Long-time Yield Record, Tillage and Rotation Experiments at the Dickinson Substation

By LEROY MOOMAW, Superintendent, Dickinson Substation

THE accompanying table of crop yields at the Dickinson Substation for the years 1907-40 is the longest continuous record of crop yields available at any branch experiment station in North Dakota and, with one or two exceptions, is longer than any record in the Great Plains area of the United States. The yields reported are from results of cooperative work of the Division of Dry Land Agriculture, Bureau of Plant Industry, U. S. Department of Agriculture, and the North Dakota Agricultural Experiment Station. Tillage and rotation experiments of the Division of Dry Land Agriculture were started in 1907 although the station was established two years earlier.

ANNUAL PRECIPITATION AND AVERAGE ANNUAL, 8-YEAR AVERAGES, AND 34-YEAR AVERAGE YIELDS OF WHEAT, OATS, BARLEY, EAR CORN, AND CORN FODDER (GRAIN AND STOVER) ON THE TILLAGE AND ROTATION EXPERIMENTS, DIVISION OF DRY LAND AGRICULTURE, DICKINSON SUBSTATION, DICKINSON, N. DAK., 1907-40.

Year	Precipitation	Wheat	Oats	Barley	Corn, grain	Corn, fodder
	(inches)	(bus.)	(bus.)	(bus.)	(bus.)	(pounds)
1907	13.67	31.8	46.8	40.2	0.0	1,470
1908	19.48	30.0	53.3	33.5	0.0	2,535
1909	20.99	36.0	67.8	46.4	50.0	5,815
1910	13.34	21.7	35.4	26.4	22.0	3,506
1911	15.62	5.9	8.9	8.9	0.0	4,070
1912	19.06	H	H	H	H	H
1913	11.93	25.9	55.6	31.2	27.6	3,589
1914	22.74	15.4	24.5	26.6	19.0	2,980
1915	19.75	37.0	93.4	57.0	0.0	3,330
1916	18.40	23.3	67.2	30.1	17.8	4,358
1917	9.25	12.6	17.9	7.7	0.0	1,316
1918	12.36	9.3	7.9	3.7	0.0	3,320
1919	8.37	3.8	3.0	1.2	9.7	2,074
1920	15.81	19.2	38.7	25.6	14.3	4,958
1921	15.76	5.8	11.0	4.4	9.0	3,154
1922	18.20	30.0	73.0	43.6	25.3	4,963
1923	19.67	18.1	45.9	27.9	48.5	7,535
1924	15.13	21.7	60.5	24.6	28.4	5,228
1925	12.19	15.0	28.3	9.3	18.3	3,333
1926	13.11	4.4	6.2	1.4	2.3	1,807
1927	19.62	20.5	52.9	32.2	40.5	6,165
1928	15.30	25.3	65.0	30.8	34.6	4,893
1929	17.21	14.1	25.2	9.1	19.6	2,920
1930	13.79	16.8	34.1	20.4	7.9	2,029
1931	16.17	4.8	2.7	1.4	16.9	3,885
1932	17.24	20.4	40.2	31.7	31.2	4,147
1933	11.50	11.6	17.3	8.6	2.6	2,170
1934	7.91	3.6	11.6	5.6	1.1	740
1935	15.00	10.4	19.3	17.8	11.0	3,061
1936	6.72	0.0	0.0	0.0	0.0	0
1937	16.28	7.5	6.7	6.8	0.0	2,023
1938	16.65	6.4	14.8	11.4	0.0	2,283
1939	15.75	29.0	65.0	41.9	16.0	3,312
1940	17.12	12.3	26.3	18.4	28.5	4,712
8-year averages						
1907-14	17.10	20.8	36.5	26.7	14.3	2,996
1915-22	14.74	17.6	39.0	21.7	9.5	3,434
1923-30	15.75	17.0	39.8	19.5	25.0	4,238
1931-38	13.43	8.1	14.1	10.4	7.9	2,289
34-yr average						
1907-40	15.33	16.2	33.1	20.2	14.3	3,284

H = Crop destroyed by hail.

Figures given in the table are average yields of wheat, oats, barley, and corn on all plots, including all methods of tillage, for each of the 34 years. The annual precipitation of each year is also given.

Precipitation during this 34-year period is from readings taken at the station and published by the U. S. Weather Bureau. Average precipitation for this period was 15.33 inches. This amount is slightly more than the average of 15.24 inches for the 49-year record which began at Dickinson in 1892.

These records cover the worst years experienced since precipitation records were started. There were no years from 1892 to 1907 which were as dry as either 1917, 1919, 1934, or 1936. On the other hand, there was no period between 1892 and 1905 when, from the records available, crop yields could be expected to average as high as those harvested from 1907 to 1915, inclusive. So it seems these records include years about as good and about as bad as may be expected over a much longer period.

Wheat yields given in the table are the average of 25 plots grown each season. These include plots grown in 3, 4, 5, and 6-year rotations, some on spring plowing, some on fall plowing, some on summer fallow and other tillage methods, and some which have been cropped continuously since 1907. All plots were planted with the same variety and seeded the same day at equal rates of seeding.

The results, therefore, were obtained by both good and poor methods and the yields are no higher than may be expected from timely seeding on a good soil and seedbed on farms in the district. Some farms in the district each season usually report yields which exceed these averages. County average yields, of course, are usually below those reported here.

The average of 31.8 bushels of wheat for 1907 is the average of these 25 plots. The yield of 29.0 bushels in 1939 is for the same number of plots grown 33 years later in the same rotations and on the same tillage methods. The yield of 16.2 bushels at the bottom of the column is the 34-year average of these same plots.

Eight-year averages for each of the crops, shown near the bottom of the table, make interesting comparisons. Wheat averaged 20.8 bushels in the first 8-year term, 1907-14; 17.6 bushels for the second term; 17.0 bushels for the period 1923-30; but only 8.1 bushels during the hazardous period from 1931 to 1938. This period included the droughts of 1931 and 1934, as well as the severe drought of 1936 when all crops were a complete failure. Low yields in 1937 and 1938 were a result of dry weather early in the season of both years, followed by severe grasshopper damage before the crops were mature. Rust and extreme heat were also factors which reduced yields.

Livestock men will be interested in the long-time production records of oats, barley, and corn given in this table. The long average is 33.1 bushels of oats, 20.2 bushels of barley, and 14.8 bushels of ear corn or 3,284 pounds of fodder (grain and stover). Judging from averages for 8-year periods, oats production would seem to be more dependable than wheat. Ear corn production is very erratic but fodder yields are more dependable, having failed completely only in 1936 from drought and in 1912 when all crops were hailed out, with practically a failure in 1934.

Water available to the crop during the growing season is the most important factor in crop production in the area. In the figures given in the table the correlation between precipitation and yields of wheat, oats, and barley is high. With only the annual precipitation given, however, it is not always clear just how much of the precipitation of a year fell during the growing season. In a few years heavy late summer or fall rains have brought the total for the year above average, yet the amount available to the crop during its critical growing period was below average.

High yields of ear corn are not always produced in years of high rainfall. It is true, however, that high yields of corn are not produced unless a good supply of water is available to the plant during the growing season, but an ample supply of water does not insure a good corn yield. A cool late spring which

VIEW OF THE TILLAGE AND ROTATION FIELD

At Dickinson Substation, in 1939, the 33rd year of continuous operation. Right, Pilot wheat on green manure fallow and Gopher Oats on disked corn ground. Results of crop yields on the various tillage methods form the most important phase of this long-time study at Dickinson.

is favorable to small grains retards corn so that it may not yield well. Also a dry spring may delay the germination of corn so that it gets a late start and never produces well. In some seasons, cutworms have been responsible for poor stands and low yields. Occasionally, grasshoppers may eat the silks and foliage and prevent development of the ear. Yet corn is one of the most dependable forage crops and is used on most farms and ranches.

The long periods of drought and low yields like those of 1934 to 1938 show the hazards of any type of farming or ranching in the area. They emphasize the necessity of having strong reserves of feed and the importance of limiting numbers of livestock so that feed in storage in the granary or on the range will be sufficient to carry through more than one bad year.

Considerable satisfaction may be derived from the fact that yields of wheat, oats, and barley in 1939 were nearly double the long-time average of these crops and were not far below the better crops harvested in the earlier years of the station. This indicates that soils in the area which have been handled carefully still have the inherent capacity to produce high yields of crops when soil moisture and other conditions are favorable.

"BOUNTY" TOMATO[1]

PRELIMINARY REPORT AND DESCRIPTION

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"BOUNTY" is an early, determinate-vine tomato variety that bears good yields of well-shaped fruits free from dark green overcolor of the stem end.

Bounty has been developed at the North Dakota Agricultural Experiment Station from a cross between the Allred variety, a Station introduction of 1937, and Break-o'-Day, a variety developed

[1] Assistance in the preparation of this material was furnished by personnel of the Works Progress Administration for North Dakota and by personnel of Student Aid and Resident Projects of the National Youth Administration. The co-operation of Charles, Henry and Robert Peterson in growing large populations of Break-o'-Day x Allred trial material is gratefully acknowledged.