

LONG TERM WHEAT YIELDS ON EACH OF SIX NORTH DAKOTA FARMS

By
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The Farm Credit Administration, Seventh District, has been fortunate in finding six individuals who could furnish year by year records of the yield of spring wheat on their farms for a period of 26 to 56 years. The year by year record of these farms is found in Table 1. These individuals are: F. O. Alin, Fullerton and Henry C. Frojen, Oakes, both in Dickey county; Lawrence L. Lee, Valley City, Barnes county; William Nordman, Noonan, Divide county; the Chris Arnt Estate, Williston, Williams county and Harry Hardy, Sr., Stanley, Mountrail county.

The information is less complete than would be desirable, in that data over the years as to acreage in wheat, cropping systems, varieties, etc. are not available. However, on each farm, wheat was a crop of major importance and cultural practices were similar to those generally followed in the neighborhood except that much more summer fallowing was done on the Nordman farm than was customary in the area.

The record of F. O. Alin, Fullerton, is notable in that it covers the 56 year period, 1893-1948. This includes all the crop years since North Dakota became a state except the first four.

The data are of particular interest in connection with land appraisal and valuation problems as the hazards that confront an individual farmer are indicated much more clearly by yield figures for individual farms than by those for counties or larger areas.

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Table 1—Wheat yields per seeded acre on six individual North Dakota farms.

Year	Southeast counties			Northwest counties		
	F. O. Alin, Dickey Co. bus.	Henry C. Frojen Dickey Co. bus.	Lee Farm Barnes Co. bus.	Wm. Nordman Divide Co. bus.	Arnt Estate Williams Co. bus.	Harry Hardy, Sr. Mountrail Co. bus.
1893	9					
1894	14					
1895	17					
1896	13					
1897	6					
1898	10					
1899	14					
1900	10					
1901	9					
1902	19					
1903	17					
1904	6					

Year	Southeast counties			Northwest counties		
	F. O. Altn. Dickey Co. bus.	Henry C. Frojen Dickey Co. bus.	Lee Farm Barnes Co. bus.	Wm. Nordman Divide Co. bus.	Arnt Estate Williams Co. bus.	Harry Hardy, Sr. Mountrail Co. bus.
1905	15			31		
1906	17			26		
1907	14			17		
1908	15			14		
1909	20		6	18		
1910	5		6	12		
1911	7		8	17		
1912	18		17	29		
1913	15		16	18		
1914	8		10	20		
1915	21		19	32		
1916	7		5	16		
1917	9		12	9		
1918	15		13	7		
1919	5	5	10	6		
1920	11	10	9	7	14	
1921	13	7	9	18	22	
1922	7	15	16	36	24	
1923	5	6	11	17	21	10
1924	15	10	16	21	20	11
1925	16	14	16	20	23	25
1926	4	7	4	18	17	9
1927	10	13	12	17	25	10
1928	16	12	14	24	0	24
1929	13	12	9	17	15	12
1930	15	14	11	15	8	4
1931	7	9	10	0	0	0
1932	13	13	16	16	7	18
1933	11	2	10	14	0	13
1934	3	0	5	1	0	0
1935	12	8	4	7	5	4
1936	1	0	0	0	0	1
1937	8	5	1	0	0	0
1938	0	3	None seeded	11	11	9
1939	12	10	0(rust)*	12	12	9
1940	8	5	2(rust)	19	14	8
1941	18	16	15	44	32	22
1942	13	20	26	34	20	20
1943	7 (too wet)	12 (too wet)	22	38	24 (40% hail)	21
1944	20	15	18	27	26	19
1945	20	14 (too wet)	20	25	20	19
1946	14	19	20	20	18	(60% hail loss)
1947	14	15	24	19	22	14
1948	13½	17	24	17	19	22
Average yield	11.9	10.3	11.9	17.9	14.4	11.9
Years in average	56	30	39**	44	29	26

*1939—Rusted badly, so was cut for hay.

**Lee Farm—exclusive of 1938, none seeded.

During the 1926-47 period, for which county figures on a seeded acreage basis are available from Federal Crop Reporting Service, the average yield on each of these farms was above the county average for the same period. This is indicated by the following comparison of the yield per seeded acre on each farm with that of the county in which it is located.

Name	County	Average yield per seeded acre on each farm, 1927-47 bus.	Average yield per seeded acre for specified county, 1927-47 bus.
F. O. Alin	Dickey	11.2	8.9
Henry C. Frojen	Dickey	10.3	8.9
Lee Farm	Barnes	11.9*	11.3*
Wm. Nordman	Divide	17.1	10.3
Arnt Estate	Williams	12.3	10.6
Harry Hardy, Sr.	Mountrail	11.1	9.4

*1938 not included as no wheat was seeded.

Following are the legal descriptions of the farms involved and some information on each farm:

- F. O. Alin:** SW $\frac{1}{4}$ Sec. 24 and NW $\frac{1}{4}$ Sec. 25, all in Twp. 132N, Rge. Fullerton, Dickey County
62W. This farm is mapped by the Dickey County Soil Survey of 1917 as chiefly Barnes silt loam.
- Henry C. Frojen:** SE $\frac{1}{4}$ Sec. 25 and N $\frac{1}{2}$ Sec. 36, all in Twp. 13N, Rge. 60W. Oakes, Dickey County
This farm is mapped by the Dickey County Soil Survey as Barnes silt loam. A part of the acreage suffers from poor drainage in wet years.
- Lee Farm:** W $\frac{1}{2}$, Sec. 8, Twp. 138, Rge. 57. The farm was operated Valley City, Barnes County
for many years by Ludvig Lee and is now owned by Lawrence L. Lee, Valley City, who furnished data for 1937 through 1946. Data for 1909-1936 were furnished by the late T. Melvin Lee, a nephew of Ludvig Lee. The farm is mapped in the Soil Survey of Barnes County of 1912 as Carrington silty clay.
- Wm. Nordman:** S $\frac{1}{2}$ NW $\frac{1}{4}$, NE $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 13; SE $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 12; Noonan, Divide County
N $\frac{1}{2}$ SE $\frac{1}{4}$, Sec. 14; all in Twp. 162N, Rge. 95W. No soil survey is available but this tract is considered to be above average for the locality in productivity. The record covers the period since this farm was broken from native sod. The higher average yields are due in part to the fact that from 1920 to 1938, about a third of the acres were ordinarily in summer fallow. Since that time, about one-half of the area has been in fallow. As is the case with most farms in the area, the land has never had any manure, legumes or commercial fertilizer.
- Chris Arnt Estate:** N $\frac{1}{2}$, Sec. 29; NW $\frac{1}{4}$ and W $\frac{1}{2}$ NE $\frac{1}{4}$, Sec. 28; SW $\frac{1}{4}$ Sec. 21; Williston, Williams County
S $\frac{1}{2}$ SE $\frac{1}{4}$, Sec. 20, all in Twp. 156N, Rge. 100W. In 1943, the N $\frac{1}{2}$ SE $\frac{1}{4}$ and S $\frac{1}{2}$ NE $\frac{1}{4}$, Sec. 20, Twp. 156N, Rge. 100W, were added. Some grazing land is owned in addition.
- Harry Hardy, Sr.:** These records relate to the following descriptions: N $\frac{1}{2}$ Stanley, Mountrail County
and SE $\frac{1}{4}$ Sec. 26, and SW $\frac{1}{4}$, Sec. 23, all in Twp. 156N, Rge. 93W. In the winter of 1935-1936, Mr. Hardy stated that in recent years, he had followed approximately the following cropping system:

Crop	Acres
Wheat	175
Barley	80
Oats	80
Corn and cane	40
Sweet clover	25
Idle	15
Total broken	415
Native pasture and hay	225

Twenty Years Needed to Get Reliable Average Yields

In humid areas, a 10 year record is generally considered adequate for a reliable average of crop production but the records from these six farms indicate clearly, under conditions that prevail in most of North Dakota, a period of about 20 years is required to secure a reliable average. By the time one has secured it, varieties and agricultural technology may have so changed that the average is not an accurate forecast of what may happen in the next 20 years but at least it is a great help to intelligent consideration of the problem of what average yields may be expected and the variations in yield that may occur from year to year.

The 1931-40 ten year average, on the Arnt farm, Williams county, of 4.9 bushels was only 28 percent of the 1921-30 average of 17.5 bushels and on the Alin farm, Dickey county, which suffered the least of the six in the drought and rust years of the 1930's, the 1931-40 average of 7.5 bushels was only 66 percent of the 1921-30 average of 11.4 bushels.

In the eight years, 1941-48, these six farms gave yields per acre that were 131 to 180 percent of those of 1921-30 and 199 to 461 percent of those of the 1931-40 period. See table No. 2.

Perhaps, after the prosperity of the war and postwar years, the need for caution regarding future prospects is almost as great as was the need for optimism in the 1930's. This is especially the case upon the part of those who are tempted to incur substantial debts in order to get into farming or to expand farm operations.

Table No. 2—The Yield Per Acre on Each Farm By Ten Year Periods.

Period	Alin bu.	Frojen bu.	Lee bu.	Nordman bu.	Arnt bu.	Hardy bu.
1893-1900	11.6 ¹	-----	-----	-----	-----	-----
1901-10	13.7	-----	6.0 ³	19.6 ⁴	-----	-----
1911-20	11.6	7.5 ²	11.9	16.1	14.0 ⁵	-----
1921-30	11.4	11.0	11.8	20.3	17.5	13.1 ⁶
1931-40	7.5	5.5	5.3	8.0	4.9	6.2
1941-48 (8 year average)	14.9	16.0	21.2	28.0	22.6	17.9
% 1941-48 is of 1931-40	199%	291%	400%	350%	461%	289%
% 1941-48 is of 1921-30	131%	145%	180%	138%	129%	137%

¹8 yr. av.; ²2 yr. av.; ³2 yr. av.; ⁴6 yr. av.; ⁵1 yr. only; ⁶3 yr. av.

In table 3 is found a summary of variations in yield on each farm. However, a significant fact in connection with the wide variation in yields is the fact that on the Arnt farm, in the seven years 1931-37, there were five years with no crop worth harvesting and the other two years, 1932 and 1935, gave only seven and five bushels per acre, respectively. On the Hardy farm, in the four years 1934-37, there were two years with a complete failure, one year with one bushel per acre and one year with four bushels per acre. The record for continuous crop failures on the Lee farm in Barnes county in the seven years, ending with 1940, is as bad as for the Arnt and Hardy farms but, in this case, rust was apparently as much of a factor as drought. In the late 1930's, losses from rust depended a great deal on the particular varieties that one happened to grow. In all sections of the state, stem rust was a major factor in the low yields secured in 1935.

At any rate, the data for each farm emphasize the importance of operating with a minimum of debt, especially of short term debt, a liberal carryover of feed and seed and a reserve in cash for living and operating expenses; as one or two years, or possibly more, with little or no crop is an ever present possibility.

Table 3—The variations in yield per seeded acre.

Yield	Alin years	Frojen years	Lee years	Nordman years	Arnt years	Hardy years
5 bushels and under	7	7	8	4	7	6
6-10 bushels	16	8	10	5	2	7
11-15 bushels	21	11	7	6	5	4
16-21 bushels	12	4	10	18	7	6
22 bushels and over	0	0	4	11	8	3
Total no. of years	56	30	39	44	29	26

Are Soils Deteriorating?

On these particular farms, it seems improbable that there was any great amount of soil deterioration in the years covered by the record. However, the yields of the later years are not directly comparable with those of earlier years as better varieties and techniques have been available in the later years. In the case of each of the Lee, Frojen, Nordman and Arnt farms, the highest yield secured in the 1940's has exceeded the yield in any previous year included in the record.

In the case of the 56 year Alin record, the highest yield secured in the 1940's was 20 bushels in each of 1944 and 1945 and the best previous yields were 20 bushels in 1909 and 21 bushels in 1915.

In the case of the Hardy farm, the best yields in the 1940's were 22 bushels in 1941 and 21 bushels in 1943 but in 1925 a yield of 25 bushels was secured and in 1923 a yield of 24 bushels was secured. However, the average production for the five years, 1941-45 of 20.2 bushels exceeded that of any five-year period in the 1920's by over four bushels per acre.

What of the Future?

Recorded weather data going back to 1867 at Buford, Williams County, to 1868 at Garrison, McLean County, to 1875 at Bismarck, Burleigh County² and to tree ring records going back, in a rough way, for over four hundred years³, indicate that droughts may be expected from time to time, although the present generation may not see another one as severe as that of the 1930's.

The following are among the factors that suggest higher average yields in the future than in the period prior to 1940:

1. Rust resistant varieties of wheat have greatly reduced the prospect of rust losses. It may happen that races of rust that are now unimportant or new races may attack the present varieties but, if and when the present varieties are attacked by new races of rust, it is likely that the plant breeders will have developed wheat varieties that are adapted to the new situation.
2. Chemical control of mustard and some other weeds will help to avert weed losses.
3. Improved machinery makes more timely and better quality work possible. In the western two-thirds of the state, the increasing acreage that is plowed, seeded and packed in one operation, makes for conservation of moisture and insures a well-packed seed bed.
4. It is likely, that with present knowledge, out-breaks of grasshoppers can be combatted somewhat more successfully than in the 1930's.

However, regardless of improvements in technology, a supply of moisture will still be a prime requirement for crop production although improved technology may enable one to make better use of limited rainfall.

Past experience indicates that it is very unlikely that a period of eight years in succession as favorable as the 1941-48 period can be expected more than once in a lifetime. Perhaps, one might hazard a guess that half of the increased yields over the 1921-30 level is due to better varieties and better techniques. If this estimate is correct, with similar weather, yields of 15 to 20 percent above those of 1921-30 can be expected.

²U. S. Dept. of Agric., Weather Bureau, Summary of Climatological Data for the United States by Sections, Reprint of Section 31, Western North Dakota.

³North Dakota Experiment Station, Bul. 338, "Tree Ring Studies in North Dakota".