The Missouri River basin project and the Mexican projects of irrigation
by Panfilo R Leon

A THESIS Submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of Master of Science in Agricultural Economics
Montana State University

Abstract:
1. The main problems that face the Missouri River Basin's agriculture are: Climatic undependability, floods, drouths, instability of farm income, and out-migration.

The main problems that face Mexico's agriculture are: Climatic undependability, drouths, floods, insufficiency and instability of farm income, shortage of cropland, and deficient agricultural technique.

2. Agriculture still is a major occupation in the Missouri River Basin. Land in farms, cropland harvested, value of livestock, output of some main products, etc., in the Missouri Basin represent a significant percentage of the corresponding figures for the United States.

Mexico is also still predominantly agricultural. About 65 percent of its economically active population is engaged in agriculture* and the capital invested in this occupation Is* by far* larger than the capital Invested in any other industry* 3. In the Missouri River Basin there are approximately 5,000,000 acres Of land already Irrigated. It is intended to irrigate another 5,233,000 acres by 1975» Land physically suited to irrigation in the Missouri Basin is plentiful relative to water supply* In Mexico there were approximately 4,245,000 acres of irrigated land as of 1946* It is planned to irrigate 2,868,000 more acres by the end of 1952» The feasibly irrigable land is rather limited.* Bough estimations indicate that only an area of approximately 17,000,000 acres could feasibly be brought under irrigation* 4* Growth of the Missouri Elver Basin's population has been variable* In recent decades the growth has been slow* Eural population has been declining# and urban population has been increasing* As of 19l|0# the rural population was 60*3 percent of the Basin's total population* Of this percentage# 36*5 percent was farm population# and 23*8 percent was rural non-farm population* Growth of Mexico's population has been steadily increasing* With the exception of a very slight decrease. 7.5 percent from 1910 to 1930 and 5.2 percent from 1930 to 1940, rural population has been rather constant. Contrasting to the Missouri Basin, the rural population almost coincides with the number of rural-farm population.

5. -Because of the high level of agricultural development already achieved in the Basin# the Missouri Elver Basin Project is considered as a comprehensive one* It contemplates irrigation# navigation# hydroelectric development# and so forth* Because of the low level of agricultural development in Mexico and its very peculiar physical characteristics * the Mexican projects of irrigation do not contemplate such a comprehensive development* In general# irrigation is the main concern of such programs with hydroelectric development in a definitely secondary position#

THE MISSOURI RIVER BASIN PROJECT AND THE MEXICAN PROJECTS OF IRRIGATION

by

PANFILO R. LEON

A THESIS

Submitted to the Graduate Faculty

in

partial fulfillment of the requirements

for the degree of

Master of Science in Agricultural Economics

at

Montana State College

Approved:

M M Nelson

Head, Major Department

M M Nelson

Chairman, Examining Committee

L A Nelson

Dean, Graduate Division

Bozeman, Montana
September, 1950

TABLE OF CONTENTS

Table of Contents (Cont'd)

Table of Contents (Cont'd)

LIST OF FIGURES

DEDICATORY:

To the MONTANA STATE COLLEGE at Bozeman, Montana and to the ESCUELA NACIONAL DE AGRICULTURA at Chapingo, State of Mexico, in due recognition for the knowledge of scientific agriculture they provided me, thus granting me a right to help in the solution of problems in Agricultural Economics.

ACKNOWLEDGMENT

Acknowledgment is due to certain persons whose help and valuable advice made possible the development and completion of this paper. Especial recognition should go to:

Dr. M. M. KELSO, Head of the Department of Agricultural Economics and Rural Sociology, for his valuable advice and help;

Dr. CARL F. KRAENZEL and Mr. LAYTON S. THOMPSON, for their help and advice;

The staff of the Agricultural Economics Library and of the Main Library at Montana State College who were very kind in making available the bibliographic material I needed.

ABSTRACT

1. The main problems that face the Missouri River Basin's agriculture are: Climatic undependability, floods, drouths, instability of farm income, and out-migration.

The main problems that face Mexico's agriculture are: Climatic undependability, drouths, floods, insufficiency and instability of farm income, shortage of cropland, and deficient agricultural technique.

2. Agriculture still is a major occupation in the Missouri River Basin. Land in farms, cropland harvested, value of livestock, output of some main products, etc., in the Missouri Basin represent a significant percentage of the corresponding figures for the United States.

Mexico is also still predominantly agricultural. About 65 percent of its economically active population is engaged in agriculture, and the capital invested in this occupation is, by far, larger than the capital invested in any other industry.

3. In the Missouri River Basin there are approximately 5,000,000 acres of land already irrigated. It is intended to irrigate another 5,233,000 acres by 1975. Land physically suited to irrigation in the Missouri Basin is plentiful relative to water supply.

In Mexico there were approximately 4,245,000 acres of irrigated land as of 1946. It is planned to irrigate 2,868,000 more acres by the end of 1952. The feasibly irrigable land is rather limited. Rough estimations indicate that only an area of approximately 17,000,000 acres could feasibly be brought under irrigation.

4. Growth of the Missouri River Basin's population has been variable. In recent decades the growth has been slow. Rural population has been declining, and urban population has been increasing. As of 1940, the rural population was 60.3 percent of the Basin's total population. Of this percentage, 36.5 percent was farm population, and 23.8 percent was rural non-farm population.

Growth of Mexico's population has been steadily increasing. With the exception of a very slight decrease, 7.5 percent from 1910 to 1930 and 5.2 percent from 1930 to 1940, rural population has been rather constant. Contrasting to the Missouri Basin, the rural population almost coincides with the number of rural-farm population.

5. Because of the high level of agricultural development already achieved in the Basin, the Missouri River Basin Project is considered as a comprehensive one. It contemplates irrigation, navigation, hydroelectric development, and so forth.

Because of the low level of agricultural development in Mexico and its very peculiar physical characteristics, the Mexican projects of irrigation do not contemplate such a comprehensive development. In general, irrigation is the main concern of such programs with hydroelectric development in a definitely secondary position.

FOREWORD

Agriculture, one of the first and fundamental occupations from which mankind obtains goods to satisfy its subsistence necessities, is an activity essentially dedicated to discover, direct, and exploit material resources contained in the land and to control all kinds of phenomena such as physical, chemical, bacteriological, and atmospheric that in one way or another may have some connection with soils. Other things being equal, dissimilarity of soils and phenomena acting upon them will bring dissimilarity in agricultural characteristics. But as long as soil and its associated phenomena, including the culture of the society, are alike, agricultural characteristics will also be much the same no matter where the place may be. In this thesis an attempt will be made to set forth some similar characteristics, mostly derived from climate, and some dissimilar characteristics, mostly derived from culture of the society, that exist between the agriculture of the Missouri River Basin and the agriculture of the Republic of Mexico.

The thesis was developed from bibliographic material cited herein. In the case of Mexico, for which there was only limited material, the knowledge, judgment, and opinions of the author were used frequently to carry this thesis to its completion.

CHAPTER I.

THE MISSOURI RIVER BASIN AND THE REPUBLIC OF MEXICO

From an agricultural point of view, the Missouri River Basin has many characteristics that are very much the same as those of the Republic of Mexico. Similarities between the Missouri Basin and Mexico are of three general kinds: First, the environmental forces shaping the development of the agriculture are very much alike; second, the rural population represents a considerable percentage of the total population; and third, the general economy of both environments still depends to a large extent on agriculture since thus far industrial development plays but a small role in the whole economy of each.

But, as may be expected, the Missouri River Basin also exhibits differences when compared with Mexico. As main differences, the following may be mentioned: First, the Missouri River Basin is but a region within the great country of the United States, and, therefore, can be helped in the solution of its problems by the United States as a whole country. Mexico represents a whole country in itself, and, therefore, if assistance for the solution of its problems is to be asked, it has to be looked for through international channels or within her own boundaries. Secondly, historical factors, social conditions, and general culture of the farm population of the Missouri Basin have been quite different from those of Mexico. The variety of circumstances just mentioned has led to dissimilarity in the level of technological development reached by agriculture in each area. The Missouri Basin has already

attained an advanced agricultural technique, while Mexico still is developing its agriculture under poor agricultural technique.

As is well known, climate is a natural force that plays a great role in the development of agriculture. Other things being equal, a favorable climate favors a successful agriculture, and, conversely, an unsuited climate tends to produce an unsuccessful agriculture. The second condition is the one which, generally speaking, prevails in the Missouri River Basin. Precipitation and temperature, two main component factors of climate, occur in an undependable pattern both through time and throughout the area of the Missouri Basin. Sometimes good weather comes, as it did after 1940, and sometimes bad weather comes, as it did during most of the 1931-40 decade. What is the probable frequency of occurrence of these alternative periods of good and bad weather? No person knows, and it is precisely this climatic characteristic that is the main source of the problems that face the farmers of the Missouri Basin.

Mexico, when considered as a whole country, is by no means more blessed than the Missouri Basin in its climate so far as stable and successful agriculture is concerned. The Mexican territory faces undependable precipitation and temperature which make their appearances at irregular intervals, and whose occurrences nobody can predict. So, in a general sense, one may say that the Missouri River Basin and Mexico face similar unsuited climatic characteristics for the development of their agriculture. About 50 percent of the Missouri Basin's area is semi-arid; 30 percent is the corresponding figure for the land area of Mexico.

As far as seasonal variation of effective moisture is concerned, about 80 percent 1/ of the Basin area has little or no water surplus in any season, and only about 10 percent 1/ of the land has little or no water deficiency in any season. The analogous figures for Mexico are 49.9 percent and 12.8 percent, respectively.

Similarity of environmental forces that shape agricultural development have resulted in the Missouri River Basin and Mexico's confronting very similar problems in carrying on their agriculture. Following is a brief description of some of the more notable problems.

Problems Faced by the Missouri River Basin

Drouths. One of the manifestations of the uneven distribution of rainfall in the Missouri Basin is the drouths that occur in some parts of the Basin simultaneously with constant moisture sufficiency in other parts. The Missouri River Basin has been stricken intermittantly by severe drouths. They occur in an irregular pattern, and it is precisely this unpredictability that makes more difficult the adoption of any single crop system that is always well adapted to climatic conditions.

The more recent serious drouths were those of 1934 and 1936. In the 60-year period reaching back to 1889, the Missouri Valley States have experienced eleven severe drouths, averaging almost one drouth

---

1/ Percentages estimated from map entitled "Seasonal Variation of Effective Moisture", Geographical Review, January, 1948, p. 94.

year in every five. These excessive dry periods occurred in 1889, 1890, 1894, 1901, 1910, 1917, 1930, 1931, 1934, and 1936. All of the Missouri Valley States were not afflicted uniformly in each of these years, but all of them were stricken intermittently. The drouths do not take place, however, throughout the entire Basin, but are more intense and more frequent in the Upper and Western parts of the Basin.

No attempt was made in this thesis to analyze the effects of drouths, since they are well known by the farmers as well as by all those persons familiar with agriculture. For our purpose it will suffice merely to remember that some of the more noticeable effects are: (1) Failure of a crop, and, as a result, higher prices for the affected agricultural commodities; (2) Low farm income, and, as a result, lack of payments of the farmer's debts with its accompanying foreclosures and distress to the farmers and their families, and the Federal Government's burden of granting financial aid; (3) Emigration of some farmers toward more favored areas, and the resulting loss of capital through deterioration of real estate, land improvements, buildings, and farm equipment.

Floods. Floods in other parts of the Basin, as in the case of drouths, are one of the manifestations of the rainfall's uneven distribution. It seems rather contradictory, however, to speak of floods in the same breath with drouths. Briefly, drouths are lack of water, whereas floods are the contrary; that is, plenty of water. However, what seems a contradiction disappears when one considers the factors that cause floods--intermittent heavy rains and melting snow. Contrary to the drouths, the floods occur in the lower portion of the Basin.

Characteristic of the Missouri River Basin are floods of two general types, the March and the June floods. The March floods result from melting snow in the plains of the Upper Basin and the break-up of river ice, accompanied by light precipitation. Snow melting in the headwater mountains, accompanied by heavier rainfall, produces the June flood which ordinarily is much more destructive than the March flood. The principal effect of a March flood is the delay in planting until the fields are dry enough to be worked. The June flood delays the preparation of land and destroys growing crops much too late in the season for planting or replanting to be profitable.

As do drouths, floods bring trouble to the farmers and to the institutions related to agriculture. These troubles are almost of the same nature as are those brought by drouths, that is, distress to the farmers, deterioration of the farms and their appurtenances, expenditures of Federal Government for relief, and so forth. In addition, the floods cause soil erosion, and sometimes make fertile land poor by depositing sterile soil upon it. Average annual flood damage, agricultural and non-agricultural, probably exceeds $736,000 for the Upper Basin, $12,731,000 for the Lower Basin, and $13,107,000 for the entire Basin.

In a century of record there have been floods in 1884, 1881, 1903, 1908, 1909, 1915, 1927, 1935, 1942, 1943 and 1944. There were three separate floods in 1943 alone; in 1945 six, covering a period of nearly two and one-half months. The highest was in 1884, but there are no adequate records, and the damage has never been estimated, although it was

small because of the undeveloped state of the country. By far the most destructive three years in the River's history were 1942, 1943, and 1944.

Instability of Agricultural Production. By agricultural production instability, I mean the ups and downs in the volume of production caused by drouths, floods, and changes in the techniques and practices in agriculture such as change in crops, adoption of new varieties of crops, change in type of farming, enlargement or reduction in size of the farm unit, movement of people into agriculture or out of it, and so forth.

Generally speaking, there are at least two types of agricultural production instability. One is that derived from technological advances in agriculture that are taking place constantly in a world of progress. Obviously, one cannot be against technological progress because it causes this type of instability, but rather the concern in this regard is how to adjust agricultural practices to technological advances without suffering deterioration in all kinds of capital already in agriculture.

The second type of agricultural production instability is that brought on by unsuitable weather. This may affect agriculture with too much rainfall (floods), or too little rainfall (drouths). There are other factors responsible for agricultural production instability such as pests and diseases, but those derived from unsuitable weather are the most drastic.

In most of the Missouri River Basin the agricultural instability caused by unsuitable weather has been most prevalent. Drouths and

floods have forced some farmers to move out of the stricken places or out of the Basin. Agricultural instability in the Missouri Basin is one very important factor accounting for the slow growth of the Basin's population. The instability of agriculture in the Basin also arises because the climatic variations appear in a very irregular pattern. Weathermen cannot predict long in advance with any degree of accuracy how and when rainfall and temperature changes will take place. Farmers hesitate to make long-run plans or commitments, and some agricultural institutions, such as agricultural credit agencies, cannot help farmers with their problems to the same degree that is possible in areas of greater climatic dependability.

Instability of Farm Income. One thinks of instability of farm income as the corollary of agricultural production instability. The Missouri River Basin is, perhaps, the region of the United States where farm income has been most unstable. Such instability of farm income may come either because of unfavorable weather or because of low prices for farm products. Of these two principal factors, drouth has by far the greatest effect in making farm income low. The reasons for drouth's decreasing farm income are obvious: the crop yields become very poor, and oftentimes considerable crop acreages are so deteriorated that it is not worthwhile to harvest them. The last drouth recorded was that of the 1930-1940 period, which, together with depression prices, reduced farm income more than 50 percent below the average farm income of the 1942-1947 period.