.

Table 7. Hay Yields from Crested Wheatgrass Varieties Seeded in 1958.				
Variety	Dry-Weight Yield - Lbs./Acre			3-Year Av. Yield
	1959	1960	1961	
Commercial Crested	1452	1815	824	1364
Commercial Fairway	1425	1619	873	1306
Nebraska 3576 Fairway	1371	1605	905	1294
Summit Crested	1328	1614	856	1266
Nebraska 10	1137	1791	864	1264
Nordan Crested	1427	1461	806	1231
Mandan 2359	1157	1687	833	1226
South Dakota 15	1164	1546	770	1160
Turkish Fairway	753	930	562	748
Average	1246	1563	810	1206

Station Grass and Mixture Trial: Tables 8, 9, 10 summarize the yields of the mixtures and straight grass seedings in the new Station trial seeded in the spring of 1958. The trial is similar to trials being carried on at the other branch stations. Yields from the mixtures and straight grass seedings were fairly good this season considering the general drought conditions that prevailed. The mixtures actually

showed very little advantage over the straight grass seedings, averaging 879 pounds per acre, while the grasses alone averaged 822 pounds per acre.

Table 8 gives the 1961 yields from the grass-alfalfa mixtures, and Table 9 summarizes the three-year average production from the mixtures. As shown in Table 8, alfalfa in the 1961 season contributed over 30 per cent of the average yield of the mixtures. Alfalfa was a major contributor to yield in four of the mixtures. These were the green stipa-ladak alfalfa mixture, the green stipa, Teton alfalfa mixture, the Lincoln brome-ladak mixture, and the Manchar brome-ladak mixture. It was a very important contributor in the case of the Lincoln brome-Teton alfalfa mixture. The two green stipa-alfalfa mixtures were seeded in the fall of 1959, and the green stipagrass is not fully established. In the other mixtures alfalfa contributed from about 10 to 20 per cent of the yield.

Stands in a number of the plots were reduced somewhat by the drought conditions of the 1961 season. However, there has been very little invasion of the stands by other grasses, and weeds have not become important in any of the established grass-alfalfa mixture plots. The 1961 yields of the Nordan crested-Teton alfalfa and the Lincoln brome-Nordan crested-Ladak alfalfa were outstandingly good for such a dry season.

The data of Table 9 show that on the basis of the three-year average yields, the Nordan crested-Teton alfalfa, the intermediate wheatgrass-Teton alfalfa, the Lincoln brome-Nordan-Ladak, and the intermediate wheatgrass-Ladak alfalfa mixtures have been the best producing mixtures. The Russian wildrye-alfalfa mixtures have been somewhat lower producing than the other mixtures, as would be expected from the growth habit of Russian wildrye. The three-year average production for all mixtures (excluding the newer seedings of green stipa) of over one ton per acre is unusually good in view of the dry 1961 season.

Table 8. Composition of 1961 Hay Yields from Station Grass-Alfalfa Mixture Trial Seeded in 1958.					
Mixtures	Dry-Weight Yields - Lbs./Acre				
	Grass	Alfalfa	Other Grass	Weeds	Total Yield
Nordan Crested-Teton Alfalfa	1232	128	---	---	1360
Lincoln Brome-Nordan Crested-Ladak Alfalfa	1044	151	---	---	1195
Green Stipa (New)-Ladak Alfalfa	104	796	---	135	1035
Lincoln Brome-Teton Alfalfa	668	268	4	3	943
Lincoln Brome-Ladak Alfalfa	494	392	13	4	903
Russian Wildrye (2355)-Teton Alfalfa	680	104	---	2	786
Intermediate Whtgr.-Ladak Alfalfa	566	112	---	77	755
Russian Wildrye (2355)-Ladak Alfalfa	647	64	---	---	711

Manchar Brome-Ladak Alfalfa	486	204	---	2	692
Intermediate Whtgr.-Teton Alfalfa	514	79	9	45	647
Green Stipa-Teton Alfalfa	162	475	---	5	642
Average	600	252	2	25	879

Table 9. Three-Year Hay Yields from Station Grass-Alfalfa Mixture Trial Seeded in 1958.

Mixtures	Dry-Weight Yields - Lbs./Acre			
	1959	1960	1961	3 - Year Average Yield
Nordan Crested-Teton Alfalfa	2536	3396	1360	2431
Intermediated Whtgr.-Teton Alfalfa	3144	3381	647	2391
Lincoln Brome-Nordan Crested-Ladak Alfalfa	2447	3204	1195	2282
Intermediate Whtgr.-Ladak Alfalfa	2818	3258	755	2277
Lincoln Brome-Ladak Alfalfa	2171	3272	903	2115
Lincoln Brome-Teton Alfalfa	2329	2765	943	2012
Manchar Brome-Teton Alfalfa	2127	2764	692	1816
Russian Wildrye (2355)-Teton Alfalfa	1449	2307	786	1514
Russian Wildrye (2355)-Ladak Alfalfa	1653	1716	711	1360
Green Stipagrass-Ladak Alfalfa	---	---	1035	---
Green Stipagrass-Teton Alfalfa	---	---	642	---
Average	2297	2896	879	2022

The production of the straight grass seedings in the Station Trial is given in Table 10. As previously mentioned, the yields of the straight grasses are very nearly as good as the yields of the grass-alfalfa mixture plots. The grass yields have been unusually good in this trial. The three-year average yield for all grass varieties of 1,988 pounds per acre compares favorably with the three-year average yields of the mixture plots at 2,022 pounds per acre.

Summit crested wheatgrass has shown the highest average yield for the three-year period with a production of 2,412 pounds per acre.

Intermediate wheatgrass (Nebr. 50), Nordan crested, Lincoln brome, and Southland brome all show an average production of over one ton per acre for the period of the trial. The two northern bromes and Russian wildrye show appreciable lower production. Slender wheatgrass, which produced fairly well the first two years of the trial, has largely gone out, and the weed covered plots of this variety were not harvested, in the 1961 season. The two green stipagrass varieties are new stands, having been seeded in the fall of 1959.

Table 10. Three-Year Hay Yields from Station Grass Trial Seeded in 1958.				
Grass Varieties	Dry-Weight Yield-Lbs./Acre			
	1959	1960	1961	3 - Year Average Yield
Summit Crested	2653	3310	1272	2412
Intermediate Whtgr. (N.50)	2865	3440	743	2349
Nordan Crested	2364	3203	1259	2275
Lincoln Brome	2559	3107	971	2212
Southland Brome	2344	3293	750	2129
Northern Brome	2324	2876	540	1913
Manchar Brome	2332	2560	707	1866
Russian Wildrye (2355)	1368	2086	686	1380
Russian Wildrye (Com.)	1404	1913	756	1358
Slender Whtgr.	1937	2601	no stand	---
Green Stipa (New)	---	---	755	---
Green Stipa (Com.)	---	---	608	---
Average	2215	2839	822	1988

New Dryland Alfalfa Plots: A new alfalfa trial with twelve varieties was seeded on June 23, 1960. Individual plots were 6' x 30', and four replications were included. Excellent first-year stands were obtained, and the trial was cut once for hay in the 1961 season. As can be seen from Table 11, which reports the yields obtained, production was generally low with the average alfalfa yield for all varieties being 876 pounds per acre (oven-dry). Some of the varieties, especially Du Puits and Pfister, showed some stand loss from the excellent first-year stands. There was very little regrowth on the plots after the first cutting.

Vernal, Rambler, Grimm, Ladak, and Narrangansett showed the best first-year yields, but little significance can be attached to the yield

differences obtained in the first year of the study. Yields of alfalfa from the plots ranged from a low of 701 pounds per acre for Pfister FD-180 to a high of 1049 pounds per acre for Vernal.

Table 11. Hay Yields from Dryland Alfalfa Plots Seeded in 1960.			
Variety	Dry-Weight Yield - Lbs./Acre		
	Alfalfa	Weeds	Total
Vernal	1049	50	1099
Rambler	1003	121	1124
Grimm	967	92	1059
Ladak	937	26	963
Narragansett	936	87	1023
Du Puits	872	102	974
Scandia	860	47	907
Ranger	838	31	869
S. Dak. H-2157	800	100	900
Rhizoma	782	45	827
Teton	764	77	841
Pfister FD-180	701	203	904
Average	876	82	958

NITROGEN FERTILIZER ON CRESTED WHEATGRASS

Plots Fertilized Every Year: Hay yields from old crested wheatgrass plots fertilized every year with ammonium nitrate (33-0-0) are given in Table 12. This trial was begun in 1955 and seven-years' data are available. Fertilizer applications on these plots have all been made in early spring, with the 1961 applications being made on April 7. The treatments include check, 25 pounds N., 50 pounds N., and 100 pounds N. per acre.

In the 1961 season, all fertilizer applications increased forage production on the fertilized plots, but all increases were very small. The check plots produced 550 pounds of forage (oven-dry) per acre; the lots with 25 pounds of nitrogen produced 661 pounds of grass per acre;

those with 50 pounds N., 693 pounds of grass; and those with 100 pounds N., 706 pounds of grass. None of these increases would have been profitable considering the price of nitrogen to be ten cents per pound and the value of hay to be one cent per pound. This very poor response to nitrogen applications is clearly a result of the unfavorable moisture situation prevailing in the 1961 growing season. The yield of the check plots was only about half the previous average check yield, and the yields on the fertilized plots were only about 40 per cent of the previous average yields on fertilized plots.

Despite the low yields and poor fertilizer response obtained in the 1961 season, the data of Table 12 show that, for the seven-year period as a whole, 25 pounds of nitrogen per acre applied annually has produced a profitable increase in hay yield over that of the check. As previously shown, there is no economic justification for using amounts of nitrogen in excess of 25 pounds per acre for hay production from old crested wheatgrass stands on dryland sites in this area.

Year	Dry-Weight Yield - Lbs./Acre				Percentage Increase Over Check		
	Check	25 lbs. N	50 lbs. N	100 lbs. N	25 lbs. N	50 lbs. N	100 lbs. N
1955	1276	2096	2121	2494	64.3	66.2	95.4
1956	612	751	763	670	22.7	24.7	9.5
1957	1356	2117	2064	2174	56.1	52.2	60.3
1958	1224	1679	1839	1993	37.0	50.2	62.8
1959	1116	1451	1284	1206	30.0	51.1	8.1
1960	1279	2003	1954	2160	56.6	52.6	68.9
1961	550	661	693	706	20.2	26.0	28.4
7-Year Average	1059	1537	1531	1629	45.1	44.6	53.8

Plots Fertilized Every Other Year: The yields from old crested wheatgrass plots fertilized every other year with ammonium nitrate are given in Table 13. These plots are fertilized in the spring, and the rates of nitrogen application are the same as for the plots fertilized annually. Fertilizer applications have been made in spring of 1957, 1959, and 1961. The data obtained thus far in the study indicate there is some carry-over from all rates of fertilization. The 1961 yields show no carry-over effect, and very little response to the current-year applications of nitrogen.

The 1961 yield on these plots were 554 pounds of grass per acre for the check, 608 pounds on the 25-pound nitrogen plots, 658 pounds on the 50-pound nitrogen plots, and 624 pounds of grass on the 100-pound nitrogen plots. Obviously the slight increases in yield obtained from the use of the fertilizer were not profitable this season.

On the basis of the use of equal amounts of nitrogen over a two-year period, the increases in yield obtained by fertilizing every other year with 50 pounds of nitrogen have not been as good as the yields obtained by fertilizing annually with 25 pounds of nitrogen per acre. Fertilizing with 100 pounds of nitrogen every other year has produced yields equal to those obtained by fertilizing every year with 50 pounds of nitrogen.

The increased yields from 50 pounds of nitrogen every year or 100 pounds of nitrogen every other year are just barely on the margin of returning the cost of the nitrogen. The use of these rates does not appear to be justified when such a distinct advantage exists for the annual 25-pound application of nitrogen.

Table 13. Forage Production From Old Crested Wheatgrass Plots Fertilized Alternate Years* at Three Rates of Nitrogen (33-0-0).							
Year	Dry-Weight Yield - Lbs./Acre				Percentage Increase Over Check		
	Check	25#N	50#N	100# N	25#N	50#N	100# N
1957	1239	1714	2013	2001	38.3	62.5	61.5
1958	1003	1016	1114	1250	1.3	11.1	24.6
1959	1094	1230	1266	1659	12.4	15.7	51.6
1960	1306	1813	1801	2187	38.8	37.9	67.5
1961	554	608	658	624	9.7	18.8	12.6
5-Year Average	1039	1276	1370	1544	28.8	31.9	48.6

*Fertilizer applied in spring of 1957, 1959, and 1961.

NEW FERTILIZER TRIAL

Hay Yields from New Fertilizer Trial: In this trial four grasses, Nordan crested wheatgrass, Lincoln brome, Intermediate wheatgrass, and Russian wildrye were grown alone, mixed with Ladak alfalfa, and in plots fertilized with 33 pounds of nitrogen per acre, 67 pounds, and 100 pounds of nitrogen per acre. Fertilizer applications were made in the fall of 1957 and 1958, and in the spring of 1960 and 1961. The trial was seeded in spring of 1956.

Fertilization was switched to the spring period because it appeared that considerable stand deterioration was taking place on the fall-fertilized plots of Lincoln brome and intermediate wheatgrass. However, stands on plots containing these varieties continued to deteriorate, and the plots could not be harvested for yield in the 1961 season. The reason for this deterioration apparently was not entirely the fertilizer, because control plots of these varieties also showed serious deterioration.

The hay yields for each of the treatments for the four-year period, 1958-1961, are given in Table 14. In the 1961 season no increases in hay yields were obtained with the alfalfa-grass mixtures over the straight grass seedings. Responses from nitrogen fertilizer were obtained with all three rates of application. Both Nordan crested and Russian wildrye, the best response was obtained with 33 pounds of nitrogen. No additional increases in yield were obtained with the heavier rates of fertilization.

Yield increases were so small that none of the rates of fertilization would have been economical. Thirty-three pounds of nitrogen per acre only increased the hay yield of Nordan crested, 151 pounds over the yield of the check, and Russian wildrye was only increased 178 pounds over the check by this amount of nitrogen.

Table 14. Hay Yields from Grasses in Pure Stands, in Mixture with Alfalfa, and in Pure Stands Fertilized at Three Different Rates, 1958-1961.

Grasses	Year	Dry-Weight Yield - Lbs./Acre				
		Grass Alone	With Alfalfa	33#N	67#N	100#N
Nordan Crested	1958	1809	1647	1832	2491	2724
Intermediate Whtgr.	1958	1729	1706	1992	2466	2714
Lincoln Brome	1958	1461	1818	2205	2459	2342
Russian Wildrye	1958	941	1111	1224	1613	1984
Nordan Crested	1959	1416	1827	2120	1737	2011
Intermediate Whtgr.	1959	1033	1372	1244	1468	1325
Lincoln Brome	1959	936	1465	1630	1421	1279
Russian Wildrye	1959	778	841	975	971	1086
Nordan Crested	1960	2134	2435	2910	2713	2714
Intermediate Whtgr.	1960	1395	1980	1877	2259	1998
Lincoln Brome	1960	1265	1610	2151	2283	2203
Russian Wildrye	1960	1287	1312	1710	1823	1997
Nordan Crested	1961	1036	1012	1187	1120	1108
Intermediate Whtgr.	1961	No yield - stand largely gone out				
Lincoln Brome	1961	No yield - stand largely gone out				

Russian Wildrye	1961	643	616	821	761	777
-----------------	------	-----	-----	-----	-----	-----

The four-year average yields are given in Table 15 for Nordan Crested wheatgrass and Russian wildrye. Satisfactory yields were obtained from the other two varieties only for the first three years of the trial, so these varieties are not included in the table. These data show that, for the four-year period, Nordan crested wheatgrass fertilized with 33 pounds of nitrogen per acre has produced enough additional hay to a little more than pay for the cost of the nitrogen. The additional production of Russian wildrye has not been enough to pay for the nitrogen on the basis of the average for the four-year period. These figures are based on hay values of one cent per pound and nitrogen costs of ten cents per pound.

It is apparent from the results of this trial that erratic responses to nitrogen may be expected, that there is little advantage in using more than 25 to 30 pounds of nitrogen per acre in annual fertilizer applications, and that some grasses (in this case Russian wildrye) may not make enough additional production to pay for the cost of the fertilizer. These conclusions apply primarily to the use of nitrogen for increasing hay production. There are a number of reasons for thinking that nitrogen may be more profitably used on pasture than on hayland in this area.

The production of the grass-alfalfa mixtures is probably lower than might be expected. There is now very little alfalfa in these mixtures, and less than 10 per cent of the 1961 yields of the mixtures was made up of alfalfa.

Stands containing a larger proportion of alfalfa in the mixture might well be expected to make better production than that obtained this season in this trial.

Table 15. Four-Year (1958-1961) Average Hay Yields from Nordan Crested Wheatgrass and Russian Wildrye in Pure Stands, in Mixture with Alfalfa, and in Pure Stands Fertilized with Nitrogen at Three Different Rates.

Grasses	Dry-Weight Yield - Lbs./Acre				
	Grass Alone	With Alfalfa	33#N	67#N	100#N
Nordan Crested Whtgr.	1599	1743	2012	2015	2139
Russian Wildrye	912	970	1182	1292	1461

SPRING GRAZING TRIAL

The pastures in the spring grazing trial were grazed for the seventh season in 1961. The grazing period was short this year, the yearling steers being on the pastures only from May 24 to June 21, a period of 48 days. The crested-alfalfa pastures were stocked with eight yearling steers each, as in the past, and one crested wheatgrass pasture (Pasture #3) was stocked with six steers. Pasture #1, which

was fertilized with 50 pounds of nitrogen per acre on April 10, 1961, was stocked with eight steers.

Table 16 summarizes pasture yields and forage utilization on the pastures in the 1961 season. It is apparent that the nitrogen application had very little influence in increasing production on Pasture #1 during the grazing period. There was a difference in appearance in the pastures, the fertilized crested wheatgrass being a darker green, but actual production was not influenced much. The data show that during the grazing period, the fertilized pasture produced 884 pounds of forage per acre (dry weight), while the unfertilized pasture produced 852 pounds per acre. Crested-alfalfa Pasture #2 produced 812 pounds per acre, and the crested-alfalfa Pasture #4 produced 958 pounds of forage per acre. There is not much alfalfa left in the crested-alfalfa pastures, and what is present made very poor growth in the 1961 season.

There were appreciable differences in the degree of utilization on the various pastures. Pastures #1 and #2 were heavily utilized, Pasture #2 being especially so, with only 27 pounds per acre of grazable forage left on the ground. Pastures #3 and #4 were somewhat less heavily utilized than the other two.

Table 16. Forage Produced and Forage Utilized on Pastures by Yearling Steers in the Spring Grazing Trial in the 1961 Season.				
Pasture No.	Pasture Type	Forage produced - lbs./acre (dry-weight)	Forage utilized- lbs./acre (dry-weight)	Forage left on ground- lbs./acre (dry-weight)
1	Crested Wheatgrass*	884	748	136
3	Crested Wheatgrass	852	647	205
	Average 1 & 3	868	697	171
2	Crested-Alfalfa	812	785	27
4	Crested-Alfalfa	958	725	233
	Average 2 & 4	885	755	130
*50 pounds of nitrogen applied per acre to Pasture 1 on April 10, 1961.				

Table 17 summarizes the data on yield and forage consumption on the pastures for the seven-year period of the study. The forage data from fertilized Pasture #1 are not included in the summary for 1960 and 1961. Thus the data of the table represent the averages for straight crested wheatgrass pastures and for crested-alfalfa pastures. It is apparent from these data that, despite the dry season, crested wheatgrass produced quite well. The season's production of 852 pounds of forage per acre compares favorably with the seven-year average production of 933 pounds per acre for straight crested wheatgrass. The production in 1956 of 743 pounds per acre was less than the production of straight crested in the 1961 season.

Production on the crested-alfalfa pastures, however, was the lowest this season for the seven-year period. The average production for the two crested-alfalfa pastures of 885 pounds per acre was appreciably less than the seven-year average yield of 1,166 pounds per acre. This low production is primarily a reflection of the drought situation, but is in part related to the decreasing importance of alfalfa in the mixtures.

Pasture Nos.	Pasture Type	Year	Forage produced- lbs./acre (dry-weight)	Forage utilized- lbs./acre (dry-weight)	Forage left on ground- lbs./acre (dry-weight)
1 & 3	Crested Wheatgrass	1955	962	817	145
1 & 3	Crested Wheatgrass	1956	743	556	187
1 & 3	Crested Wheatgrass	1957	1046	827	219
1 & 3	Crested Wheatgrass	1958	902	756	146
1 & 3	Crested Wheatgrass	1959	1046	713	333
3*	Crested Wheatgrass	1960	981	821	160
3*	Crested Wheatgrass	1961	852	647	205
	7-Year Average		933	734	199
2 & 4	Crested-Alfalfa	1955	1429	969	460
2 & 4	Crested-Alfalfa	1956	1020	756	264
2 & 4	Crested-Alfalfa	1957	1415	1231	184
2 & 4	Crested-Alfalfa	1958	1102	930	172
2 & 4	Crested-Alfalfa	1959	1110	870	240
2 & 4	Crested-Alfalfa	1960	1200	1055	145
2 & 4	Crested-Alfalfa	1961	885	755	130
	7-Year Average		1166	938	228

Table 18 gives the animal data obtained on the pastures during the 1961 season. The average seasonal gains per head were slightly better on crested wheatgrass Pasture #3 than on any of the other pastures. The seasonal gain per head here was 111 pounds. On fertilized crested wheatgrass the seasonal gain was 107 pounds; on crested-alfalfa Pasture #2, 82 pounds; and on crested-alfalfa Pasture #3, 103 pounds. The gains per acre this year were 107.0 pounds on fertilized crested, 82.2 pounds on straight crested wheatgrass, 82.0 pounds

on crested-alfalfa Pasture #2, and 103.0 pounds on crested-alfalfa Pasture #4. The fertilized crested wheatgrass pasture thus produced the greatest gain per acre, although this gain was only slightly better than the gain per acre on the best crested-alfalfa pasture.

Table 18. Performance of Yearling Steers on Crested Wheatgrass and Crested Wheatgrass-Alfalfa Pastures During Spring Grazing Period from May 4 to June 21, 1961. (Weights and gains in lbs.)

Pasture No.	Pasture Type	No. of Steers	Acres per Pasture	Days on Pasture	Avg. initial wt./steer	Avg. final wt./steer	Avg. seasonal gain/head	Avg. daily gain/head	Gain per acre
1	Crested Whtgr.*	8	8	48	516	623	107	2.23	107.0
3	Crested Whtgr.	6	8	48	525	636	111	2.31	83.2
2	Crested-Alfalfa	8	8	48	514	596	82	1.71	82.0
4	Crested-Alfalfa	8	8	48	515	618	103	2.15	103.0

*Pasture #1 fertilized with 50 pounds nitrogen per acre.

Table 19 summarizes the animal data obtained on the pastures during the seven-year period of the study. Data from fertilized Pasture #1 are not included in this summary. The seven-year averages clearly show the superiority of the crested-alfalfa pastures over the straight crested wheatgrass pastures in the production of pounds of beef per acre. It should be pointed out that as the trial has proceeded and the alfalfa has become less vigorous in the mixture pastures, the differences in production between the crested wheatgrass and the crested wheatgrass-alfalfa pastures have become much less. However, over the seven-year period of the trial, the crested wheatgrass-alfalfa pastures have produced an average of 32.5 per cent more beef per acre than the straight crested wheatgrass pastures.

Table 19. Seven-Year Summary of Weights and Gains of Yearling Steers on Crested Wheatgrass and Crested Wheatgrass-alfalfa Pastures, 1955-1961.

Pasture No.	Pasture Type	Year	No. Steers on Pasture	Days on Pasture	Avg. Initial Wt. Per Steer Lbs.	Avg. Final Wt. Per Steer Lbs.	Avg. Seasonal Gain Per Head Lbs.	Avg. Daily Gain Per Head Lbs.	Gain Per Acre Lbs.
-------------	--------------	------	-----------------------	-----------------	---------------------------------	-------------------------------	----------------------------------	-------------------------------	--------------------

1 & 3	Crested Wheatgrass	1955	7	51	494	568	74	1.44	64.3
1 & 3	Crested Wheatgrass	1956	6	45	520	601	81	1.79	60.3
1 & 3	Crested Wheatgrass	1957	6	60	478	622	144	2.40	107.7
1 & 3	Crested Wheatgrass	1958	6	63	555	680	127	2.02	95.3
1 & 3	Crested Wheatgrass	1959	6	52	528	666	138	2.64	103.2
3*	Crested Wheatgrass	1960	6	73	523	658	135	1.85	101.2
3*	Crested Wheatgrass	1961	6	48	525	636	111	2.31	83.1
	7-Year Average		6	56	518	633	115	2.06	87.9
2 & 4	Crested-Alfalfa	1955	7	51	494	600	106	2.06	92.2
2 & 4	Crested-Alfalfa	1956	8	45	520	616	96	2.14	96.3
2 & 4	Crested-Alfalfa	1957	9	60	498	639	141	2.35	158.1
2 & 4	Crested-Alfalfa	1958	8	63	550	682	132	2.10	132.0
2 & 4	Crested-Alfalfa	1959	8	52	523	636	113	2.17	112.5
2 & 4	Crested-Alfalfa	1960	8	73	521	658	137	1.88	137.0
2 & 4	Crested-Alfalfa	1961	8	48	514	608	94	1.96	94.0
	7-Year Average		8	56	517	634	117	2.09	117.4

*Pasture #1 not included because of fertilizer treatment.

Table 20 contrasts forage production and beef gains per acre for the last three years on straight crested wheatgrass, on crested-alfalfa, and on crested wheatgrass fertilized with 50 pounds of nitrogen per acre. These data show that on the average for the three-year period fertilized crested wheatgrass has produced about 26 per cent more forage than straight crested wheatgrass, and about 10 per cent more than crested and alfalfa. Beef production per acre on fertilized crested has averaged about 41 per cent more than on straight crested, and about 18 per cent more than crested and alfalfa.

The increase in forage production would not pay for the cost of the fertilizer, with forage figured at one cent per pound and fertilizer at ten cents per pound. However, the extra beef produced, figured at 20 cents per pound, would be substantially profitable as between straight crested and fertilized crested. Comparing increased beef production between fertilized crested and crested-alfalfa pastures the return would be near the break-even point. From the results obtained so far, it would appear that substantial increases in beef production are possible through the use of nitrogen on crested wheatgrass pasture, but in the long run the lower costs involved in using crested wheatgrass-alfalfa pasture may prove more profitable.

Table 20. Forage Production and Gains Per Acre on Spring Grazing Trial Pastures of Crested Wheatgrass, Crested Wheatgrass and Alfalfa, and Crested Wheatgrass plus 50 Pounds of Nitrogen.

Pasture Type	Year	Forage Production-Lbs./acre	Gain Per Acre Lbs.
Crested Wheatgrass	1959	940	103.2
Crested Wheatgrass	1960	981	101.2
Crested Wheatgrass	1961	852	83.1
3-Year Average		924	95.8
Crested and Alfalfa	1959	1110	112.5
Crested and Alfalfa	1960	1200	137.0
Crested and Alfalfa	1961	885	94.0
3-Year Average		1065	114.5
Crested + 50 Lbs. N	1959	1153	133.0
Crested + 50 Lbs. N	1960	1476	165.0
Crested + 50 Lbs. N	1961	884	106.9
3-Year Average		1171	135.0

NEW PASTURE SEEDING

A new pasture trial to compare the value of straight crested wheatgrass, crested wheatgrass and alfalfa, and crested wheatgrass with nitrogen fertilizer was begun in the fall of 1961. Nordan crested wheatgrass was seeded on a 48-acre piece of land directly east across the road from the present spring grazing trial. Duplicate crested wheatgrass, crested wheatgrass and alfalfa, and fertilized crested wheatgrass pastures will be established on this seeding. The alfalfa for the mixture pastures will be seeded in the spring of 1962. It is hoped that

grazing can be started on these pastures in the spring of 1963.

In addition, land was selected for a new trial on summer grazing using Russian wildrye and Lincoln brome pastures. The land will be uniformly cropped this year in preparation for a pasture seeding, probably to be made in the fall of 1963.

PERSONAL ACTIVITIES

Correspondence: Twenty-seven letters were written in the conduct of business relating to the Dickinson Station.

Radio Programs and TV Shows:

Radio Programs	
April 19, 1961	Fertilizing Grass (recording)
May 19, 1961	Pasture Fertilization
June 8, 1961	Time of Cutting Hay
July 13, 1961	Varieties of Crested Wheatgrass
August 17, 1961	Poisonous Plants
October 5, 1961	Grass Yields (recording)

TV Programs	
February 22, 1961	TV Short Course (WDAY)

Public Meetings:

Date	Meeting	Attendance	Participation
2/27/61	Kiwanis Farmers' Night, Dickinson	80	50 minutes on grassland agriculture
5/15/61	Livestock Feeders' Committee	25	Discussion
7/12/61	Dickinson Crops Field Day	250	Half-day of tours
7/18/61	4-H Camp Field Trip	56	Half-day plant identification
7/19/61	Dickinson State Teachers College Conservation Class	35	50 minutes on grassland agriculture

10/28/61	Federal Land Bank Assoc., Mandan	36	Grassland values
10/29/61	Federal Land Bank Assoc., Napoleon	19	Grassland values
11/21/61	North Dakota Crop Imp. Conference, Jamestown	200	Grassland potentials
12/6/61	Livestock Research Roundup	1350	Tour and 15 minutes on grasses
12/16/61	Burleigh County Crop Imp. Association	60	Pasture in the feeding program

Scientific Conferences:

Date	Meeting	Attendance	Participation
1/31 - 2-3-61	American Society of Range Management, Salt Lake City, Utah	800	Attended sessions
2/16-17/61	GP-6 Range Research Committee, Denver, Colorado	16	Preparing range project
3/9/61	Weather Bureau Conference	15	Discussion of frost occurrence data
5/5-6/61	North Dakota Academy of Science, Grand Forks	70	15-minute paper on grassland micro-climate
7/13-15/61	America Society of Range Management, Northern Plains Section, Maple Creek, Saskatchewan	85	Range field trip
8/10/61	Great Plains Range Weed Committee, Omaha, Nebraska	17	Helped prepare weed project
8/27-30/61	Ecological Society of America, Purdue University, Indiana	220	Attended symposium on climate and plant growth

Publications:

Whitman, W. C., D. Petersen, and T. J. Conlon. 1961. Results of Clipping Trials with Cool-Season Grasses; North Dakota Farm Research 22: 9-14.