

## VARIABILITY OF NORTH DAKOTA FARM INCOME<sup>1</sup>

By  
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H. L. Walster has characterized the Great Plains as being subject to three great physical laws:

- (1) The law of variability;
- (2) The law of limited expansion and severe contraction;
- (3) The law of exhaustible and destructible resources.<sup>3</sup>

Each of these laws has its peculiar economic implications, to which North Dakota agriculture must adapt itself if its rural economy and culture is to prosper. Since physical laws are not readily altered, the major burden of adjustment to the Plains environment falls upon economic and social arrangements by which people live in this region. We cannot prevent drought, but perhaps we can prevent the economic havoc it has created during the thirties. Here lies a great challenge to the ingenuity of the people of the Great Plains.

Let us examine the nature of the variability and its economic consequences.

### The Story of the Tree-rings

Painstaking work on tree-rings of old oaks and cedars in North Dakota made it possible to construct a weather calendar for a period of 536 years, from 1406 to 1941.<sup>4</sup> The import of the story told us by these trees is that for centuries past dry years tend to bunch together into drought periods of irregular length; and so do wet years bunch into irregular periods of good rainfall. Rarely do dry and wet years alternate, as is seen in Table 1. Over a 536 year period, there were 22 dry periods and 24 wet periods of 3 or more years, and only 5 dry and 5 wet periods of 1 or 2 years.

The economic implication of this bunching of dry and wet years is extremely serious. A farmer can hardly plan his finances ahead for more than 10 years or so, and he cannot carry on his farm reserves of grain and feed that would tide him over more than one or two really dry years. A more regular alternation of dry and wet years would greatly ease the problem of stabilizing farm income; as it is, we must find means to bridge the economic gap created by a prolonged period of drought.

**Table 1. Frequency and Length of Dry and Wet Periods as Revealed by Tree Rings,  
Over 536 Years (1406-1941)**

Duration (in years)	Number of Periods	
	Dry	Wet
1-2	5	5
3-9	11	15
10 or more	11	9
Longest period	16 yrs.	39 yrs.

<sup>1</sup>Geo. F. Will, *Op. cit.* p. 23.

<sup>2</sup>A comprehensive study is being carried on in this field under Project Purnell 143, "Weather and Price Uncertainties and their impact on North Dakota Farm Income" with the Bureau of Agricultural Economics, USDA, cooperating.

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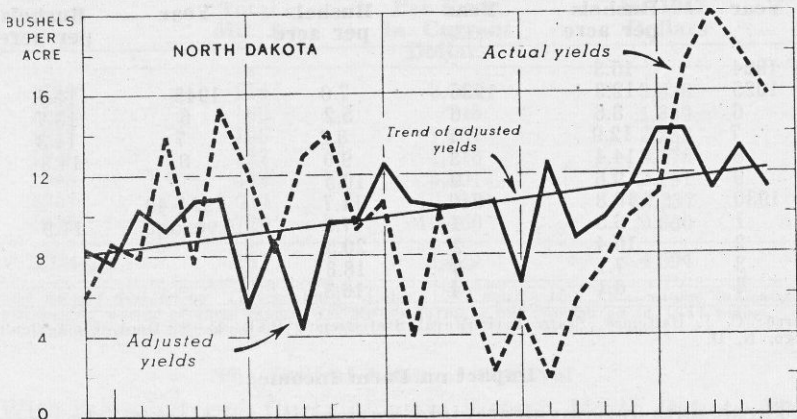
<sup>4</sup>H. L. Walster, *Planning in the Great Plains*, Bimonthly Bulletin, N. D. Agr. Experiment Station, Vol. 5, No. 6, July 1943, p. 14.

<sup>5</sup>Geo. F. Will, *Tree Ring Studies in N. D. N. D. Agr. Exp. Sta. Bul.* 338, Apr. 1946.

### The Story of Wheat Yields

The weather history revealed by tree-rings is, of course, very general and lacks many details important for sustaining an economy of arable farming. Moreover, sometimes it is not drought alone that causes crop failures and threatens the farmer's survival. Crop disease and insects also take their toll. Although science has made remarkable progress in helping farmers to reduce crop hazards from plant pests, they still represent an important menace to the farm economy. Let us look at the most direct indicator of North Dakota farm production, the yield of wheat.

There has been a remarkable upward trend in North Dakota wheat yields. During the last 20 years, the average yield is estimated to have increased by about 50 percent.<sup>1</sup> It would be hard, however, to gather this fact by just looking at a chart of wheat yields because of the extremely wide fluctuations due primarily to the erratic character of Plains weather. Fig. 1 shows the actual wheat yields per acre planted, the computed yields adjusted for major weather variations, and the yield trend for the period 1919-1944. A glance at this chart reveals that actual yields were way below the trend line during the 9 year period of 1931-39 (with only one exception in 1932), and stayed well above the trend line since 1941.



**Figure 1—Actual Wheat Yields Per Acre Planted and Yields Per Acre Planted Adjusted for Major Weather Effects, North Dakota, 1919-44.** (See Figure A1 for precipitation Data Used.) A definite upward trend in wheat yields is apparent for North Dakota after adjusting for major effects of precipitation and temperature ("adjusted yields are the net regression of yield on 'time' with precipitation and mean temperatures for selected months held constant".) "Time" here means the unexplained correlation, the part not explained by rainfall and temperature variations. (From same source as Figure A1.)

Here, again, the bunching of poor and good years is an outstanding feature of the environment to which our farm business must adapt itself. For the 13 year period of 1933-45, wheat yields

<sup>1</sup>See H. L. Walster and P. A. Nystuen, North Dakota Wheat Yields, N. D. Agr. Exp. Sta. Bul. 350, May 1948, p. 8.

(per acre harvested) in the first 5 years were more than 30% below the average of 11.8 bushels, and in the last five years more than 30% above the average. During only 3 of these 13 years did the yield fall within 30% of the average. Such a distribution of poor and good years presents most difficult problems to the economic arrangements of a farm business.

The nature of yield variability is rather unique to the Plains region. In Iowa, for example, corn yields during the same period (1933-45) fell below 30% of average in only 2 years, and exceeded 30% in none of these years.

Taking the history of wheat yields in North Dakota for the last quarter century (1924-48), we find that the average of 11.9 bushels per acre has been exceeded by 20% or more in 7 out of the last 8 years; it has been deficient by 20% or more in 9 years of that period, 6 of which were consecutive years (1933-38). What are the chances that wheat yields during the fifties will be less than 10 bushels during most years of the decade ahead of us? It certainly would do us no harm to be prepared for such an eventuality.

**Table 2. North Dakota Wheat Yields (All Spring Wheat)<sup>1</sup> Per Acre Harvested, 1924-48**

Year	Bushels per acre	Year	Bushels per acre	Year	Bushels per acre
1924	15.3				
1925	12.3	1935	7.0	1945	15.7
6	8.6	6	5.2	6	13.7
7	12.9	7	8.2	7	14.3
8	14.4	8	9.0	8	14.3
9	9.6	9	10.5		
1930	10.8	1940	11.7	1924-48	
1	6.5	1	17.8	Average	11.9
2	10.4	2	20.5		
3	7.1	3	18.8		
4	6.1	4	16.3		

<sup>1</sup>Source: C. J. Holtemes, State Agricultural Statistician, BAE, U. S. Dept. of Agriculture, Fargo, N. D.

### Impact on Farm Income

These data on physical yield variability understate the magnitude of the economic problem of income variability. Farm incomes have fluctuated much more than crop yields, due to three basic reasons:

(1) In years of poor yields per acre, the proportion of abandonment of planted crop acreage tends to be high, so that low yields are harvested from a reduced acreage; wheat production, therefore, fluctuates more than wheat yield. During the 25 years from 1924-48, North Dakota wheat production ranged from 19 to 159 percent of the period average.<sup>1</sup>

(2) Poor yields in many years have coincided with low prices, good yields with high prices. Gross cash income per farm in North

<sup>1</sup>Yield variations on individual farms usually are even wider than those of county or state averages. See Cavert, Wm. L., Long Term Wheat Yields on Each of Six North Dakota Farms, N. Dak., Agr. Expt. Sta. Bim. Bull. XI, (5) 167-172.

Dakota ranged from 24% to 328% of the last 25 year average, or roughly from \$750 in 1932 to \$10,300 in 1948, with an average of \$3,200 as shown in table 3. If we adjust for changes in the general price level, gross cash income per farm (with the purchasing power of the dollar held constant so that one dollar of farm income buys the same amount of goods in any year of the period) still varied from 30 to 220 percent of the long-time average.

(3) In extensive grain farming, the real cost per crop acre remains nearly the same regardless of the wide variations in production. The cost of field preparation, seeding and harvesting is largely independent of the crop output—a condition that occurs but rarely in other industries and does not fit into the conventional methods of economic analysis. This means that in poor years the costs cannot be brought down along with the gross income, and in good years costs do not rise materially. Therefore, net farm income fluctuates much more than gross income and crop yields. The *net* cash farm income of a typical wheat farm in the Northern Plains varied from \$175 in 1932 to \$9,514 in 1947, according to a recent study by the U. S. Department of Agriculture.<sup>3</sup>

**Table 3. North Dakota Gross Farm Income, Selected Years  
Gross Cash Income from Sale of Farm Products**

	Total Mil. \$	Per Farm In Current Dollars	In 1947 Dollars <sup>3</sup>
1929	214	2,763	3,838
1932	60	745	1,380
1937	106	1,307	2,253
1940	127	1,716	3,178
1945	473	6,801	9,191
1947	711	10,237	10,237
1948	726	10,460	9,680
Av. 1924-28	251	3,429	4,594

<sup>3</sup>Current dollars divided by "Prices Paid" index. 1947 equals 100. This column indicates the real purchasing power of farm income for things farmers buy, measured in 1947 prices. Source: Farm Income Situation, BAE, USDA, Wash., D. C. Current Issues.

### The Critical Limit of Survival

With these extreme fluctuations in income, North Dakota farmers face a tough problem of adjusting their business and financial arrangements to the uncertainty of the farm income flow.

As long as income varies above a minimum level which will meet farm expenses and necessary family living costs, even wide income fluctuations do not jeopardize the continuation of the farm as a going concern and the livelihood of the farm family. If necessary living expenses of a typical North Dakota family require say \$2,500, the most erratic variations in net farm income (after payments of debts and taxes) above that level don't endanger the security of that family, or the economic stability of that farm business.

<sup>2</sup>W. D. Goodsell, R. W. Jones and R. W. Bierman, Typical Family-Operated Farms, 1930-45, and supplement 1945-47. Bureau of Agricultural Economics, F. M. 55 and 70, U. S. Department of Agr., Washington, D. C. April 1946 and Sept. 1948.

But if net farm income drops below that critical level of family living requirements, then the real crisis is on. During the thirties, most of the farmers' net incomes remained way below the minimum requirements for a decent living standard; many of them depended upon some form of outside relief, and many went bankrupt and were dispossessed of their land and equipment due to no fault of their own. Plains farmers have often been called gamblers but few of them would deliberately play with the livelihood of their families as stake.

A recurrence of such a collapse of our farm economy, with its drawn-out aftermath of human suffering and soil wastage, must be avoided. Price support programs can help—but they cannot by themselves solve the problem of tiding a family over a sequence of poor crop years. The Plains region needs to develop its own peculiar arrangements, ways of doing things, financial and other institutions specifically designed to meet the challenge of its "Law of Variability."

### What Can Be Done?

The goal is simple. We must find ways, through a combination of individual practices, cooperative organization and public policies, for a competent and honest farmer to *ride out periods of drought and poor yields without starving his family, robbing his soil and losing his farm.*

We must discover better farm management and business practices, new cooperative methods and government programs *that will provide an adequate minimum of economic security over the years for any farm family willing to do its share*, in face of the extreme crop and price hazards to which our region is exposed. This is a new frontier for Plains farmers to conquer.

Let us briefly look over the various possibilities that have been suggested. Each of these has its limitations; but each might contribute toward the goal.

#### 1. Meeting weather and crop hazards:

- a. Providing for **feed and cash reserves** in good years from which to draw in poor years.
- b. Improving **moisture conservation practices** such as summer fallow, stubble mulching and strip cropping.
- c. Operating an **adequate size farm** which permits keeping sufficient land in fallow and making ends meet even if crop yields are moderately below normal.
- d. Expanding and improving the **crop insurance program**. Wheat insurance has been in effect for 10 years, but has not yet developed beyond the experimental stage.

#### 2. Meeting Price Hazards:

- a. **Diversifying farming** wherever physical conditions, market location and price relationships permit, and making fuller use of family labor during the year and of roughage that otherwise goes to waste. In many areas of the Plains, the economic opportunities for diversification are severely limited.
- b. Developing an **ever-normal granary** program by building up stocks when prices are low and releasing them when they are high. An ef-

fective long-range storage program could contribute much to stabilizing grain prices as well as the livestock industry.

c. Working out a **long-range price support program** that will prevent ruinously low crop returns, but will not price our products out of their markets.

### 3. Making fixed costs more flexible:

a. Expanding the use of **long-time amortized mortgage loans with flexible payment provisions**. Under certain conditions beyond the borrower's control, he might be entitled to deferment of debt payments under the terms of the contract.

b. Increasing the use of "**budgeted production loans**" running over periods of various length depending upon the purpose of the loan, and working out a repayment schedule suited to the income flow of the particular farm.

c. **Amending bankruptcy and foreclosure laws**, so as to grant the borrower deferments if he becomes delinquent through causes beyond his control, such as crop failures and severe price declines—without however impairing the amount of the lender's claim.

d. Improving **Real Estate taxation** through more equitable assessments and equalization of tax bases, and through deferment provisions similar to those just mentioned.

No single measure can provide a panacea for the vagaries of weather and markets. Perhaps we will need action along all of these lines. We certainly should explore them, detect and evaluate their pros and cons, their possibilities and limitations. Wise action must be based on thorough and objective research employing up-to-date scientific methods.

The Great Plains offer a great challenge to their farmers, community leaders, researchers and educators. We all are called upon to make a contribution to the sustained fullness and security of farm life in the Plains.

## GRASS ROOTS CONFERENCE ON GREAT PLAINS PROBLEMS

Director E. J. Haslerud of the North Dakota Extension service was general chairman of a conference on Great Plains problems, attended by 150 persons from the seven northern plains states. The conference was held in the Black Hills of South Dakota in June, 1949. North Dakota had the largest delegation, 33. About half the 150 were farmers and farm wives, the rest being research workers, students and representatives of agricultural colleges and extension service.

First day of the conference considered "lessons from the past." Dean W. V. Lambert of the Agricultural College of Nebraska, reviewed progress of the last 20 years in crop and livestock production, soil management and erosion control.

Panel discussions traced the effect of drought and depression of the 1930's upon farming and rural life of the plains. Farmers recalled hardships of that decade and expressed hope that we may have learned enough to handle these problems more effectively if drought and low prices should again descend upon us. Rev. Eidbo of Riverdale, N. D., spoke of the church's responsibility of coming to grips with the issues troubling rural people.

The second and third day were devoted to looking toward the future. Missouri Valley development was discussed, and there were panels on crop insurance, credit problems, getting young farmers started, landlord-tenant problems and rural housing.

Proceedings of the conference will be published soon by one of the colleges in the region and will be made available to farmers and others interested through the Extension service of the seven states.