CALIFORNIA STATE UNIVERSITY, NORTH RIDGE

AGRICULTURAL DEVELOPMENT IN THE
VALLE DEL YAQUI, SONORA, MEXICO

A thesis submitted in partial satisfaction of the requirements for the degree of Master of Arts in

Geography

by

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ABSTRACT

AGRICULTURAL DEVELOPMENT IN THE
VALLE DEL YAQUI, SONORA, MEXICO

by

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The Rio Yaqui Irrigation District in the Valle del Yaqui, Sonora, Mexico, has become the number one agricultural district in Mexico within the past twenty years. Located in a desert land, the District developed an agricultural base early in its human history because of a fortuitous juxtaposition of physical factors. This early development of a population dependent upon sedentary agriculture paved the way for the eventual transformation of a desert landscape into a modern agricultural district.

The Spanish colonization of the area enhanced the position of agriculture within the Valley. The new European extensive farming methods were introduced, and the region became a production area for food for the new mines and ranches being run by the European immigrants.
Later, after independence, the colonists were Mexicans who gradually displaced the original inhabitants, the Yaqui Indians, almost entirely within the area that was to become the irrigation district.

In 1935 the Mexican government officially formed the irrigation district, buying out most of the foreign investors who had obtained land during and after the nineteenth century.

In 1937, a unique Mexican form of land holding was introduced into the District, the ejido. This last modification of the economic and cultural landscape produced a contrast in land tenure in the Valley, and certain differences became obvious, the most noteworthy being the lack of parity between the production level of the two land tenure types, private and ejido.

The eventual development of the District can be traced by the chain of events which produced modifications of the cultural, historical, and physical landscapes. This thesis investigates physical, historical and contemporary characteristics of the Yaqui Valley and illustrates their modifications over time.
CHAPTER I

INTRODUCTION

Problem and Objective

The Valle del Yaqui (Yaqui Valley), specifically the Rio Yaqui Irrigation District, has become the number one agricultural district in both production and crop value in Mexico within the past twenty years, in spite of being located in one of the most arid areas of Mexico. This paper attempts to examine this situation and analyze the chain of events which culminated in the supremacy of the Yaqui Valley. It also provides information on an agricultural area which has not been previously studied as a unique region.

Sources

While much background information was found in libraries, especially the Bancroft Library at the University of California, Berkeley, the contemporary agricultural data were obtainable only in the irrigation district itself. Furthermore, much information could be acquired
only through direct observation. Thus, most of the information was procured by the author on two field trips during the spring of 1971. During these trips the primary sources of information were the Secretaría de Recursos Hidráulicos (Department of Water Resources) branch office in Ciudad Obregón and those individuals mentioned in the bibliography. Other sources were private farmers, ejidatarios (ejido 1 farmers), and other personnel on the various properties.

**Methodology**

The methodology of research consisted of three steps: first, assembling from books all background information necessary for Chapters II and III; second, conducting the field trips to collect the agricultural data; and third, compiling the data for presentation.

The methodology of analysis was to present the successive steps which modified the original landscape and brought about the contemporary situation: first, a description and analysis of the physical environment is set forth; second, a description and analysis of the historical geography is offered; third, a description and analysis of the recent agricultural development is presented; and finally, a description and analysis of land tenure as it
affects the contemporary agricultural landscape is given.

**Previous Studies**

There are no specific works concerning the Valle del Yaqui agriculture; most information is in the form of government reports. The most complete historical work concerning the Valley is *El Valle del Yaqui* by Caludio Dabdoub which covers the area up to 1960 but contains little specific agricultural information.

Regional descriptive literature is well represented, the two most useful works being Dunbier's *Sonoran Desert* and Bojorques' *Descripción de Sonora*. These provide some information on the Valle del Yaqui.

Topical literature is covered by many sources. The *ejido* system is explained in Simpson's *Ejido: Mexico's Way Out* and Velasquez's *El Ejido*. *El Ejido Colectivo en México* by Eckstein provides information on a unique type of ejido. Sauer and Spicer both published a series of works dealing with the early Indian tribes of the area.² McBride's *Land Systems of Mexico* gives excellent insight into the land tenure situation up to 1920.

The best information is presented in the articles in the professional journals. Henderson and Dozier³ provide the most recent and reliable data on agricultural problems.
confronting the northwest region of Mexico.
Footnotes for Chapter I

1. The *ejido* is a parcel of land granted by the Federal Government to a village for communal ownership and/or farming, in keeping with the land re-distribution provisions set forth in the post-Revolution Constitution and laws. Chapter V presents a brief explanation of the system and its regulations.

2. See bibliography.

CHAPTER II

THE PHYSICAL ENVIRONMENT OF THE VALLE DEL YAQUI

Location

The Valle del Yaqui is located in the Basin and Range physiographic unit of North America and the climatic and vegetation regions of the Sonoran Desert. Its boundaries are approximately 27° 40' N. to 27° N. and 109° 30' W. to 110° 20' W. Map I shows the location of the Valley while Map II locates the main elements of the Valley and its vicinity.

The Valle del Yaqui contains approximately 450,000 hectares (1.1 million acres) of which 240,000 (592,800 acres) form the Distrito de Riego Número 41, Río Yaqui (Irrigation District Number 41, Yaqui River) which lies mainly to the south of the Río Yaqui (Map II). The remaining area, both north and south of the river and lying to the west of the District, is federal government property, parts of which were ceded to the Tribu Yaqui (Yaqui Indian Tribe) by federal statute in 1939.
MAP I

Source: Doubles, Sonoran Desert, frontispiece.
MAP II

Source: Secretaría de Recursos Hidráulicos, Branch Office, Cuidad Obregón.
While most of the following discussion relates directly to the immediate Valley, the characteristics of the broader areas of physiography, climate, vegetation, and other elements of the physical geography will be examined in light of their relationship to the Valley.

**Landforms**

The Valle del Yaqui lies within an area of alternating basins and ranges which extends from the northern United States to mid-Mexico and lies west of the cordillera formed by the Sierra Madre Occidental in Mexico and the Rocky Mountains in the United States.

The formation of this landscape in northwest Mexico was caused by the down-faulting of the Golfo de California (Gulf of California) and the epeirogenic uplift of the western ranges of the Sierra Madre Occidental (Map I). Weathering and erosion then selectively modified the original terrain creating the contemporary vista of isolated mountains and vast plains. Waibel states that "the greatly eroded mountains are the result of long continued subaerial denudation; and the alluvium filled valleys, of subsequent deposition."

The underlying rock associations which form the foundation of the desert geomorphology reflect the general
succession of erosion. In the west older rocks are covered over in the basins by recent alluvium. In the middle zone denudation prevails with the younger deposits missing, and igneous rocks and most extrusives are exposed. In the Sierra Madre thick-covering extrusions of rhyolite dominate the landscape. A mountain pediment later developed which itself is eroded to form a "maze of small hills...whose original surface is preserved only in the tops of hills or inter-stream areas." The alluvial plains, covering approximately two-fifths of mainland northwest Mexico, rise steadily toward the north and east, thereby dictating the flow of rivers and streams to the south and southwest. Alluvial fans are formed over the pediment where the plains and small hills converge, and terracing sometimes develops where the lower of two adjacent valley basins has become filled.

The Valley exhibits the following features in the corresponding portions of its geography: A mountain pediment connects the Valley alluvium to the foothills of the Sierra Madre to the east while broad depositional plains dip slightly from the northeast to the southwest (mean gradient, 1.5 meters per kilometer, or approximately one foot per mile). Small, isolated hills occur infrequently in the Valley, mainly to the north and east.
The geographic features which bound the Valle del Yaqui are shown in Map II. On the west and southwest is the Golfo de California; on the northeast, east, and southeast lie the foothills of the Sierra Madre Occidental; on the north and northwest is the Sierra del Bacatete; and to the south of the Rio Yaqui agricultural lands runs the Río Mayo.

**Climate**

A relatively uniform type of climate exists throughout the Sonoran Desert, the climatic region within which the Valle del Yaqui is located. Although variations occur from northwest to southeast, intense aridity dominates the picture.

While records reveal the climatology, the meteorological processes behind it are not so easily defined nor readily understood. Lydolph has developed the following explanation, perhaps the best available to date:

But it can be said that since the subtropical high pressure areas are broken into separate cells whose mean eastern boundaries of circulation are usually approximately coincident with the respective coastlines, and since the greatest divergence takes place on the equatorward part of the eastern arc of an anticyclone, then the optimum conditions of atmospheric subsidence and surface contrasts...
do exist along subtropical coasts on east sides of ocean basins...Such coastlines, then, are climatic controls conductive [sic] to aridity. 9

The Sonoran coastline and Pacific anticyclone are juxtaposed in a manner coincident with Lydolph's explanation so that with the accompanying high insolation and stability of the atmosphere, the result is paltry precipitation.

The western half of the Sonoran Desert receives less than 200 millimeters (7.9 inches) of rainfall annually, with the east receiving between 200 and 400 millimeters (7.9 and 15.8 inches). The rainfall generally occurs during two "seasons," winter rainfall running from November through March and summer rainfall running from July through September. The Valle del Yaqui conforms to this pattern, receiving 272 millimeters of rain (10.7 inches) annually, 30 percent of it during the winter season and almost 70 percent of it during the summer. 10 Rainfall variability is very high for the Sonoran Desert as a whole. 11

Seasonal temperatures, unlike rainfall, do not vary significantly from year to year. High temperatures prevail throughout the region; summer maxima regularly exceed 38° C. (100° F.). In winter, only northern areas and higher elevations experience freezing weather in the Sonoran Desert, and even in these locations only occasionally.
The highest diurnal temperature recorded for the Valley in the summer is $45^\circ$ C. ($113^\circ$ F.), and the lowest diurnal winter temperature is $-3^\circ$ C. ($27^\circ$ F.). The average diurnal maximum and minimum are $25.3^\circ$ C. ($78^\circ$ F.) and $23^\circ$ C. ($73^\circ$ F.), respectively. The annual mean is $24^\circ$ C. ($75^\circ$ F.) with a summer average of $30^\circ$ C. ($86^\circ$ F.) and a winter average of $18^\circ$ C. ($64^\circ$ F.).

Relative humidity in the Valle del Yaqui is very low and averages 30 percent during the interfaces between the two rainy seasons. The winds are controlled by the previously mentioned Pacific anticyclone and the stable conditions over the Sonoran Desert.

The Pacific high shifts southward $16^\circ$ in winter, causing a small shift in general wind direction, but the Sonoran low, a result of the divergence over the northwest Mexico-southeast United States landmass and generally located on the border, remains a permanent phenomenon. Therefore, wind direction is usually from the southwest except during the equinoxes, when the Sonoran low breaks up into separate centers.

**Soils**

Desert soils commonly evolve through the combined processes of weathering and erosion. The soils of the plains and valleys of the Sonoran Desert have evolved
mainly through but one type of erosion. Sheetflood erosion

...does more than any other one factor to give the bajadas their characteristic uniformity and their consequent straight-line profiles. This is also the principal factor in the removal of the finest material from the surface and its transportation to the playas or flood plains.¹³

As a result of desert storms, water flows in continuous sheets over perhaps hundreds of hectares to a depth of one centimeter (approximately .39 inches) or more, rushing downhill and being replaced by further rainfall and upslope drainage.

The desert soils generally exhibit little organic matter (humus) with the important exception of the river valley soils. Sheetflood erosion is important in this regard as it is the principal transporter of plant debris to the lower areas and river valleys such as the Valle del Yaqui. Thus, the soils of the Valley are unusually rich in humus, resulting from the extensive deposition from the drainage system of the Río Yaqui.

The Sonoran Desert has a characteristic high salt content in its soils, probably a result of the high evapotranspiration rate, and caliche or "hardpan" deposits are often found in the basins. Soil textures vary, as would be expected, with the proximity to the plains;
coarser grains are found in the upland areas, finer grains toward the plains. Reyes classifies the soils thusly:

The plains typically are of sierozem soils: the interzones between the plains and mountains are composed chiefly of sierozem and chestnut soils; and the mountain zones, of course, a confusion of different mountain soil complexes.\textsuperscript{14}

The Valle del Yaqui soils are probably some of the most fertile soils in Sonora, but, while having a high humus content, they are, unfortunately, also afflicted with a high salt content. In addition, the low-lying areas suffer from poor drainage, compounding the salt problem. Henderson states that, as of 1965, "presently 40,000 hectares (98,000 acres) are affected and that 15,000 hectares (37,000 acres) have already been retired from production,"\textsuperscript{15} due to inadequate drainage. In recent years land reclamation proposals have been formulated to counter this problem although no active effort has yet been applied.

\textbf{Water and Drainage}

The most important physical features to man in the Sonoran Desert are the five major river systems which cross the desert from the eastern mountain ranges to the Golfo de California (Map I). Most of the human settlements are situated on either the major rivers themselves
or their upstream tributaries. These systems are the Gila-Salt, Altar-Concepción, Sonora, Yaqui, and Mayo. All receive the great majority of their water volume from areas external to the desert.

Other than the larger rivers the most common manifestations of water and drainage are the ephemeral streams which carry away the runoff from desert storms. These constitute the whole of the interior drainage. Underground water supplies are rare and greatly centralized, sometimes, however, in surprising quantities. Agricultural areas near Guaymas (Map III), for instance, have depended upon well-water for the majority of their needs for the past thirty years. Future prospects for ground water are diminishing as current usage is far exceeding natural replenishment.

The Valle del Yaqui depends upon the Río Yaqui for both its agricultural and municipal water supplies and also its electric power (Chapter IV). The actual water supply system is handled through a system of canals and ditches commenced in the 1890's and laid out in parallel grids running north-south and east-west with the drainage ditches running perpendicular to the supply canals. Map II shows the location of the three principal canals. Figure 1 shows the bed of the Río Yaqui during mid-summer 1971 when
all the water was being used in the irrigation system, and Figure 2 shows the Canal Bajo (Lower Canal) from the headquarters of the Quechahueca ejido. The development of the irrigation system is examined later in Chapter III.

Vegetation

Shreve, the authority for vegetation of the Sonoran Desert, divides the desert into units by their principal plant associations. This approach is used in this paper to provide a general understanding of the vegetation pattern.16

The north and northeast sections of the Sonoran Desert are characterized by low brush and bushes with hardy trees occurring infrequently in only the better watered areas. An increase in number and species of trees in conjunction with low shrubs characterizes the middle plains and foothills. On the coastal strip vegetation consists solely of a few scattered trees and shrubs in areas where rain water collects during the occasional rains.

In the Foothills of Sonora, the Shreve classification in which the Valle del Yaqui is placed, is found the least desertic section. Characterized by an abundance of small trees and the disappearance of the creosote and burro
Figure 1. The dry bed of the Río Yaqui approximately four kilometers northwest of Ciudad Obregón is a result of the utilization of most of the water in the irrigation system, leaving the natural river virtually empty.

Since the construction of the dam upstream, brush has filled in the bed between the tall trees of the riverine vegetation.

Figure 2. The Canal Bajo or Lower Canal, seen from the Quechahueca ejido, along with the other canals, holds most of the water normally contained in the Río Yaqui.
bush, this area is best defined as an "arboreal desert." Mesquite and acacia are the dominant trees, followed by the ironwood and palo verde. Low to medium height shrubbery occupies the area between the trees creating a "filled in" look. In general the Valle del Yaqui serves as a transition zone between the true desert to the north and the wet-and-dry-tropical region to the south.

**Summary**

The physical geography of the Valley is very propitious to the development of agriculture, especially grains. It is located in one of the most favorable areas of the Sonoran Desert with regard to uniformity of climate, high insolation, high number of frost-free days, low humidity (important for wheat production), relatively even topography, large and convenient water supply, sufficient drainage, and fertile soils.

Thus, even before man modified the Valley, a favorable base for agriculture existed.
Footnotes for Chapter II

1. As defined by Fenneman in his early works, such as *Physiography of the Western United States*, 1931, McGraw-Hill.


3. These coordinates demarcate the delta and lower river only. The term "Yaqui River" has a variety of meanings and could include, for example, parts of northern and eastern Sonora if hydrology and drainage patterns were being studied.

4. The term "Valley" in this paper refers to the Valle del Yaqui; "District" refers to the Distrito de Riego Numero 41; and the term "Yaquis" refers to the Tribu Yaqui.


7. This pediment occupies almost two-fifths and the mountains occupy one-fifth of the area of mainland northwest Mexico. The alluvial plains comprise the complement.


16. The majority of this section was taken from Shreve's Vegetation of the Sonoran Desert, pp. 39-48, which may be consulted for an in-depth study of the vegetation of the entire desert area of both Mexico and the United States.
CHAPTER III

THE HISTORICAL GEOGRAPHY OF THE VALLE DEL YAQUI

Introduction

The historical development of the Valle del Yaqui can be divided into five periods which relate to the general history of the Mexican Republic. These are the Pre-European Period, during which the indigenous peoples had control over the area; the Spanish Entradas (initial conquests and explorations) Period, during which the Spanish military conquered central Mexico and conducted explorative missions in the northwest; the Colonial Period, during which the Roman Catholic Church became a primary colonizing instrument; the National Development Period, during which Mexico gained independence and began to function as a sovereign nation; and the Revolutionary-Post Revolutionary Period, during which the agrarian reforms now in effect were formulated, became law, and put into practice.
The Pre-European Period

Before the Spanish conquest of Mexico the northwest coastal plains were inhabited by a large Indian population of nearly 540,000, divided into various tribes. These tribes were of the Uto-Aztecan language family.

The main Indian groups in the present area of the Yaqui Valley were the Yaquis, who lived on the Río Yaqui delta and the closely related Mayos, who lived on the Río Mayo delta to the south (Map III). These two tribes totaled about 60,000 persons and with three other tribes located to the south and east, comprised the sub-group of the Cahita language classification. The Cahita lands covered a coastal stretch about 120 kilometers (75 miles) wide inland from the coast and ran from just north of the Río Yaqui to just south of the Río Sinaloa (Map III).

The Indians practiced a form of simple inundation agriculture which utilized diversion dams and shallow canals. Their crops mainly consisted of maize, squash, beans, pumpkins, agave, and prickly pear cactus. The yields were good and were sufficient to support the population. The importance of this early dependence on agriculture by a sedentary population is that a firm base for future crop cultivation existed even before the arrival
of the Europeans. This form of Indian agriculture formed the foundation upon which the modern irrigation district was built.

The Spanish Entradas

In 1519 Hernando Cortés began the Spanish conquest of Mexico, and, by late 1521, the Aztec empire had crumbled, and central Mexico was under Spanish rule. Attention soon turned to Nueva Galicia, or the northwest frontier, which was named after the northwest province of Spain.

Cortés made several attempts to secure lands on the northwest frontier of New Spain, but both those undertaken by his lieutenants and by himself failed. His contemporary and rival Nuño de Guzmán was more successful.

The first expedition into Sinaloa in the northwest of Nueva Galicia was led by Nuño de Guzmán, who left Mexico City in 1529. He razed the Indian villages and enslaved the population along his route, establishing four presidios (military towns), one of which, San Miguel de Culiacán (1531), was to serve as the departure point for all future expeditions northward. Guzmán also introduced into the northwest the Spanish institution of the encomienda, within which influential soldiers were paid in
grants of Indian labor and tax rights to Indian villages. The *encomienda* was a land grant, in effect, with the added bonus of a convenient labor force. Both the Mocorito and Fuerte river valleys (Map III) were given in *encomienda* by Guzmán to his soldiers.

Spanish activity in Nueva Galicia during the rest of the period was limited to exploratory expeditions due primarily to a lack of manpower. Diego de Guzmán (no relation to Nuno) visited both Mayo and Yaqui Indian villages in 1533 and ventured northward into Pima territory, where he reported viewing a recently Yaqui-sacked village on the upper Río Yaqui (Map III). In 1539 Fray Marcos de Niza traveled from San Miguel de Culiacán, later called simply Culiacán, to north of the Río Sonora (Map III) and brought back reports of the existence of the Seven Cities of Cíbola. In 1540 Coronado set off in search of the Cities, establishing a short-lived *presidio* near the present town of Ures (Map III). Although no "golden" cities were found, Spanish knowledge of the Northwest was increased greatly. The last expedition of the period was by Ibarra who traveled into the lands of the Ópatas, north-east of the Río Sonora, and established the route along which the missions were later built, the *Camino Real* (Royal Road).
The immediate prerequisite to the establishment of the missions, which became the main colonizing force in northwest Mexico, was the arrival of the Jesuit Order in 1590. They were given the responsibility of subduing and converting to Christianity all the peoples north of the Río Sonora. Thus, the foundation was established for the conquest of northwest Mexico by the end of the sixteenth century.

The Colonial Period

At the time that the Jesuits arrived in the new frontier, the governor of Sinaloa was Diego Martínez de Hurdaide. He directed the mission to become the primary vehicle for extending Spanish rule northward in Nueva Galacia. The first missions were established near Ocoroni (Map III) on the Río Sinaloa, and by 1605 the first mission on the Río Fuerte was built. Hurdaide then led a vigorous campaign in the area of the lower Cahitas, and soon eight missions were operating north of the Río Fuerte.

The strategy of expansion was to build successive missions along the Camino Real between the coast and the foothills to the east. "River by river, valley by valley, the Spaniards during the first quarter of the seventeenth
century, advanced up the coastal region: the Sinaloa, Fuerte, Mayo, Yaqui..." 5 "Thus the individual mission site was chosen with frontier military factors in mind." 6 Missions in the Mayo area were not established until 1614, and pacification measures required the force of arms from 1604 until 1617, when the Yaquis asked for a mission in their area after they had defeated Hurdaide in a skirmish. This was done only to forestall the repercussions which surely would have followed had they not capitulated, 7 but the establishment of the mission meant the virtual end to independence.

Fortunately for the missionaries, the cultivation of crops in the new realm was readily achieved since the Cahitas had practiced their own form of simple sedentary agriculture. Thus, adaptation to the more sophisticated European techniques was quick, and many missions soon became self-sufficient economic units.

Although life in the missions was less harsh for the Indians than under the encomienda system, the results were similar—the Indian civilization degenerated, both in a decrease in population and a deterioration of culture.

Encroachment onto Indian land by the early settlers occurred on a small scale until 1684 when one of Mexico's richest silver deposits was discovered near Alamos
(Map III). Shortly thereafter the huge influx of Spanish miners and farmers began to disrupt the previous relative tranquility by appropriating large sections of Indian property and raiding the Indian villages and missions for Indian labor. It is significant that even with these handicaps the Yaqui farms were so productive that they provided a surplus of grain for the mines as well as for the new missions, both in Baja California and Sonora. 8

A major conflict soon developed between the landed aristocracy and the Jesuit missionaries who had maintained a paternalistic relationship with their charges. The civil authority sided with the miners and farmers against the Jesuits, who were also simultaneously experiencing attacks from other fronts, and the Order was eventually expelled in 1767. After this, the situation in Sonora could only deteriorate further.

Later, A Mayo revolt precipitated by the Church-State strife gained Yaqui support and was fought in both river valleys, resulting in the deaths of 5,000 Indians and 1,000 Spaniards. Hurdaide quelled the uprising and there were no further major disturbances during the period. The Indians only protectors, the Jesuits, having been expelled, this left the farmers and miners free to exploit Indian land and labor.
Population figures at the end of the eighteenth century show that the Indian villages had been reduced from their pre-colonial high of 60,000 to approximately 25,000, and that the white population was now about 13,000 of which more than half were living in Alamos and the surrounding area. Other than in the missions, now being run by the Franciscan Order, there was practically no white settlement in the Cahita area.

The National Development Period

The national struggle for independence had little effect in northwest Mexico as "the War for Independence meant little to the Cahitans." However, the aftermath had the effect of creating an almost constant state of conflict between the Yaquis and the Mexican Government for the next century.

The Constitution of Mexico brought two practices into operation that were counter to Indian custom, taxes and citizenship. Taxes meant surrendering a portion of their yields each year to the despised government and citizenship meant an end to autonomy. When the Mexican Government attempted to assert its authority, the Yaqui Wars resulted.
There were five major outbreaks by the Yaquis. The first in 1825 was an attempt to create a separate Indian state in northwest Mexico. A local leader named Banderas organized resistance but was ultimately captured and executed in 1834, and only sporadic skirmishes occurred until 1838. The main result of the rebellion was the garrisoning of a permanent military detachment in the largest Yaqui Indian village, Pótam (Map III).

The second revolt was precipitated by a rivalry between two antagonists for the Governorship of Sonora, Manuel Gándara and General Pesqueira. Gándara originally armed the Yaquis in 1838, 1840 and 1842 to defeat an opponent named Urrea. When Gándara later lost the election to General Pesqueira, he quickly re-armed the Yaquis under the leadership of an Indian called Marquín and fomented a major rebellion which lasted from 1856 to 1859. An end to hostilities occurred only after Gándara was captured and federal troops were called in. Marquín, however, was spared and remained a leader of the Yaquis. Gándara, although failing to achieve his own goal, succeeded in distributing Indian lands to nearly 6,000 Mexican colonists in the area between the Río Yaqui and Río Mayo.

The French were the cause of the third Yaqui uprising. During their invasion of Mexico, French commanders
defeated Pesqueira at Guaymas (Map III) in 1865 with the assistance of the Cahitas under the direction of Marquin. Soon, however, with the ultimate expulsion of the French, the Yaqui and Mayos, without the logistical support and organization of the French armies, were quickly routed by the superior forces of Pesqueira. Coincident with the French withdrawal was one of the worst floods ever reported on the Río Mayo. It entirely destroyed the Mayo villages of Navojoa and Etchojoa (Map III), thereby virtually cutting the Cahita rebel forces in half. Pesqueira's victory was great enough to sustain calm in the Valle del Yaqui for the next several years, and further colonization of the Indian lands continued.

The fourth Yaqui War was touched off by the news that Pesqueira's son had succeeded his father to the governorship. A local alcalde mayor (the combined office of mayor, municipal judge, and commander-in-chief of the militia) in Tórim, called Cajeme, organized resistance in conjunction with the Mayos. Minor raids began in 1869 and a full revolution was soon forthcoming. The last battle was fought in the hills north of Tórim and was called the Battle of Buatachive (Map III). The Yaquis again fought the decisive battle alone as the Mayo villages were suffering from a smallpox epidemic. More than 200
Yaquis were killed and 2,000 were taken prisoner; the remaining Indians fled into the mountains.

By the end of the fourth revolt Yaqui resistance was becoming noticeably weaker. Colonization of the Indian lands was proceeding rapidly. The land reform measures of President Benito Juárez were concerned not only with the redistribution of ecclesiastical properties, but also with the lands of the mestizo pueblos and the Indian communal holdings. Between 1877 and 1893, 4,501 individual titles were allotted, representing nearly 240,000 hectares, which had been held in common in the Mexican State of Sonora. Most of this land was previously Indian land.

The Conant Concession, the precursor to the modern Río Yaqui Irrigation District, was granted in 1890 to a group of financiers headed by Carlos Conant Maldonado, and just one year prior to this...

...the Scientific Commission of the State of Sonora, working under military guard, proceeded with the survey of lands and planning of irrigation canals to water land on both sides of the river.

Further aiding colonization in the Valley was the completion of the railroad from Guaymas to Los Mochis in 1891.

The final major Yaqui War began in 1890 when a local leader called Tetabiate conducted raids on the surveyors and railroad workers in the area. The raids waned for a
while in 1897 and 1898, but a major rebellion was under way in 1899. The Mexican Army was enlisted and it cordoned off the rebel area, consolidated the Yaqui insurgents into one area, and soundly defeated the last major contingent of Indians in early 1901.

Major Yaqui resistance ceased after Tetabiate's defeat. In addition to the depredations wrought by the Mexican Army, three other ongoing processes were at work depleting the Indian population: deportation of Indians by enforced enlistment in the army; deportation of the Indians through sale "...at sixty pesos a head to henequen plantation owners in Yucatan and sugar field owners in Oaxaca;"\textsuperscript{16} and "a great emigration of Yaquis [resulting] from attempts to avoid deportation."\textsuperscript{17}

In 1904 a large portion of the aforementioned Conant Concession was ceded to the Richardson Company as partial compensation for their work on the railroad in the Valle del Yaqui. Conant had developed a plan of major canals and drains and had developed the land through the Sonora and Sinaloa Irrigation Company. However, the firm went bankrupt in 1902, forcing the eventual transfer of its developments to the Richardsons.

The Richardsons were three brothers from the United States who had generated operating capital from earlier
investments in Mexican mines obtained in 1887. By 1910 they had built nearly 40 kilometers (25 miles) of main canals and another 80 kilometers (50 miles) of lateral or subsidiary canals. By 1913 they had developed 11,000 hectares (27,170 acres) of irrigated land.\(^{18}\)

By the end of the nineteenth century, the Yaqui menace had been virtually eliminated, immigration of Mexican colonists into the Valley had accelerated, and extensive irrigation works had been erected on the lands adjacent to the river.

**Revolutionary-Post Revolutionary Period**

The disturbances of the Mexican Revolution between 1910 and 1917 had little direct effect on the Valle del Yaqui. The most important effects were to be seen later in the 1930's with the land re-distribution programs and *ejido* system (Chapter V). The Indians viewed each new administration as only another variation of the previous situation. Thus, the Yaquis continued to be a minor problem until 1927, and the Army continued to respond by imposing pacification measures. By 1920 the only remaining viable Yaqui village was Pótam.

In 1926 the Mexican government bought out the Richardson family for six million American dollars\(^{19}\) and began
to distribute the lands to Mexican farmers. By then, over 28,500 hectares (70,400 acres) were under irrigation, and the three main canals were being enlarged and reinforced (Map IV).

During the two decades which followed World War I foreigners, predominantly Americans and Germans, colonized and developed the Yaqui delta farm lands. Some of these foreign farmers held very large properties while others participated in the development of agricultural commerce in Ciudad Obregón and other population centers in the Valle del Yaqui.

In 1935 the Distrito de Riego del Río Yaqui, Sonora, Número 41, was formed out of the territory between the Yaqui and Mayo rivers and lands immediately north of the Río Yaqui. In 1939 Mexican President, Lázaro Cárdenas, acknowledged limited autonomy of the Tribu Yaqui on their former lands north of the Río Yaqui. These are the only Indian lands now in the Irrigation District (Map IV).

Summary

The historical geography of the Valle del Yaqui has focused on three interrelated trends in its development: the removal or pacification of an hostile indigenous population by a succession of Spanish and Mexican authorities;
The Yaqui Boundary District Valley is made up of Ejido land and Yaqui Indian Lands. Boundaries are marked by a contour interval of 5 meters.

Source: Dirección General de Estadística, VIII Censo General de Población, 1960, p. XXIII; Secretaría de Recursos Hidráulicos, Distrito de Riego, Río Yaqui, Sonora, frontispiece; Pfeiffer, Sinales und Sonora, p. 440.
the development of a modern community and its incorporation into the mainstream of the Mexican economy; and the utilization of the Valley in agricultural modes, beginning with the Indians and ending with the contemporary irrigation district. Chapter IV continues with an analysis of the present condition of the District.
Footnotes for Chapter III

1. The majority of this chapter is taken from Sauer's *The Aboriginal Population of Northwest Mexico; Distribution of Aboriginal Tribes and Languages in Northwest Mexico; Road to Cibola;* and Spicer's *Cycles of Conquest* and *Potam*. These works undoubtedly provide the best historical data for the northwest region of Mexico.


3. Sauer used language classifications to differentiate between the different Indian tribes and peoples in his works.

4. The Seven Cities of Cibola caused excitement because they were reported to be made of gold. Although such reports later proved false, exploration of the northwest area of Mexico was vigorously pursued by persons searching for wealth.


11. In addition to Spicer and Sauer, Dabdoub also provides information for this section. His *Historia del Valle del Yaqui* constitutes the main source for this section.
CHAPTER IV

RECENT DEVELOPMENT AND AGRICULTURAL PRODUCTION IN THE VALLE DEL YAQUI

Introduction

The Río Yaqui Irrigation District (Map II) has evolved from a humble beginning as an off-shoot of the Richardson Company's holdings to become the number one irrigation district in all of Mexico, in both area cropped and total value of crop. All this was accomplished within the past twenty-five years. The building of a complex irrigation network, organization of institutions and associations, and utilization of modern farming techniques have all played vital roles in effecting this result.

The Irrigation Network

Four dams have been built on the Río Yaqui and its upstream tributaries, and these, along with the attached network of supply canals and drainage trenches, comprise the irrigation system.

The first large-scale water control on the Río Yaqui
was the Hornos diversion dam built in 1911 (Map II). Its main function is to divert water from the river into the Canal Principal Bajo (Lower Main Canal), but it also stores a small amount of water, about three million cubic meters (2,432 acre-feet). Hornos Dam was built by the Richardson Brothers, but it still fulfills its original functions and remains an integral part of the present network.

In 1935 the irrigation district was formed, incorporating much of the area between the Río Yaqui and Río Mayo. Federal funding was then available to build the second dam of the system, La Angostura, which was constructed between 1937 and 1941 under the supervision of the Comisión Nacional de Irrigación.² The dam was built on the Río Bavispe about 130 kilometers (81 miles) upstream of the junction of the Bavispe and Yaqui rivers (Map I). It has a storage capacity of 856 million cubic meters (693,970 acre-feet) and was built at a cost of 20 million pesos (4.17 million dollars).³

The next dam built was the Alvaro Obregón Dam, constructed between 1947 and 1953. It has a storage capacity of 2.9 billion cubic meters (2.35 million acre-feet). Hydroelectric facilities with a 20,000 kilowatt per hour capacity were also built into the dam. Obregón Dam is
located on the Rio Yaqui about 65 kilometers (40 miles) north of Ciudad Obregón, the commercial center of the Valle del Yaqui.

The last dam, Plutarco Calles, was built in 1963 and is located on the Rio Yaqui upstream from the Obregón Dam (Map I). Its primary function is the generation of electric power for the Valley, and its output is rated at 90,000 kilowatts per hour. In 1968 further refinements were added to the Obregón and Angostura Dams which created an additional 300 million cubic meters (243,214 acre-feet) of water storage capacity to the system. The total water storage of the system is approximately 7,168 million cubic meters (a little more than 5.8 million acre-feet).

Each successive addition or refinement to the system has increased the irrigated land by a significant amount. In 1911 only 10,000 hectares (24,710 acres) were irrigated, and the sole source of water was the Hornos Dam. The building of La Angostura increased the area to nearly 60,000 hectares (148,200 acres). Later, the completion of the Obregón Dam brought the total to 190,000 hectares (469,300 acres), and the additional improvements of 1968 added more than 30,000 hectares (74,100 acres), bringing the combined total to 220,000 hectares (543,400 acres) of irrigated land in the District today.
The individual farms depend on a system of canals and drains that transfers the water from the dams to the plots and removes the runoff. There are three main canals, the Alto, Bajo, and Díaz (Map II). The main canals together have a length of over 230 kilometers (144 miles) and have an irrigation potential of almost 250,000 hectares (617,500 acres). From these three main canals run 770 kilometers (481 miles) of primary lateral canals, off of which run an additional 1295 kilometers (809 miles) of secondary supply canals which ultimately deliver the water to the farmers' plots.

In addition to the water obtained from the Río Yaqui, farmers of the District have another 275 million cubic meters (222,942 acre-feet) of water available from wells, most of which are privately owned (Figure 4). The Secretaría de Recursos Hidráulicos branch office in Ciudad Obregón (Figure 3) estimates that there are 2,865 million cubic meters (2.32 million acre-feet) of water available for use in the irrigation district each year. 5

The District is governed by the Comité Directive del Distrito Río Yaqui (Board of Directors of the Yaqui River District) which is composed of the executive director (who is always the manager of the local branch of the Secretaría
Figure 3. The Secretaría de Recursos Hidráulicos Branch Office in Ciudad Obregon. This building is the headquarters of the Distrito de Riego Numero 41, Río Yaqui.

Figure 4. Exploration for alternate sources to gravity flow stream water is a major function of Secretaría de Recursos Hidráulicos. Although most wells are privately owned, new wells, such as this one, are now being drilled under the authority and under the control of the District.
de Recursos Hidráulicos); the executive secretary (who is always an agent of the Secretaría de Agricultura y Ganadería de Sonora [Sonoran Department of Agriculture and Livestock]); and various water-user group and local bank representatives.

Agricultural Credit

The credit union and the federal banking system provide the two most frequently used sources of agricultural credit. Three agricultural credit unions exist in the Valley, the Unión de Crédito Agrícola de Cajeme 6 (Cajeme Agricultural Credit Union), Unión de Crédito Agrícola Yaqui (Yaqui Agricultural Credit Union), and Unión de Crédito Agrícola e Industrial del Noroeste (Northwest Agricultural and Industrial Credit Union). These unions are composed of local farmers and ejidatarios in the District and are locally operated.

Agricultural credit is also available through two government banks, the Banco Nacional de Crédito Ejidal (National Ejido Credit Bank) and the Banco Nacional de Crédito Agrícola (National Agricultural Credit Bank). These institutions offer credit to ejidatarios and private farmers who cannot obtain credit from the credit unions. Both banks are federally regulated, not only through the
Banco de México (Bank of Mexico) but also through the Secretaría de Agricultura y Ganadería.

Private banks also supply credit to the more prosperous farmers, both those with privately held farms and those on ejidos.

Agricultural Organizations and Associations

A number of important federal, state and local organizations facilitate farming operations within the District by developing and instituting experimental and protective measures. The most important of these is the Centro de Investigaciones Agrícolas del Noroeste (Northwest Agricultural Experiment Center), or CIANO (Figures 5 and 6). Originally organized by Sonoran Governor Rodolfo Elias Calles in the early 1930's, CIANO's primary function is the development of improved varieties of both crops and livestock. CIANO introduced all the new hybrids of cotton and wheat which are now being grown in the District and has been the main force in both importing the new cash crops in the Valley and teaching District farmers in the proper techniques of operating in the new cash crop economies. For example, the latest result of CIANO research was the development of a cotton-wheat-soybean crop rotation cycle, the best yet devised for the Valle del
Figure 5. The CIANO research park located south of Ciudad Obregón in the District. CIANO conducts the majority of agricultural research in the Valle del Yaqui.

Figure 6. The mural in the foyer of the CIANO office building depicts the basic philosophy behind CIANO: improved production through agricultural research.
Yaqui from the standpoints of high yield, profitability and soil revitalization. CIANO also conducts subsidiary research in associated areas, such as developing chemical fertilizers. In 1954 CIANO introduced the use of nitrogenous fertilizers to aid soil replenishment and in 1960 promoted the utilization of phosphoric fertilizers.

CIANO is funded by the Sonoran and federal governments and the Rockefeller Foundation, and it is under the auspices of the Sonoran Secretaría de Agricultura y Ganadería. The results of the research at CIANO are published regularly, and its recommendations are usually put into immediate practice by the farmers and ejidatarios of the District, although this is not required by law.

Another important organization is the Comité Estatal de Fomento y Defensa de la Ganadería (State Committee for the Development and Protection of Livestock) (Figures 7 and 8), the purpose of which is to inspect livestock, quarantine diseased animals, vaccinate livestock, and enforce livestock regulations.

In the District several semi-official associations exist the primary purposes of which are commodity promotion and mutual assistance. The Patronato para la Investigación, Fomento y Defensa de Agricultura de la Región del Distrito del Valle del Río Yaqui (Yaqui River
Figure 7. Holstein cattle, representative of the local dairy industry, here being held in an inspection yard operated by the Comité Estatal de Fomento y Defensa de la Ganadería.

Figure 8. The tank holds a disinfectant for diseased cattle at a railroad inspection station. The sign reads: "State Committee for the Development and Protection of Livestock Campaign Against the Cattle Tick, Government of the State of Sonora."
Valley District Association for the Research, Protection, and Development of Agriculture) is the main crop-farmers' association of the District and was formed originally as a pest control alliance. A similar but newer group is the Patronato de Agricultores del Valle del Yaqui (Yaqui Valley Farmers' Association). Livestock ranchers promote their interest through the Ganaderos Asociados (Associated Ranchers) which has had considerable success in rapidly enlarging the previously low number of ranching concerns.

The final type of recognized organization is that formed by the federal government, but managed by the local banks. Government sponsored technical-agricultural training programs, promoted through the banks, provide the banks' clients with specialized training to which they would normally not have access.

In many cases loan procurements hinge upon mandatory enrollment in courses geared to improving agricultural conditions by those loan applicants who would otherwise have the least chance to succeed at farming. Both the loans and the training programs are underwritten by both the Secretaría de Agricultura y Ganadería and the Banco de México.
Marketing of District Agricultural Produce

The Mexican economic system parallels that of the United States, for the most part, utilizing the free enterprise system to promote the production of goods and services and the marketing of these same goods and services to the general populace.

Two federally owned corporations, however, operate to control the economy to a limited extent, much as the now defunct Commodity Credit Corporation of the United States once did by providing for some artificially produced price competition and some anti-monopolistic measures in the distribution of produce. These two corporations are the Compañía Nacional de Subsistencias Populares (National Popular Subsistence Company), or CONASUPO, which tries to keep private enterprise stores from gouging buyers by "supply[ing] working class people with every basic consumption need at prices they can afford to pay," and Almacenes Nacionales de Depósito (National Storage Warehouses) which sells the farm produce to private processors and, in doing so, prevents hoarding and monopolistic practices.

Much of the local farm produce is processed in Ciudad Obregón. Flour mills, cotton gins, cottonseed oil
mills, and factories for the manufacture of poultry and cattle feed exist locally as does an important brewery which uses the locally grown barley crop.

The three main crops, wheat, cotton, and corn, go to markets outside the Valley. Mexicali, on the California-Baja border, constitutes the main corn market and also receives the produce from the burgeoning Valley beef industry. The wheat yields are transported to the interior of Mexico primarily for the manufacture of bread. The textile mills of Japan and Europe are the main recipients of the District's cotton production.

**Recent Agricultural Production**

Tables I and II present 1950 and 1960 agricultural data for Mexico, Sonora and the District. Figures 9 through 12 show graphically extracted information from the tables. Data for Mexico and Sonora for 1970 were not available when this study was undertaken, and the data for the District for 1970, which is examined in the next chapter, are based on different statistical criteria and are not comparable to data shown here.

Three important points are indicated by the data. First, significant gains were made between 1950 and 1960 in the District in regards to area, production, value and
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<th>Region</th>
<th>Crop</th>
<th>Area (ooo's of hectares)</th>
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<th>Production (metric tons)</th>
<th>(%)</th>
<th>Yield (metric tons per hectare)</th>
<th>Unit Price (pesos per metric ton)</th>
<th>Total Value (millions of pesos)</th>
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Source: Dirección General de Estadística, Tercer Censo Agrícola, Ganadero y Ejidal.
## TABLE II

AREA, PRODUCTION AND RELATED INFORMATION FOR LEADING CROPS FOR MEXICO, SONORA AND THE RIO YAQUI IRRIGATION DISTRICT FOR 1960

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<tr>
<th>Region</th>
<th>Crop</th>
<th>Area (%)</th>
<th>Production (%)</th>
<th>Yield (metric tons per hectare)</th>
<th>Unit Price (pesos per metric ton)</th>
<th>Total Value* (millions of pesos)</th>
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<td>32.2</td>
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<td>1</td>
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<td>.9</td>
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<tr>
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<td>84</td>
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<td>181.9</td>
</tr>
</tbody>
</table>

*Peso values are adjusted to 1950 par value equivalents

Source: Dirección General de Estadística, Cuarto Censo Agrícola, Ganadero y Ejidal.
Figure 9. Percentage of total crop area occupied by corn, wheat, and cotton by division for 1950 and 1960.

Source: Tables I & II.

Figure 10. Percentage of total crop production for corn, wheat, and cotton by division for 1950 and 1960.

Source: Tables I & II.
Figure 11. Percentage of total crop value for corn, wheat, and cotton by division for 1950 and 1960.

Figure 12. Crop yield in metric tons per hectare for corn, wheat, and cotton by division for 1950 and 1960.

CORN

WHEAT

COTTON

Percentage

Metric tons per hectare

1950
1960
M = Mexico
S = Sonora
Y = Rio Yaqui District
yield as shown in Figures 9 through 12, and these gains exceeded those registered by Sonora and Mexico in the comparable categories. Second, comparable statistics from Tables I and II show that the District's area, production, yield, unit price and value are superior to those of Mexico and are either equal to or superior to those of Sonora. Third, the District has progressed more rapidly toward an emphasis on the new cash crops, such as sesame and soybeans, than has either Mexico or Sonora.

An example of the importance of Yaqui agriculture in the economy of the nation of Mexico is shown by the following:

From 1950-57 Mexico's wheat production doubled, the increase came almost entirely from the State of Sonora where production is largely concentrated in the Yaqui and Mayo districts.\textsuperscript{11}

Mid-decade data show that the District has now become the number one agricultural district in Mexico in regards to area cropped and total value of the crop.\textsuperscript{12} In percentages, the District is credited with 2.5 percent of Mexico's production which is valued at 3.4 percent of the nation's crop value and grown on only 1.0 percent of the country's crop land in 1960.

\textbf{Summary}

The District evolved from its early status to become
the most highly productive irrigation district in Mexico. The firm base provided by the natural and historical factors have been significantly aided by the development of the contemporary irrigation district. The basic landscape has been modified by the building of the irrigation network and dams and water resource management; the availability of sufficient capital for agricultural loans at relatively low interest rates; and the benefit of all the research, training and information centers provided by the government and mutual assistance organizations and associations.

In addition to the above changes created by the formation of the District, the direction which this agricultural arrangement orients itself also accounts for the transformation of the original cultural and economic landscape. The selection of high profit yielding crops as opposed to the traditional corn and beans subsistence crops is in itself a modification of Mexican agriculture. Additionally, the orientation of these crops toward export within and outside the country is a further modification.

The combination of these physical, cultural and economic modifications produced by the formation of the District thus resulted in the ascendance of the Distrito
de Riego del Río Yaqui as the number one irrigation district in the Republic of Mexico.
Footnotes for Chapter IV


2. The material for this section is primarily contained in two works, both Mexican government publications, Estado de Sonora, Proyecto de Programa de Gobierno de Estado de Sonora, and Secretaría de Recursos Hidráulicos, Distrito de Riego Número 41, Río Yaqui, Sonora.

3. Based at the 1941 rate of exchange, 4.85 pesos to the United States' dollar.

4. By comparison, Hoover Dam in the southwest United States has a storage capacity of approximately 31 million acre-feet.


6. Cajeme is the name of the municipio (county) in which the city of Ciudad Obregón and part of the District are located.


10. Ibid.


CHAPTER V

CONTEMPORARY LAND TENURE IN THE VALLE DEL YAQUI

Introduction

The development of the agricultural lands of the District has been generally a scenario of the mexicanization of Indian land. In 1937, the ejido system was introduced into the Valley and thereby produced a variation of the land tenure. This chapter examines the two systems of land tenure, private property and the ejido, which predominate in the District and compares their agricultural data.

The Valle del Yaqui Ejidos and the Ejido System

The ejido is a communally held land grant which resulted from revolutionary land holding reforms which redistributed much of Mexico's agricultural land. This grant is usually made to a village and can be initiated by petition to the federal government by no fewer than twenty persons.¹

Two manifestations of the ejido developed, the individual and the collective. In the individual ejido
(denoted by the single word "ejido") the grant is divided into separate parcelas, or plots, which are individually farmed by the ejidatario (ejido farmer) although ownership still resides with the village. In the ejido colectivo (collective ejido) the land is owned, farmed and controlled by the village as a single entity. It is important to note that in both forms there is a tendency towards cooperation, although much more pronounced in the ejido colectivo. The number of collective ejidos has always been small, and few exist today, probably due to the high degree of cohesiveness needed to operate a large area of land effectively.

Besides village ownership, the ejido differs from private property significantly in two other aspects. First, hired help is not legally allowed for the production of most crops (this would be exploitation of the working class, which is specifically prohibited in the Mexican agrarian law) and one of parcelas can be passed on only to the eldest son (this was developed to prevent fracturing of valuable farm land).

Ejidos first appeared in the Valle del Yaqui in 1937, and were created out of previously held private property that exceeded the legal area of 100 hectares.
Land that was available for ejido grants included all land within a seven kilometer (four and a half mile) radius of the village center. In the Valle del Yaqui:

A permanent irrigation area of 17,000 hectares (42,000 acres) and 30,000 hectares (75,000 acres) of temporarily irrigated land was granted to 2,160 ejidatarios, organized into 14 ejidos. Since then, the Valle del Yaqui ejidos have grown in number from 14 to 42 and now occupy 34 percent of the total land in the irrigation district. A few collective ejidos have existed in the District from time to time, especially during the early years of the District's formation. However, all ejidos presently operate as individual ejidos.

Private Property in the Valle del Yaqui

Private property did not exist in the Yaqui Valley until the establishment of the missions among the Indian villages. This occurred in 1614 for the Mayos and 1617 for the Yaquis. Indian land was held in common and the notion of private property was unknown.

Shortly after the establishment of the missions, the encomienda system was founded and private land tenure in the Valley. Today, private property occupies 66 percent of the land in the District.
Comparison of Ejido and Private Properties

Data obtained from the Distrito de Riego office affords a direct comparison of the results of the different types of land tenure. Tables III through VIII present the most recent available (at the time of research) and are used in the ensuing discussions.

Location, Population, Area and Distribution

Map IV shows the location of the ejido and private property in the irrigation district. Table III names the ejidos, gives their populations, and approximates their areas. Data for the separate parcelas and the separate private plots were not available. However, the number and sizes of the properties are shown in Table V.

The population of the District is estimated to be 75,000.

<table>
<thead>
<tr>
<th>Tenure Type</th>
<th>Ejido</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Population</td>
<td>45,950</td>
<td>29,080</td>
</tr>
<tr>
<td>Total Properties</td>
<td>4,311</td>
<td>3,615</td>
</tr>
<tr>
<td>Average Population/Property</td>
<td>10.66</td>
<td>8.04</td>
</tr>
</tbody>
</table>

Source: Secretaría de Recursos Hidráulicos branch office in Ciudad Obregón.

The breakdown of population by tenure type is 61 percent ejido, 39 percent private.
### TABLE III
**POPULATION AND APPROXIMATE AREA OF THE RIO YAQUI EJIDOS BY MUNICIPIO, 1970**

<table>
<thead>
<tr>
<th>Municipio</th>
<th>Ejido</th>
<th>Population</th>
<th>Area (hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacum</td>
<td>Agrarista de Cd. Obregón</td>
<td>n.a. *</td>
<td>2,700</td>
</tr>
<tr>
<td></td>
<td>Atotonilco</td>
<td>671</td>
<td>2,300</td>
</tr>
<tr>
<td></td>
<td>Bacum</td>
<td>2,110</td>
<td>1,900</td>
</tr>
<tr>
<td></td>
<td>Bateve</td>
<td>n.a.</td>
<td>1,300</td>
</tr>
<tr>
<td></td>
<td>Francisco Javier Mina</td>
<td>n.a.</td>
<td>4,100</td>
</tr>
<tr>
<td></td>
<td>Independencia</td>
<td>231</td>
<td>1,200</td>
</tr>
<tr>
<td></td>
<td>Miguel Alemán</td>
<td>325</td>
<td>900</td>
</tr>
<tr>
<td></td>
<td>San José de Bacum</td>
<td>2,798</td>
<td>2,200</td>
</tr>
<tr>
<td></td>
<td>Tinajera</td>
<td>243</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>Villa de Guadalupe</td>
<td>n.a.</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>1 de Mayo</td>
<td>n.a.</td>
<td>3,500</td>
</tr>
<tr>
<td>Cajeme</td>
<td>El Aguila</td>
<td>213</td>
<td>1,700</td>
</tr>
<tr>
<td></td>
<td>Alvaro Obregón</td>
<td>234</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>Cajeme</td>
<td>n.a.</td>
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</tr>
<tr>
<td></td>
<td>Cuauhtémoc</td>
<td>1,667</td>
<td>2,500</td>
</tr>
<tr>
<td></td>
<td>Emiliano Zapata</td>
<td>n.a.</td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>Esperanza</td>
<td>92</td>
<td>1,800</td>
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<tr>
<td></td>
<td>Francisco I. Madero</td>
<td>746</td>
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</tr>
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<td></td>
<td>Guadalupe Victoria</td>
<td>317</td>
<td>1,000</td>
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<td></td>
<td>Hornos</td>
<td>518</td>
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<td>Cocorit</td>
<td>3,819</td>
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<td>José M. Morelos</td>
<td>1,040</td>
<td>2,300</td>
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<tr>
<td></td>
<td>Lázaro Cárdenas</td>
<td>309</td>
<td>2,000</td>
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<td></td>
<td>Progreso</td>
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<td>1,400</td>
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<td>Providencia</td>
<td>2,722</td>
<td>1,800</td>
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<td>Quechahuéca</td>
<td>2,827</td>
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<td>Tepeyac</td>
<td>95</td>
<td>1,200</td>
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<td>Teras</td>
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<td>Vicente Guerrero</td>
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<td>31 de Octubre</td>
<td>1,290</td>
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<td>Etchajoa</td>
<td>Bacame</td>
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<td>2,600</td>
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<td>Bacobampo 1, 2, 3</td>
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<td>Basconcobe</td>
<td>1,481</td>
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<td>Batevito</td>
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<td>Bayajorit</td>
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<td>El Buaraje</td>
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<td>Buaysiacobe</td>
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<td>Joaquín Amara</td>
<td>n.a.</td>
<td>400</td>
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*Not available in Census.*

Source: Compiled by author from Secretaría de Recursos Hidráulicos reports.
Table V presents the areal information of the two tenure types. The first observation is that, on the average, the private plots are twice as large as the **ejido parcelas**. The second observation is that the private properties follow abnormal distribution patterns, with the majority of the land being found in the larger categories (50.1 to 100.0 and 25.1 to 50.0) of area class. On the other hand, the **ejido parcelas** follow a generally normal distribution with the majority of land being found in the "middle" category (10.1 to 25.0), and the majority of the rest of the land being found in the two adjacent categories (5.1 to 10.0 and 25.1 to 50.0). The third generalization is that there is a wider range of property sizes (by average) in the private properties (3.23 to 102.0) than in the **parcelas** (4.36 to 60.50).

The reasons for this distribution are primarily due to historical precedent and federal law. The private properties were settled first and usually were organized to be as large as possible. **Ejidos**, with their **parcela** divisions, later developed, but they were subject to smaller maximum sizes according to the **Codigo Agrario**. Also, during the early years of **parcela** formation, the **ejidatarios** were subject to the delaying tactics of
<table>
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<th>Percent</th>
<th>Area (hectares)</th>
<th>Percent</th>
<th>Average (hectares)</th>
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<tr>
<td>or fewer</td>
<td>ejido</td>
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</tr>
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<td>hectares</td>
<td>ejido</td>
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</tr>
<tr>
<td>hectares</td>
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<td>-</td>
<td></td>
<td>-</td>
<td>-</td>
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<td>5</td>
<td>-</td>
<td></td>
<td>510</td>
<td>1</td>
<td>102.00</td>
</tr>
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<td>73,372</td>
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<td>3,615</td>
<td>100</td>
<td></td>
<td>141,190</td>
<td>100</td>
<td>39.06</td>
</tr>
</tbody>
</table>

Source: Data reports, Secretaría de Recursos Hidráulicos, Cd. Obregón.
government administrators partial to the desires of the private property owners. In addition, many private property owners were allowed to hold land in excess of the legal limit by these same officials. Consequently, there was no irrigated land at times for the formation of ejidos, and without access to water, the land was not productive, as the ejidatarios certainly could not afford to install their own irrigation system. One result of these legal and historical restrictions is that while there are 915 private properties in excess of 50 hectares, there are only six parcelas of such size.

The distribution of land in the District as shown in Map IV shows a number of patterns. One, the earliest formed properties (private properties in the majority) obtained the best land; in this case, the higher, better-drained land. Two, the ejido parcelas have at least one common border with an adjacent private property. Three, the parcelas are generally clustered. Last, the more newly formed properties are located on the fringes of the District.

The reasons for these areal distributions are, again, based on historical precedent and law. The earlier forming private properties obtained the best lands. When ejido legislation was enacted, the private land owners
with excess land logically kept the best portions and relinquished the poorest sections. Thus, the parcelas usually are located in the poorly drained areas. Since the ejido parcelas were formed out of private property, the majority of the ejidos border the private property out of which they were created.

Ejidos were restricted in their formation, but two or more villages could be "instantly" formed and six months later petition for an ejido grant. Since many such villages were in actuality simply neighbors, and since the lands yielded by the private property holders were usually connected, the ejidos formed out of the private property were themselves usually joined, "clustering" the ejidos during their formation. Both private properties and ejidos coming into existence today are being formed on the fringes of the District for two reasons: one, because all the irrigated land in the District is already owned, and two, because properties located outside, but adjacent to the District, may petition for admittance to the District. In fact, the canal distribution system has been so effective at times that the area located east of the District in the Municipio de Cajeme has become an unofficial "sub-irrigation district," and expands and contracts in size according to the volume of the Rio Yaqui, enlarging in
years of higher than normal rainfall. Fortunately, the management of the District is flexible and opportunistic enough to begin incorporating these areas into the formal District.

**Agricultural Machinery in the District**

Table VI shows the present situation regarding the ownership of machinery in the District. The major items of interest are the numbers of critical equipment and the relationship of the machinery to the properties.

Obviously, the private land holders own by far most of the equipment. This is a result of the amount of capital that can be used to purchase items, and the private property owners are usually much more financially stable than the *ejidatarios*. The distribution of the machinery, if done on a perfectly equable basis, would still put the *parcelas* at a disadvantage to the private properties. Only in numbers of corn huskers does the *ejido parcela* approach the private property. However, as previously mentioned, the *ejidatarios* cooperate to a moderate degree. In the Valle del Yaqui, there is a great deal of evidence that many of the more successful *ejidos* cooperate extensively and may even own the larger pieces of machinery in common. 10 The formation of the irrigation system into
### TABLE VI
**EJIDO AND PRIVATELY-OWNED MACHINERY IN THE RÍO YAQUI IRRIGATION DISTRICT, 1970**

<table>
<thead>
<tr>
<th>Machinery</th>
<th>Total ejido</th>
<th>Total private</th>
<th>Unit/parcela</th>
<th>Unit/property</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tractors</td>
<td>593</td>
<td>2,957</td>
<td>.14</td>
<td>.82</td>
</tr>
<tr>
<td>Sowers</td>
<td>826</td>
<td>2,057</td>
<td>.20</td>
<td>.57</td>
</tr>
<tr>
<td>Threshers</td>
<td>87</td>
<td>710</td>
<td>.02</td>
<td>.20</td>
</tr>
<tr>
<td>Corn Huskers</td>
<td>6</td>
<td>5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cotton Harvestors</td>
<td>4</td>
<td>247</td>
<td>-</td>
<td>.07</td>
</tr>
<tr>
<td>Mechanical Trenchers</td>
<td>87</td>
<td>612</td>
<td>.02</td>
<td>.17</td>
</tr>
<tr>
<td>Cereal Mowers</td>
<td>259</td>
<td>1,232</td>
<td>.06</td>
<td>.34</td>
</tr>
<tr>
<td>Cotton Balers</td>
<td>16</td>
<td>161</td>
<td>-</td>
<td>.05</td>
</tr>
<tr>
<td>Steel Plows</td>
<td>362</td>
<td>963</td>
<td>.09</td>
<td>.27</td>
</tr>
<tr>
<td>Harrows</td>
<td>626</td>
<td>1,859</td>
<td>.15</td>
<td>.51</td>
</tr>
<tr>
<td>Jeeps, Trucks</td>
<td>344</td>
<td>793</td>
<td>.08</td>
<td>.22</td>
</tr>
<tr>
<td>Portable Machinery</td>
<td>498</td>
<td>2,855</td>
<td>.12</td>
<td>.79</td>
</tr>
</tbody>
</table>

"user" groups has helped foster this union, besides the more obvious tendency to work together which is inherent in the ejido system. Thus, the statistical lack of machinery is ameliorated somewhat by internal sharing and cooperation.

The condition of most of the machinery on both ejido and private lands is excellent. Proper maintenance is a good indication that technical training and adequate supervision is being utilized on the District's properties. Most of the farm machines are modern and have a full complement of auxiliary devices (Figures 13 and 14).

Agricultural Production in the District

Tables VII and VIII give the 1970 production data for the ejidos and private properties in the District. Figures 15, 16 and 17 highlight this information graphically for the more important crops.

The most striking observation is the similarity of data between two contrasting types of properties, one highly independent, capitalistic, and having certain legal and historical advantages, the other more communal, restricted and disadvantaged through certain legal and historical precedents. Official reports show that the yields (Figure 16) and unit prices (Figure 17) are
Figure 13. A modern grain combine seen on the Quechahueca ejido. This large piece of farm equipment is a good example of the quality and condition of machinery found in the Valle del Yaqui.

Figure 14. Modern tractors towing farm wagons are a common sight in the Valle del Yaqui during harvest time.
identical, and this data are supported by Tables VII and VIII. This also accounts for the stability of the relationship between area, production and value statistics within the tenure type as shown in Figure 15. This is because of the simple mathematical ratio of unit price (value divided by production) and yield (production divided by area). In essence, this data have probably been adjusted to reflect this conclusion.

The second observation is that the **ejido** properties differ from the private properties in crop preference. The **ejido** farmers apparently prefer to grow more safflower and corn, whereas the private properties prefer cotton, sorghum and sesame (Figure 15). Both properties utilize wheat and soybean crops equally, as they reflect the same percentages in crop data as they do in the overall land percentages, that is, the **ejido** control 36 percent of the land, produce 36 percent of the total crop, and account for 36 percent of the total value of production; the crop information for wheat and soybeans shows the same data, so there is no statistical difference shown other than that produced by the land tenure division for these two crops. This preference produces no significant profit advantage for either tenure type over the other one, but it does indicate the equal acceptance of both types of a cash crop.
### TABLE VII

CROPS, AREA, PRODUCTION AND RELATED INFORMATION FOR THE RIO YAQUI IRRIGATION DISTRICT EJIDO PROPERTIES BY AGRICULTURAL SEASON FOR 1970

<table>
<thead>
<tr>
<th>Season Crop</th>
<th>Area (hectares)</th>
<th>Production (metric tons)</th>
<th>Yield (metric tons per hectare)</th>
<th>Unit Price (pesos per metric ton)</th>
<th>Total Value (millions of pesos)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WINTER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barley</td>
<td>9</td>
<td>29</td>
<td>3.20</td>
<td>900</td>
<td>.03</td>
</tr>
<tr>
<td>Linseed</td>
<td>1,167</td>
<td>2,567</td>
<td>2.20</td>
<td>2,150</td>
<td>5.52</td>
</tr>
<tr>
<td>Safflower</td>
<td>5,604</td>
<td>15,024</td>
<td>2.68</td>
<td>2,100</td>
<td>31.55</td>
</tr>
<tr>
<td>Wheat</td>
<td>46,989</td>
<td>178,887</td>
<td>3.81</td>
<td>800</td>
<td>143.11</td>
</tr>
<tr>
<td>Other</td>
<td>975</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>3.16</td>
</tr>
<tr>
<td>Total:</td>
<td>54,744</td>
<td>196,507</td>
<td>100</td>
<td>183.37</td>
<td>100</td>
</tr>
<tr>
<td><strong>SPRING</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton</td>
<td>13,923</td>
<td>36,005</td>
<td>82</td>
<td>2.59*</td>
<td>2,712</td>
</tr>
<tr>
<td>Sesame</td>
<td>344</td>
<td>212</td>
<td>1</td>
<td>.62</td>
<td>2,807</td>
</tr>
<tr>
<td>Sorghum</td>
<td>1,520</td>
<td>7,643</td>
<td>17</td>
<td>5.06</td>
<td>588</td>
</tr>
<tr>
<td>Other</td>
<td>99</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>.36</td>
</tr>
<tr>
<td>Total:</td>
<td>15,886</td>
<td>43,860</td>
<td>100</td>
<td>103.10</td>
<td>100</td>
</tr>
<tr>
<td><strong>SUMMER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alfalfa</td>
<td>610</td>
<td>9,157</td>
<td>10</td>
<td>15.02</td>
<td>350</td>
</tr>
<tr>
<td>AND Corn</td>
<td>10,220</td>
<td>32,254</td>
<td>33</td>
<td>3.16</td>
<td>875</td>
</tr>
<tr>
<td>PEREN- Sesame</td>
<td>6,457</td>
<td>3,977</td>
<td>3</td>
<td>.62</td>
<td>2,807</td>
</tr>
<tr>
<td>NIAL Soybean</td>
<td>24,519</td>
<td>50,387</td>
<td>54</td>
<td>2.06</td>
<td>1,950</td>
</tr>
<tr>
<td>Other</td>
<td>65</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.54</td>
</tr>
<tr>
<td>Total:</td>
<td>41,806</td>
<td>95,775</td>
<td>100</td>
<td>141.38</td>
<td>100</td>
</tr>
<tr>
<td><strong>YEARLY TOTAL:</strong></td>
<td>112,436</td>
<td>336,142</td>
<td>427.85</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*See footnote 11, p.

Source: **Secretaria de Recursos Hidráulicos**, Ciudad Obregón.
### TABLE VIII

**CROPS, AREA, PRODUCTION AND RELATED INFORMATION FOR THE RIO YAQUI IRRIGATION DISTRICT PRIVATE PROPERTIES BY AGRICULTURAL SEASON FOR 1970**

<table>
<thead>
<tr>
<th>Season</th>
<th>Crop</th>
<th>Area (hectares) (%)</th>
<th>Production (metric tons) (%)</th>
<th>Yield (metric tons per hectare)</th>
<th>Unit Price (pesos per metric ton)</th>
<th>Total Value (millions of pesos) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WINTER</td>
<td>Barley</td>
<td>200</td>
<td>640</td>
<td>3.20</td>
<td>900</td>
<td>.58</td>
</tr>
<tr>
<td></td>
<td>Linseed</td>
<td>1,245</td>
<td>2,739</td>
<td>2.20</td>
<td>2,150</td>
<td>5.89</td>
</tr>
<tr>
<td></td>
<td>Safflower</td>
<td>5,191</td>
<td>13,917</td>
<td>2.68</td>
<td>2,100</td>
<td>29.23</td>
</tr>
<tr>
<td></td>
<td>Wheat</td>
<td>89,714</td>
<td>341,541</td>
<td>3.81</td>
<td>800</td>
<td>273.23</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>2,246</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>7.59</td>
</tr>
<tr>
<td></td>
<td>Total:</td>
<td>98,596</td>
<td>358,837</td>
<td>-</td>
<td>-</td>
<td>316.52</td>
</tr>
<tr>
<td>SPRING</td>
<td>Cotton</td>
<td>20,160</td>
<td>52,134</td>
<td>2.59*</td>
<td>2,712</td>
<td>141.37</td>
</tr>
<tr>
<td></td>
<td>Sesame</td>
<td>824</td>
<td>508</td>
<td>.62</td>
<td>2,807</td>
<td>1.42</td>
</tr>
<tr>
<td></td>
<td>Sorghum</td>
<td>7,321</td>
<td>37,052</td>
<td>5.06</td>
<td>588</td>
<td>21.78</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>658</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2.34</td>
</tr>
<tr>
<td></td>
<td>Total:</td>
<td>28,963</td>
<td>89,694</td>
<td>100</td>
<td>-</td>
<td>166.91</td>
</tr>
<tr>
<td>SUMMER</td>
<td>Alfalfa</td>
<td>1,310</td>
<td>19,671</td>
<td>15.02</td>
<td>350</td>
<td>6.88</td>
</tr>
<tr>
<td></td>
<td>Corn</td>
<td>7,659</td>
<td>24,172</td>
<td>3.16</td>
<td>875</td>
<td>21.15</td>
</tr>
<tr>
<td></td>
<td>PEREN-</td>
<td>Sesame</td>
<td>7,762</td>
<td>4,903</td>
<td>.62</td>
<td>2,806</td>
</tr>
<tr>
<td></td>
<td>Soybean</td>
<td>51,496</td>
<td>105,824</td>
<td>2.06</td>
<td>1,950</td>
<td>206.54</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>529</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1.71</td>
</tr>
<tr>
<td></td>
<td>Total:</td>
<td>68,756</td>
<td>154,570</td>
<td>100</td>
<td>-</td>
<td>250.04</td>
</tr>
<tr>
<td>YEARLY</td>
<td>TOTAL:</td>
<td>196,315</td>
<td>603,101</td>
<td>-</td>
<td>-</td>
<td>733.47</td>
</tr>
</tbody>
</table>

*See footnote 11, p.

Source: Secretaría de Recursos Hidráulicos, Ciudad Obregón.
Figure 15. Percentage of crop area, production, and value, of district totals for selected crops by tenure type for 1970.

SAFFLOWER  WHEAT  COTTON  SORGHUM  CORN  SESAME  SOYBEANS  TOTAL

Figure 16. Yields for selected District crops for 1970.

SAFFLOWER  WHEAT  COTTON  SORGHUM  CORN  SESAME  SOYBEANS

Figure 17. Unit prices for selected District crops for 1970.

SAFFLOWER  WHEAT  COTTON  SORGHUM  CORN  SESAME  SOYBEANS

Source: Tables VII and VIII.
The last observation of these data is that of the author's personal opinion. These data, directly derived from official Mexican sources, are unreliable. Through direct observation, from discussion with District officials, and background information from general sources such as those listed in the Bibliography, this author cannot accept these data at face value. Taking into account the previous problem with data (see page 57 and footnote 11) and the exact duplication of data for the two tenure types, it is rather obvious that the information cannot be valid. Thus, the conclusions based on such data cannot be relied upon. It is the author's opinion that the data regarding the crop preference are correct and that the overall statistics are correct in regard to crop area. The rest of the data contained in Tables VII and VIII, however, should not be accepted as valid representations of fact.

Summary

Private property developed in the area now formed as the Rio Yaqui Irrigation District during the early years of the seventeenth century during the Colonial Period of Northwest Mexico history and came to be the single
significant form of land tenure by the end of the nineteenth century.

The aftermath of the Mexican Revolutionary Period of 1910-1917 saw the rise of the **ejido** system in Mexico. The **ejido** first appeared in the Yaqui Valley in 1937 and has developed into a second significant land tenure type in the District. It is also significant that during the past twenty years—a period during which both land tenure types have existed in the District—the Rio Yaqui Irrigation District has become the number one irrigation district in all of Mexico.

Significant differences in organization and goal exist between the two types, the **ejido** being developed primarily as a land redistribution system and having a loosely structured but highly restricted form by law of organization and operation, and the private property being independently owned, operated and managed.

Data regarding the comparisons of the two tenure types elicit the following conclusions: 1) the **ejido parcelas** generally have more people than do the private properties; 2) the private properties generally have larger properties, are located in better-drained areas, and are distributed with the majority of the properties having larger areas than the majority of the **parcelas**;
3) the private property owners generally have a great deal more machinery than do the ejidatarios, although this is ameliorated somewhat by the tendency toward cooperation within the ejidos; and 4) the private properties control crop land account for agricultural production and produce a total crop value of about two-to-one over the ejido parcelas. The official data present statistics that indicate that yields and unit prices for the ejidos and private lands are equal, but this was found to be invalid.

In the final analysis other sources must be consulted to ascertain the validity of the author's opinion regarding ejido and private property production data, which is that the ejidos, in general, cannot compete with the private properties. Only those ejidos which are large enough and which can incorporate a quasi-corporation organization and management can approach the private property. A few ejidos in the Valley operate (although illegally) as such, and these do compare favorably to the private properties. Support for this conclusion is produced in a number of sources (Dozier, Eckstein, and Brandenburg, for example), but Henderson probably states it best:

But where individual ejido parcelas are of moderate size and where...ejidos have been influenced by intelligent managers, farms have remained as productive as the larger private properties."
Footnotes for Chapter V

1. Laws regarding agricultural land are contained in the Código Agrario (Agrarian Code), a set of federal laws.

2. Private lands used for the production of cotton have a limit of 150 hectares. Dabdoub, Historia, p. 373.


4. Population figures were estimated by the author using both national census information for 1950 and 1960 and raw data from the Secretaría de Recursos Hidráulicos office.

5. Ejido size was obtained from two maps in the office of the Jefe de Irrigación (Irrigation Chief). Map IV is derived from the information contained in those maps.

6. Dabdoub makes the only reliable population estimate, but is for the Valley and its environs. He estimated this to be 163,000 in 1960 (Dabdoub, Historia, p. 368).

7. Although the generally topography of the Valley is flat, the local contour differs enough to affect drainage.

8. The few exceptions to this rule are ejidos which were created out of a former ejido, which may have become too large, lost its population due to inefficiency, or simply split into two separate ejidos because of the desires of the constituents.

9. For example, the cluster of ejidos located in the southeast part of the District comprises the most newly formed ejidos. Although this information is not inherent in the map itself, the information listed in the irrigation office yields this conclusion. Formation data were available only for the ejidos formed during the last twenty years.
10. This fact is supported by no written source but was directly observed by the author on his two trips to the District. Two ejidos were visited and were observed to share the more expensive machinery among the ejidatarios. The Jefe de Irrigación indicated that while the ejidos were not collective, the ejidatarios often purchased machinery together, since financing could not have been obtained singly by the ejidatarios.

11. To provide them a type of comparative measure the following crop yields are given for the Imperial Valley of Southern California, a prime agricultural region of the United States; all figures have been adjusted to compare with the Valle del Yaqui yields: Corn, 3.78 metric tons per hectare; Wheat, 4.18; and Cotton, .89.

Note that the cotton yield for the Imperial Valley is one-fourth that of the Valle del Yaqui. This inconsistency of the data is but one more indication that the data for the District is invalid. Obviously, the data for the District are unginned cotton, not the finished, exportable product.

CHAPTER VI

CONCLUSION AND FUTURE PLANS

Conclusion

The development of the contemporary irrigation district has depended upon a unique chain of events which directed the eventual disposition of the area toward agricultural production. These events produced landscape modification—physical, cultural and economic—which ultimately reflected the present situation of the number one agricultural district in Mexico, the Distrito de Riego del Río Yaqui.

The physical environment of the Yaqui Valley provides a contrasting picture. Although located in an arid, hot region, with little natural vegetation to suggest extensive agriculture, the area did have important natural prerequisites such as a level topography, high number of frost-free days, uniformity of climate, high insolation, and, being located in a river valley, a convenient water source and fertile soils.

This physical landscape was altered very early in
its human history by indigenous peoples who developed a simple form of irrigation, and thus instituted a form of sedentary agriculture, cultivating prickly pear cactus, agave, maize, beans, and squash, along with other native plants. This situation was dramatically modified by the Spanish invasion during the sixteenth century. In particular, the Jesuit missionaries, who later colonized the northwest region, were responsible for the introduction of European crops into the native economy and their subsequent cultivation, development, and production. Since the rudiments of farming were already known to the Indians, it was easy for the missionaries to educate the tribes in the more sophisticated techniques of growing crops on a large scale. These two events, the development of sedentary agriculture by the Indians themselves, and the introduction of large scale farming techniques into the Valley by the Jesuits, directed the eventual development of the modern irrigation district.

The next modification of the landscape was the gradual replacement of the Indian population with Spanish and Mexican colonists who began to transform the area into a modern settlement, principally to support the extensive mining operation located nearby. By the mid nineteenth
century another phenomenon was taking place, the invasion of foreign investors.

The Yaqui Valley area which was later to become the Rio Yaqui Irrigation District was first granted to the Conant consortium which founded the Sonora and Sinaloa Irrigation Company. During this same period other modifications of the landscape were taking place; the scientific commission surveyed the lands, the railroad was built from Guaymas to Los Mochis, and the final Yaqui War of importance was fought and decided.

The financial misfortunes of the Conant group led to bankruptcy, and the concession was picked up by the Richardsons in compensation for their work on the railroad. The Richardsons, during their tenure of the District area, constructed a great portion of the irrigation network extant today. They developed over 28,000 hectares (69,160 acres), built Hornos dam, and completed the three main supply canals.

In 1926 the Mexican Government bought out the Richardsons, and nine years later formed the federal irrigation district. The physical landscape was further transformed during the next four decades with the building of the dams, extension of the irrigation network, and development of the area into a manageable organization.
The subsequent modification of the political and economic landscape was marked by the evolution of CIANO and other advisory, research and regulatory organizations, the growth of Ciudad Obregón and participation of federal, state and local credit, management, and advisory agencies in the development of the Yaqui Valley.

A major modification unique to the Republic of Mexico was the introduction of the ejido system. Over one-third of the land in the District today is on ejidos, and a comparison of the two predominate land tenure types, private and ejido, demonstrated the following facts: one, the ejidos generally fare poorer than the private properties due to historical and legal precedents, and two, the larger, more efficiently run, but illegally operated, ejidos can compete favorably with the large private properties.

The development of the Rio Yaqui Irrigation District had been dependent on a definite series of events which modified the landscape in such a way as to direct and produce the modern irrigation district. This paper has attempted to extract from the physical, historical and contemporary data the essentials of this chain of events
and the modifications of the cultural, physical and economic landscape which resulted.

**Future Plans**

There are three items which currently comprise the future plans of the agricultural picture in the Río Yaqui Irrigation District: the aqueduct system, development of a beef cattle industry, and improvement of the Ejido-private property gap in production.

The most important and far-reaching of these plans is the Plan Hidráulico del Noroeste (Northwest Hydraulic Plan) or PLHINO. This plan calls for the construction of a permanent aqueduct connecting the major rivers of the Mexican northwest. It is intended to provide the arid Sonoran coastal plains with additional water supply from the more well-watered wet-and-dry tropical region to the south in Sinaloa. This program is under the direction of the Secretaría de Recursos Hidráulicos. As yet, however, no actual work has been done on the system past the planning state.

_Ganaderos Asociados_, the cattlemen's association of the Yaqui Valley, has been very persuasive and zealous
in promoting the beef cattle industry. There is a high demand for beef in the nearby beef-deficient markets of Mexicali and Tijuana, Baja California, and indications are that the Yaqui Valley area will soon become a major cattle raising area.

The progress that the ejidos have shown over the past twenty years indicates that, at least in the Yaqui Valley, they are no longer just a palliative for the masses, but constitute an integral part of agricultural productivity. However, their production level is not, and cannot, be equal to that of the private properties if the current legal restrictions continue. Many ejidos are beginning to follow the examples of the most successful ejidos and deliberately flaunt the law. This will continue in the irrigation district as long as the ejidos are successful. However, a series of failures would probably cause a return to the strict agrarian laws, and parity with the private properties would never be achieved.

The Rio Yaqui Irrigation District will remain a topnotch agricultural district for a long time. The problems it has will have to be solved, especially the problem with soil saltation, but with the benign physical
environment, the efficient management of the irrigation system, and dynamic flexibility to institute changes and plan ahead, the District should be able to function efficiently for many decades to come.
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Sources of Data Tables


Persons Interviewed

Carrillo Dávila, Alfredo. An employee in the Departamento de Agricultura Mixta (Mixed Agriculture Department), located in Hermosillo, who was the author's first contact in Mexico.

Mendoza Nava, Amador. Chief of the census department of the Secretaría de Recursos Hidrálicos in Ciudad Obregón, who assisted the author in the collection of current data.

Morales de la Cruz, Enrique. General manager of a privately owned ranch in the Yaqui Valley, who explained local marketing, planning and harvesting operations in the area.

Nuñez, César. An employee in the Departamento de Carne Clasificada (Meat Grading Department). He was the author's first contact in the Yaqui Valley and served as liaison between various officials and the author.