

Summer Gains of Yearling Hereford Steers on Native and Cultivated Pastures¹

By GEORGE A. ROGLER²

THE 1943 season marked the 28th year of the long time grazing experiment at the Northern Great Plains Field Station, Mandan, N. Dak.

Procedures used, results obtained, and description of the vegetation during the first 25 years of these investigations (1916-40) were thoroughly summarized and discussed in North Dakota Agricultural Experiment Station Bulletin 308³. The present discussion will be limited primarily to the results obtained during the last 3 years of the experiment from 1941 to 1943. The reader is asked to refer to Bulletin 308 for comparisons of gains shown here with those made in previous years and for details in connection with the grazing experiment.

During the first 20 years from 1916 to 1935, two-year-old steers were used and during the 8 years from 1936 to 1943, yearling steers were used. For the five-year period 1936 to 1940 the yearling steers were grazed on the native pastures at the same acre-rate as the two-year-old steers were grazed. It was apparent by 1940 that yearlings were consuming about 30 percent less forage than an equal number of two-year-olds would consume under the same conditions. In 1941 the number of yearlings was increased by 30 percent in each native grass pasture. In most cases this was an increase from the usual 10 steers per pasture to 13 steers per pasture.

Climatic conditions at Mandan were favorable for the growth of grass during the entire period yearling steers were used, except for the extremely dry year of 1936. Precip-

itation for the years 1941, 1942, and 1943, was especially high, being well above the 69-year average as shown in Table 1. The annual precipitation of 21.15 inches in 1943 was the highest since 1915 and resulted in one of the most luxuriant growths of grass, and highest gains per head, since the beginning of the experiment.

GAINS ON NATIVE PASTURES

Gains made on each of the pastures and the amount of foliage covering remaining at the end of the grazing season are shown in Table 2. Without exception the average seasonal gain per head on each pasture for the 1941-43 period was above the 1936-40 average even though a 30 percent higher intensity of grazing was used during the last three years.

The fact that the steers on the 100-acre pasture grazed at 7.69 acres

¹Cooperative investigations between the Divisions of Dry-Land Agriculture and Forage Crops and Diseases, Bureau of Plant Industry, Soils, & Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, and North Dakota Agricultural Experiment Station. The experiments reported here were conducted at the Northern Great Plains Field Station at Mandan, North Dakota.

²Associate Agronomist, Divisions of Dry-Land Agriculture and Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering.

³Grazing Investigations on the Northern Great Plains by J. T. Sarvis, Associate Agronomist, Bureau of Plant Industry.

**Table 1—Monthly, seasonal, and annual precipitation at the Northern Great Plains Field Station.
(Data in inches. T - Trace)**

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Seasonal Apr.-Sept.	Annual
1940.....	.03	.45	.93	4.24	1.20	1.95	2.73	.25	1.28	1.69	.98	.41	11.65	16.14
1941.....	.31	.22	1.00	1.57	1.95	5.72	1.10	2.36	4.16	.90	.27	.16	16.86	19.72
1942.....	T	.47	.79	3.15	2.30	2.44	3.10	1.30	2.33	.69	.04	.46	14.62	17.07
1943.....	1.17	.55	1.67	.87	1.95	7.67	1.56	3.20	.16	1.56	.60	.19	15.39	21.15
Average:														
1936-40..	.54	.67	.72	1.56	1.38	3.16	1.83	1.01	1.11	.61	.59	.35	10.04	13.53
1940-43..	.48	.32	1.10	2.46	1.85	4.45	2.12	1.78	1.98	1.21	.47	.31	14.63	18.52
1875-1943	.46	.46	.91	1.60	2.30	3.42	2.30	1.73	1.32	.94	.57	.51	12.67	16.52

Table 2—Gains of yearling Hereford steers and estimated percentage of foliage cover not grazed, under various rates of grazing native pasture, Northern Great Plains Field Station, Mandan, N. Dak.

Year	Gain or loss per head (pounds)							Gain per acre (lbs.)	Total days ¹ grazed	No. of steers	Acres per head	Estimated percentage of foliage cover not grazed	
	May	June	July	Aug.	Sept.	Oct.	Season						
100-Acre Pasture													
1941.....	26.9	85.4	67.7	43.5	40.4	— 9.6	254.2	1.95	33.1	130	13	7.69	45
1942.....	39.6	69.6	70.8	68.1	11.2	9.2	268.4	1.80	34.9	150	13	7.69	70
1943.....	51.5	72.3	70.4	53.8	63.5	— 0.8	310.8	2.00	40.4	155	13	7.69	75
Average													
1941-1943..	39.4	75.8	69.6	55.1	38.3	— 0.4	277.8	1.92	36.1	145	13	7.69	63
1936-1940..	47.6	68.1	52.0	47.6	29.8	14.5	250.7	1.83	25.1	137	10	10.00	50
1936-1943..	44.0	71.5	59.7	50.9	34.0	7.3	262.6	1.88	29.2	140	..	....	55
70-Acre Pasture													
1941.....	27.3	85.8	51.9	64.6	40.4	—17.7	252.3	1.94	46.9	130	13	5.38	40
1942.....	44.6	81.5	50.4	43.1	17.3	10.0	246.9	1.65	45.8	150	13	5.38	65
1943.....	42.3	75.4	71.2	56.9	32.3	5.0	283.1	1.83	52.5	155	13	5.38	60

Average													
1941-1943..	38.1	80.9	57.8	54.9	30.0	— 0.9	260.8	1.80	48.4	145	13	5.38	55
1936-1940..	44.0	70.6	47.8	57.0	27.0	7.9	247.3	1.81	35.3	137	10	7.00	36
1936-1943..	41.4	75.1	52.2	56.1	28.5	3.5	253.2	1.81	40.2	140	...	....	43
50-Acre Pasture													
1941.....	23.8	90.4	50.4	60.0	26.9	— 5.0	246.5	1.90	64.1	130	13	3.85	20
1942.....	48.8	72.7	69.6	38.5	8.8	— 1.5	236.9	1.58	61.6	150	13	3.85	35
1943.....	46.2	66.9	78.5	52.3	39.6	11.2	294.6	1.90	76.6	155	13	3.85	30
Average													
1941-1943..	39.6	76.7	66.2	50.3	25.1	1.5	259.4	1.79	67.4	145	13	3.85	28
1936-1940..	50.5	70.5	43.9	42.5	22.5	— 1.7	224.1	1.65	44.8	136	10	5.00	29
1936-1943..	45.1	73.5	54.9	46.3	24.0	— 0.8	241.5	1.73	54.5	140	..	....	29
23.1-Acre Pasture ²													
1941.....	26.5	85.0	46.0	58.0	21.5	— 1.5	235.5	1.81	101.9	130	10	2.31	10
1942.....	38.5	68.5	48.5	32.0	12.0	8.0	207.5	1.38	89.8	150	10	2.31	10
1943.....	47.5	64.0	76.5	66.0	28.5	— 8.0	274.5	1.77	118.8	155	10	2.31	10
Average													
1941-1943..	37.5	72.5	57.0	52.0	20.7	— 0.5	239.2	1.65	103.5	145	10	2.31	10
1936-1940..	49.5	73.4	42.6	45.5	19.0	3.5	227.9	1.68	76.0	136	10	3.00	14
1936-1943..	44.4	73.0	48.7	48.3	19.8	1.5	232.7	1.66	86.1	140	..	....	12
50-Acre Rotation Pasture ²													
1941.....	24.2	87.3	64.6	40.0	15.8	— 1.2	230.8	1.78	60.0	130	13	3.85	32
1942.....	43.5	51.9	48.1	47.3	14.6	10.0	215.4	1.44	56.0	150	13	3.85	43
1943.....	46.9	63.1	72.3	73.5	28.1	— 8.5	275.4	1.78	71.6	155	13	3.85	40
Average													
1941-1943..	38.2	67.4	61.7	53.6	19.5	0.1	240.5	1.66	62.5	145	13	3.85	38
1936-1940..	43.0	70.2	39.5	39.2	20.0	4.7	212.1	1.55	42.4	137	14	5.00	31
1936-1943..	41.6	69.2	47.4	44.4	19.8	2.8	222.3	1.59	48.5	140	..	....	34

¹Average days grazed during monthly periods 1936-43; May (19), June (30) Aug. (30), Sept. (30), Oct. (13).

²This pasture contained 30 acres from 1916-1940, inclusive.

³This pasture contained 70 acres from 1918-1940, inclusive.

per head gained more than those on the 70-acre pasture grazed at 5.38 acres per head cannot be explained on the basis of difference in available feed. Sufficient grass was available at all times in the 70-acre pasture to produce maximum gains, with an average of 55 percent of the foliage cover being left at the close of the grazing seasons for the 1941-43 period. The only explanation offered for the lower gains in the 70-acre pasture is that the steers spent considerable time grazing highly palatable big bluestem in a swale running through the pasture when they would have obtained a larger volume of grass by grazing a greater area. The big bluestem was kept closely grazed at all times. Water facilities also were not quite so conducive to uniform grazing in the 70-acre as in the 100-acre pasture.

Average gains on the 50-acre pasture grazed at 3.58 acres per head were lower for the 1936-40 period than those on the 70-acre pasture, but practically the same as those on the 70-acre pasture for the 1941-43 period. From the amount of foliage cover remaining at the end of each season it did not appear that a rate of 3.58 acres per head would be high enough to give maximum gains over a series of years including some dry seasons, without detrimental effect to the vegetation.

The 23.1-acre pasture was originally the 30-acre pasture. Instead of increasing the number of yearlings on this pasture by three in 1941, the size of the pasture was reduced approximately 30 percent to increase the intensity of grazing. Gains on this pasture grazed with one steer to 2.31 acres were less than on any of the continuously grazed native pastures. Sufficient grass was available to carry the steers the entire season during each year from 1938 to 1943, but only in 1943 was there enough forage to

put on high gains. These gains were not as high, however, as those on the more lightly grazed pastures even during the favorable season of 1943. In 1943 precipitation was high and well distributed. This kept new grass coming all the time. Since new grass is high in nutrients, good gains were produced. Even during good years, too great a percentage of the forage was removed to allow a high enough carryover of old grass. Such close grazing was also injurious to the vegetation. In years of lower rainfall 2.31 acres per head would not be enough to carry yearling steers the full season without serious loss in weight. In the past, injury to vegetation grazed at a high intensity has been more severe during dry years than during wet years.

In 1941, the 70-acre deferred and rotation pasture was re-arranged and reduced in size to 50 acres and then divided into three equal parts. The steers allotted to this pasture were grazed on each division at different periods during the season in the manner shown in Bulletin 308. The grass in one division was allowed to come to maturity for two successive years before it was grazed in the fall of each year. Each division was grazed approximately one-third of the season depending upon the vegetative growth. During the time two-year-old steers were pastured under the deferred and rotation system at the rate of 5 acres per head, gains were higher than under a system of continuous grazing at the same rate. There was also less injury to the vegetation. For some reason however, yearling steers have not done as well under deferred and rotation grazing as when grazed continuously at the same rate, even though utilization of the vegetation was not as high with rotation grazing. It is possible that yearlings are more

reluctant to graze the mature forage in the summer-and-fall-grazed divisions, and that they are not as capable of assimilating the mature forage they do graze as are two-year-old steers. It must be remembered that no comparisons between continuous and rotation grazing have been made with yearlings during dry years. The gains made under deferred and rotation grazing might be higher in comparison during such years. The period in which yearling steers have been used is not long enough to arrive at definite conclusions.

It would appear from a study of gains, rate of grazing and vegetative conditions during the last 3 years compared with those during the previous 20 years that on good native range land in the northern Plains with climatic conditions similar to those at the Northern Great Plains Field Station, an average rate of 5.5 acres to one yearling steer for a period from approximately May 16 to October 15 is sufficient to give near maximum gains. At this rate, the vegetation will not be injured and sufficient forage carryover will remain at the end of most grazing seasons.

Gains on Cultivated Pastures

The use of cultivated pastures has increased rapidly in the northern plains during the last 10 years, but their value for use as a supplement to native pastures or in combination with native pasture is not fully realized. Information that has been obtained on the grazing of cultivated pastures along with native pastures would indicate that this system of grazing, which provides a longer grazing season with production of more beef on less acres could well be expanded in this region.

The first cultivated pasture used in the grazing experiment was

planted to bromegrass in 1921. This pasture was grazed each year until the grass was killed by the 1934 drought. Sweetclover was pastured from 1926 to 1928. One crested wheatgrass pasture was established in 1932 and another in 1935. In 1938 a mixed grass pasture was seeded with a seed mixture of 4 pounds crested wheatgrass, 1.5 pounds bromegrass, 1 pound slender wheatgrass, and 0.5 pound Russian wild-rye, (rates per acre). All species in the mixture were established in somewhat the same proportion as they were planted. A palatability pasture consisting of plots of many species and strains was also established in 1938. The last cultivated pasture to be established was that of Russian wild-rye in 1941.

Gains made by yearling steers on cultivated pastures and on a combination of these and native pastures are shown in Table 3 for the period 1940 to 1943. In 1940 gains on the 1932-planted crested wheatgrass pasture grazed continuously the entire season, were compared with gains made on a combination of cultivated pasture (grazed spring and early summer) and native pasture. Gains on continuously crested wheatgrass began to decline in July and continued to be lower the rest of the season than gains of the steers that had been transferred to native pasture the latter part of the season. The same type of trial was carried on in 1941 and 1942, with a still greater advantage in gain being shown for cultivated and native pasture grazed in combination, over continuously grazed crested wheatgrass. In 1942 a difference of as much as 90 pounds per head gain was shown in favor of the cultivated-native system of grazing over straight crested wheatgrass. The steers on crested wheatgrass from May 15 to July 15 grazed at 1.5 acres per head and on native grass

Table 3—Gains of yearling Hereford steers on cultivated grass pastures (single species, mixtures, in rotation, and in combination with native pastures), Northern Great Plains Field Station, Mandan, N. Dak.

Kind of Cultivated Pasture	Year planted	Gain or loss per head (pounds) ¹							Date grazing started	Date grazing stopped	No. of days grazed	Gain per head	No. of steers	Acres per head	No. of days grazed	Gain per head	Total seasonal gain per head (lbs.)
		May	June	July	Aug.	Sept.	Oct.										
Cultivated pasture																	
Native pasture																	
—————1940—————																	
Crested wheatgrass.	1932	71.3	98.8	27.5	25.0	-6.2	-11.2	5-16	10-13	150	205.0	4	1.75	0	....	205.0
Crested wheatgrass.	1935	64.6	77.5	37.1	44.6	30.8	-10.8	5-16	7-15	60	175.4	12	1.04	90	68.3	243.7	
Mixed.....	1938	60.5	83.0	35.5	34.5	35.5	8.5	5-16	7-30	75	179.0	10	0.63	75	78.5	257.5	
—————1941—————																	
Crested wheatgrass.	1932	26.3	85.0	40.0	27.5	15.0	-7.5	5-26	10-3	130	186.3	4	1.50	0	....	186.3
Crested wheatgrass.	1935	20.0	76.3	47.6	67.5	20.0	-22.5	5-26	6-30	35	96.3	4	1.50	95	112.5	208.8	
Mixed.....	1938	20.0	96.3	33.8	55.0	50.0	-3.8	5-26	7-30	80 ²	166.2	4	1.50	50	85.0	251.2	
—————1942—————																	
Crested wheatgrass.	1932	56.3	78.8	31.3	16.3	13.8	-10.0	5-16	10-13	150	186.3	4	1.50	0	.....	186.3
Crested wheatgrass.	1935	51.3	75.0	43.8	63.8	33.8	8.8	5-16	7-15	60	143.8	4	1.50	90	132.5	276.3	
Mixed.....	1938	57.5	80.0	26.3	50.0	30.0	17.5	5-16	7-15	60	141.2	4	1.50	90	120.0	261.2	
—————1943—————																	
Crested wheatgrass ³ .	1935	46.3	83.8	55.0	31.3	41.3	-6.3	5-11	10-13	155	251.3	4	2.70	0	.....	251.3
Rotation ⁴		44.4	78.8	46.9	58.8	65.6	18.8	5-11	7-30	80	170.0	8	1.34	75	143.1	313.1	
Russian wild-rye....	1941	37.5	90.0	95.0	57.5	46.3	1.3	5-11	9-28	140	326.3	4	1.50	15	1.3	327.6	

¹July gains on 1935 crested wheatgrass pasture in 1940 and on 1935 crested wheatgrass and mixed pastures in 1942 were made on both cultivated and native pasture.

²This pasture was grazed from May 26 to June 30 (65 days) and from Sept. 18 to Oct. 3 (15 days).

³This pasture of 6 acres was grazed continuously for 80 days and then in addition was supplemented by a 10-acre previously grazed mixed pasture for 75 days.

⁴Steers changed back and forth twice between a 6-A. mixed pasture and 6-A. crested wheatgrass pasture during first 80 days¹ on native pasture remainder of season.

the remainder of the season made as high gains in 1942 as the steers on the 100-acre native pasture grazed at the rate of 7.69 acres per head.

A system of rotation grazing was used on cultivated pastures in 1943. Steers were changed back and forth twice on two pastures, the mixed pasture and 1932 crested wheatgrass pasture, during the period from May 11 to July 30. The remainder of the season, they were on native pasture. This rotating was done to try to extend the grazing season on cultivated pasture by not allowing the grass to mature. One pasture was grazed down closely, and the steers were then transferred to another pasture. By the time the second pasture was grazed down, enough recovery had been made in the first pasture so that it could be grazed again. No great advantage was found in the rotation grazing of crested wheatgrass in the one-year trial. Subsequent trials with this and other species may prove rotation grazing on cultivated grass to be profitable.

Total seasonal gains on continuously grazed crested wheatgrass pasture were low in 1943 in comparison with gains made on other pastures and combinations of pastures. This was true in spite of the fact that the steers on this pasture were also allowed access to an additional acreage of mixed pasture after July 30. It is evident that crested wheatgrass does not make much recovery after about the last of June or early July. Steers have not made good gains on mature crested wheatgrass, therefore regardless of the system of grazing crested wheatgrass, native grass pasture must be provided from the latter part of June or early July until the end of the season if maximum gains are to be made.

The Russian wild-rye pasture was grazed for the first time in 1943.

This grass has the ability to recover rapidly after defoliation if sufficient moisture is available. Since precipitation was high during the grazing season, a large amount of new growth was available for grazing until the last of September. Gains on this pasture were extremely high, even though the steers were allowed only an average of 1.5 acres per head. A small amount of sweetclover was present in this pasture during June and July and may have helped to hold up the gains during these two months. In spite of the fact that this was a new pasture with the usual high production the first year, the gain of 327.5 pounds per head would indicate the potential possibilities of Russian wild-rye as a pasture grass. The 327.5 pounds gain per head represented an increase in weight of 70.4 percent above the 465 pounds average weight of the steers at the beginning of the grazing season. Recommendations cannot be made on the basis of a one-year trial. Further investigations will be carried on in subsequent years.

Palatability Studies

Studies on the relative palatabilities of grasses under cultivation have been carried on since 1939. The information that has been obtained will serve as a guide to the proper composition of mixtures, and to the management of mixed stands. Palatabilities or preferences in themselves are sometimes misleading. Cattle will show preference for certain grasses if they have a chance for selection, but if restricted to a more or less unpalatable grass, they will ordinarily do as well as those restricted to a more palatable one, providing of course, that both are of equal nutritive value and productivity. On the other hand, palatability studies are useful in determining when certain

grasses become palatable or unpalatable and give indication of what might be expected when certain combinations of grasses are used together in mixtures. A detailed report on these investigations has been

published in the Journal of the American Society of Agronomy. Vol. 36, No. 6, June 1944 "Relative Palatabilities of Grasses Under Cultivation on the Northern Great Plains" by George A. Rogler.

Agencies Cooperating

(Continued from Page 14)

U. S. D. A. Mr. Smith gives special attention to cereal breeding, testing of cereal varieties, corn, and forage crop varieties.

Stationed at Mandan

Cooperative relationships are maintained with the Northern Great Plains Field Station of the Office of Dry Land Agriculture, Bureau of Plant Industry, Soils, and Agricultural Engineering along all lines. Much of the work accomplished by the Mandan Station has been published by the North Dakota Agricultural Experiment Station — this includes their work on crop rotations, forestry, grazing, grasses, etc. Special mention should be made of the long-time cooperative trials with this Station on the grazing of native and cultivated pastures, the latest results which are reviewed in this issue of the Bimonthly Bulletin. The following Mandan workers are cooperating closely with this Station:

Other research agencies which are cooperating with the Station include the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, United States Department of Agriculture, which in addition to assigning staff members to residence at Fargo or elsewhere in the State, makes a special grant for certain phases of wheat breeding. Other United States Department of Agriculture bureaus with which there is at present active cooperation include the Bureau of Agricultural Economics, the Bureau of Entomology and Plant Quarantine, the Bureau of Agricultural and Industrial Chemistry, the Bureau of Animal Industry, the Bureau of Dairy Industry, and the Bureau of Home Economics and Nutrition, all of the United States Department of Agriculture.

Within the State the Station is actively cooperating with the North Dakota Research Foundation, the Walsh County Agricultural and Training School, the State Water Conservation Commission, the State Mill and Elevator, and the State Department of Agriculture and Labor, and the State Pure Seed Commission. The Station stands ready to cooperate with all state, federal, and private agencies and persons subject only to the limitation of the size of its personnel and the availability of funds.

Special mention should be made of the constant field cooperation within the Extension Service of the College, a field area of the institution through which the researches of the Station are brought to the attention of the farmers. Finally the director desires to express his appreciation of the time put in by hundreds of North Dakota farmers and ranchers who have run test plots, and made valuable observations. Farm organizations and commercial organizations have all helped get out the facts about the work of the Station this cooperation is gratefully acknowledged.

With Office of Dry Land Agriculture

J. M. Stephens, Superintendent and Principal Agriculturist.

John C. Thysell, Associate Agronomist.

Ernest J. George, Assistant Superintendent and in charge of Forestry investigations.

William P. Baird, Associate Horticulturist.

Howard J. Haas, Assistant Agronomist.

With Division of Forage Crops & Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering

George A. Rogler, Associate Agronomist.

With Division of Cereal Crops and Diseases

Dr. Roderick Sprague, Plant Pathologist.

With Division of Dairy Cattle Breeding, Feeding and Management

A. L. Watt, Assistant Dairy Husbandry Superintendent.

H. L. WALSTER, Director.