

SHIFTING PATTERNS OF SUGARCANE
PRODUCTION IN NORTHWEST ARGENTINA

DISSERTATION FOR THE
DEGREE OF Ph. D.

MICHIGAN STATE UNIVERSITY

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1975

This is to certify that the
thesis entitled

SHIFTING PATTERNS OF SUGARCANE
PRODUCTION IN NORTHWEST ARGENTINA

presented by

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has been accepted towards fulfillment
of the requirements for

PH. D. degree in GEOGRAPHY

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29 July 1975

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ABSTRACT

SHIFTING PATTERNS OF SUGAR CANE PRODUCTION
IN NORTHWEST ARGENTINA

by

David M. Jones

This study constitutes a comparative regional analysis of the two major sugar producing areas of Argentina, namely Tucumán and Salta-Jujuy. During the late 1960's an apparent shift occurred in sugar cane production northward from Tucumán to Salta and Jujuy. The objectives of the research were to determine the nature and extent of the areal shift in sugar production within these provinces, to isolate and weigh the factors contributing to this situation, and to analyse the effects. Features studied and compared in each area include: 1) physical conditions affecting production, such as water availability, soil characteristics, frost frequency and sun hours; 2) socio-historical factors, including land tenure systems, differences in population density and labor problems; 3) economic factors, such as production and processing techniques, transportation facilities, marketing arrangements, and capital availability; and 4) government policies affecting the industry.

The research period in Argentina extended from October, 1969, through August, 1970. Residence was established in San Miguel de Tucumán, but about forty-five days were spent in Salta and Jujuy. Within the study areas the principal techniques used in data collection were personal interviews, air photo interpretation, the study of published documents, and direct observation. The producing areas were delimited and mapped, and historical documents, interviews and personal notation revealed changes in land use patterns. A grid system of sampling allowed selective direct comparisons with data from 1965, a year of maximum cane cultivation. Interviews with about 110 cane farmers and more than fifty farm and factory workers were recorded. In addition, the sugar mills, twenty-one in number, were visited and data regarding each were collected from interviews with representatives of factory management.

Evidence of a shift in production after 1966 was overwhelming. Seven sugar mills in Tucumán province closed after the 1966 harvest season, and between 1965 and 1969 a total of eleven mills were shut down. Total sugar acreage in Tucumán was reduced by about 120,000 hectares, and about 40,000 persons became suddenly unemployed. The planted areas most affected were the marginal lands subject to severe frosts and the regions dominated by minifundia. The immediate cause of this devastation was government intervention in the industry in 1966 and

succeeding legislation. The conditions leading to these actions, however, were long-standing and complex.

Salta and Jujuy have evolved into more effective and efficient sugar producing areas than Tucumán. Agricultural yields are higher, due chiefly to irrigation, more intensive use of fertilizers and more effective sun hours. Factory yields are likewise higher in the Norte, principally a result of larger mills with more modern machinery and a better field-to-mill movement of the harvested cane.

The size of holdings is a major drawback to production in Tucumán. Even with the elimination of the smallest sugar quotas many minifundia of less than fifteen acres have continued to operate. The owners of these small holdings could not take advantage of improved inputs because of limited means. Thus, mechanization, irrigation and fertilization were inhibited in much of Tucumán, and the "primitive" methods used have mitigated against the development of high quality cane and the rapid movement of the harvest to the mills.

Effective organization and a strong economic base characterize most mills of Salta and Jujuy. Individual mills can be so described in Tucumán, but inefficiencies and hesitant management are typical of many. Administratively, the large northern mills are run like corporations with efficiency and profit foremost. They also make better use of sugar "wastes." The prime example of this was the large

Kraft factory in Ledesma, turning sugar cane bagasse into paper.

The effects of government intervention and the resultant shift in production most directly concern Tucumán province. Official attention has been directed toward agricultural and industrial diversification. The marginal cane lands taken out of production have been planted to more draught resistant crops such as sorghum. Nearly all crops other than sugar cane have increased in acreage. At the same time, an attempt has been made to attract new industry to the province, but by 1970 the effort could be judged as only moderately successful. In general, the firms locating in the province have been small and have little national outreach. Thus, the measures to reduce dependency on sugar in Tucumán were positive but limited by 1970.

The landscape in 1970 reflected great changes in Tucumán, with a decrease in cane emphasis, while there was a strengthening and concentration of the sugar industry in Salta and Jujuy. The forced decrease in sugar production in Tucumán was conceived with "good" long-term goals in mind. A better balance between the sugar producing regions would be of benefit to the Northwest. In any event, it seems clear that both Tucumán and Salta-Jujuy will continue to be important sugar zones for many years to come.

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IN NORTHWEST ARGENTINA

by

David Melvin Jones

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Geography

1975

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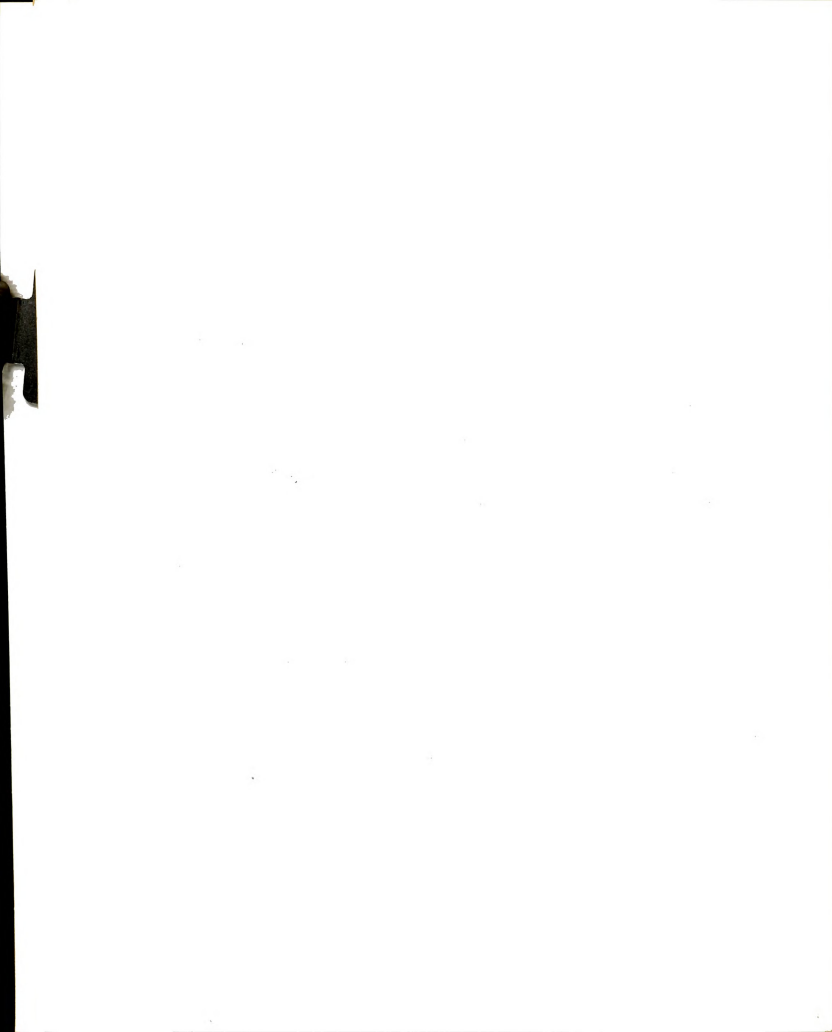
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PREFACE

Prior planning is an essential part of any research project and is doubly so when the field work is scheduled for a foreign country. Many thanks are due my academic and dissertation advisor, Dr. C. W. Minkel, for his personal reconnaissance and in-country contacts that laid a firm base for the study. The aid of my Guidance Committee (Dr. Robert N. Thomas, Dr. Ian M. Matley, and Dr. Robert D. Stevens) in the formulation of my proposal is also appreciated. Attempts were made to secure the involvement and aid of appropriate individuals in Argentina and a warm abrazo upon arrival in Tucumán attested to the success of these efforts.

My wife Julie and I are indebted to many individuals in Argentina for their friendship during our residence there. The support and camaraderie of all members of the Geography Department of the National University of Tucumán were invaluable. Professors Teodoro R. Ricci, Estela B. de Santamarina, Selva E. Santillán de Andrés and Enrique de Jesús Setti were especially helpful. Professor Ricci was my mentor and good friend and made two Yanquis feel like members of his family. Don Mario Santamarina provided experienced insights and useful contacts during the late stages of the field work. Ing. Agr. Jorge A. Mariotti,



professor of agronomy and expert on sugar cane, was a source of many ideas and useful information. To Agr. Pablo Dragan, of the Comisión de Cartografía in Buenos Aires, go many thanks for his assistance in attaining needed air photos. Of special note is the friendship of the Bulacio family, particularly Pedro and Marta, who shared many experiences with us and made our stay extremely enjoyable.

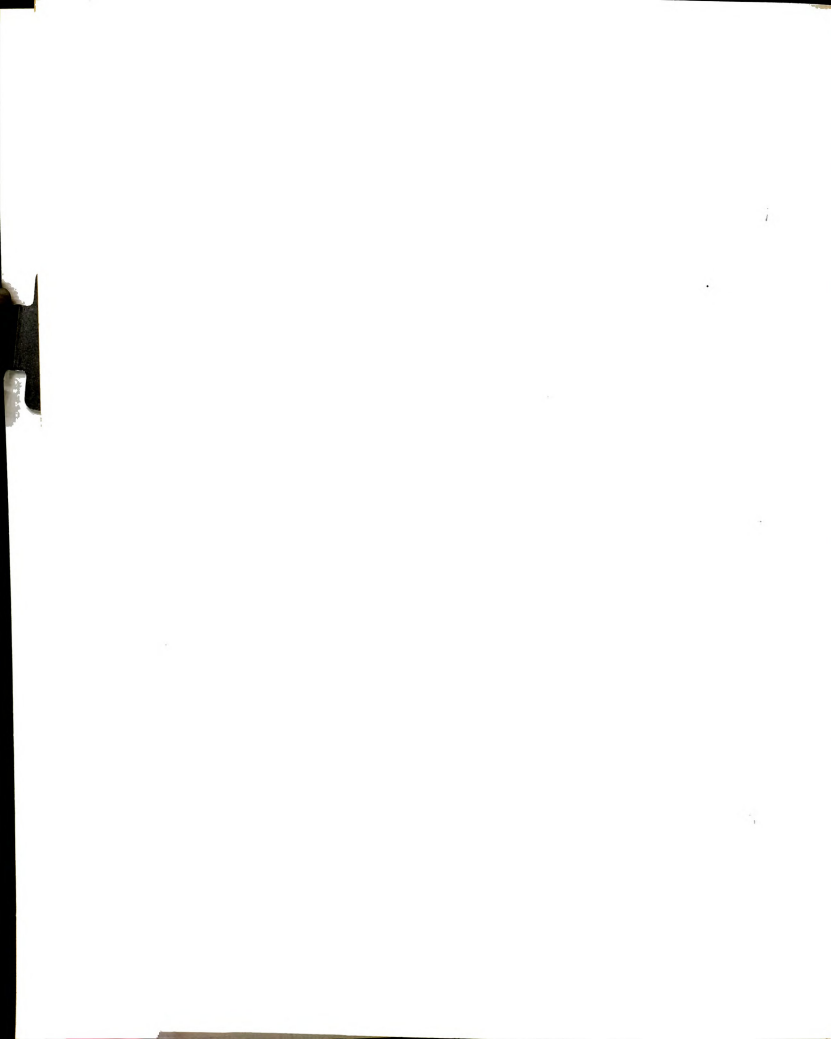
The first three months in Argentina were personally financed but our hope never faltered for some outside funding. Perseverance was finally rewarded, as Ford Foundation monies administered by the Latin American Studies Center of Michigan State University provided sustenance for the period from January through July of 1970. For this financial aid, and to the people who made it possible, the author is grateful. Particular mention should be made of the support of Dr. John M. Hunter and Dr. C. W. Minkel. Appreciation is also extended to the active Latino group of the Geography Department and to the Paul C. Morrison Latin American Research Fund of Michigan State University for emergency financial help.

During the protracted period of analysis and writing, support was provided by numerous individuals. The staff of the Social Science Research Bureau at Michigan State University and the geography faculty and staff at the University of South Carolina were especially helpful. Dr. Richard G. Silvernail and Dr. Julian V. Minghi, Heads



of the Geography Department at South Carolina were solicitous of my problems and aided in finding solutions. All consideration was extended to facilitate my completion of the dissertation. Cartographic work was ably done by Mike Holland, Douglas McKay, Janice Jones and Jerry Ulrey, who all spent long hours learning about the Argentine sugar industry! The typing was capably handled by Mrs. Dot Brabham and Mrs. Frances Blanton.

In the final stages of this study, the perseverance of Dr. C. W. Minkel was notable. Throughout the research period and thereafter the support of my family was unstinting. Special appreciation is due my wife, Julie, for constant assistance in the field and subsequently during the writing stage.





CHAPTER I

INTRODUCTION

Few commodities are as universally produced and consumed as sugar. Total world demand currently reaches 84 million short tons, over double the figure of fifteen years ago.¹ Sugar growing and processing operations exist in nearly every nation, and most countries consider it a matter of national interest to maintain a defined level of local production. Despite this general policy, exports of sugar have averaged 40 percent of production since 1900.² The importance of sugar in world trade is notable as it accounts for 7 to 9 percent, by value, of all agricultural products exchanged.³

¹U.S. Department of Agriculture, Foreign Agricultural Service, World Agricultural Production and Trade: Statistical Report (Washington, D.C.: Government Printing Office, June 1974), p. 8.

²International Sugar Council, The World Picture, Vol. II of The World Sugar Economy: Structure and Policies (London: International Sugar Council, 1963), p. 134.

³U.S. Department of Agriculture, Economic Research Service, World Trade in Selected Agricultural Commodities, Foreign Agricultural Economic Report No. 44 (Washington, D.C.: Government Printing Office, June 1968), p. v.



Although sugar is produced in most parts of the world, the crops cultivated for sucrose accumulation are limited in number. Sucrose (sugar) exists in some quantity in every green plant, but sugar cane and sugar beets are the most efficient converters and are the most widely used crops commercially. In addition to these dominant sources, various palm species, the maple tree, sorghum and maize are of purely local significance and do not appear in international sugar statistics. Cane usually provides between 55 and 60 percent of world sugar production (59 percent in 1969/70), while beet sugar represents the remaining 40 to 45 percent.⁴

The extraction of sugar from beets was a relatively late but very successful development. The experiments leading to commercial production occurred in Germany and Austria-Hungary in the late 1700's, but cultivation lagged until about 1800. By the middle of the nineteenth century a thriving industry existed in numerous European nations, and the corresponding industry in the United States was firmly established by 1880.⁵ Limited to temperate climates, the sugar beet opened vast new areas to the possible production of sugar. The more highly developed nations of the

⁴Bank of London & South America Review, Vol. 5, No. 49, January 1971, p. 58.

⁵International Sugar Council, The World Picture, p. 14.



northern hemisphere became less dependent upon tropical regions for this product, but cane sugar remained a dominant item of trade.

The natural home of sugar cane is believed to be New Guinea and nearby islands in the South Pacific. The earliest evidence of processing sugar from cane, however, dates from 1500 B.C. and indicates northeastern India as the hearth. From this beginning the cultivation of cane spread slowly. The product did not become generally known until about 400 A.D. and remained a luxury item well into the eleventh century.⁶ Cane did not reach the "western" world until the Arabs introduced it into the Mediterranean Basin, where its success was only partial. During the fifteenth century, cane production shifted to the more favorable habitats of the Portuguese islands of Madeira and São Tomé and the Spanish-ruled Canary Islands. Sugar enjoyed sufficient popularity and demand at this time so that cane stock accompanied most of the early explorers and settlers to the New World.

Sugar in Latin America

Sugar cane was the first plantation crop brought by Europeans to the Americas. Columbus introduced cane to the island of Hispaniola on his second voyage, in 1494, and it

⁶Ibid., p. 3.



was found to thrive in its new surroundings.⁷ From this foothold the crop spread rapidly to the other islands and then to the mainland of Middle and South America. Thirty years after successful establishment in Hispaniola, "sugar cane was being so widely grown that the islands of the Caribbean were called the 'sugar islands'."⁸ While the Spanish explorers and colonists were dispersing sugar cane throughout propitious sections of their domain, the Portuguese introduced it to Brazil in 1500 and began sugar shipments to Lisbon by mid-century. The European market became dependent upon the West Indies and other New World territories to satisfy a growing sweet tooth. In addition to the renowned mineral wealth of the Americas, trade ships carried sugar, molasses, and other agricultural products to Europe, and slaves often filled the ships on the return trip.

The productive capacity of the Latin American sugar industry grew steadily throughout the seventeenth and eighteenth centuries. By 1800 this region became the world's leading producer and supplier of sugar.⁹ Then followed years of rapid change and innovation in the

⁷W. R. Aykroyd, Sweet Malefactor (London: William Heinemann Ltd., 1967), p. 15.

⁸Leslie C. Hurt, "Sugar: One of Latin America's Oldest Assets," Foreign Agriculture, Vol. 5, No. 15, April 10, 1967, p. 15.

⁹International Sugar Council, The World Picture, p. 11.

industry. With the increasing competition of beet sugar, added to problems engendered by emancipation, many cane areas could not adjust to the new conditions. Other producers, through forced consolidation and technological advances, welcomed the advent of a modern industry. By the late 1800's, the adaptations necessary for large-scale production and processing had been introduced and Cuba became the measuring stick of the tropical sugar industry. In 1890, for instance, Cuba produced nearly 60 percent of the total sugar harvest in the Americas and about 15 percent of the world total.¹⁰ During the same year, South American nations accounted for less than 20 percent of the regional totals. The major change since the beginning of this century is that South American production has risen to match and surpass the Cuban total. In fact, during the early 1970's Brazilian sugar production alone has exceeded that of Cuba.¹¹ The Latin American countries following Brazil and Cuba in importance, and producing over one million short tons of sugar each, are Mexico, Argentina, the Dominican Republic and Peru.¹²

¹⁰Ibid., p. 29.

¹¹U.S. Department of Agriculture, Foreign Agricultural Service, Foreign Agricultural Circular - Sugar, FS 3-73 (Washington, D.C.: Government Printing Office, December 1973), p. 5.

¹²Ibid.

The Argentine Sugar Industry

Argentina is probably best known for its beef cattle and waving fields of wheat. Thus, it is surprising to note its relative importance in the production of sugar from cane, being surpassed within South America only by Brazil. This fact helps to emphasize the overall size, north - south extent, and corresponding diversity of this, the world's eighth largest country (Map 1).

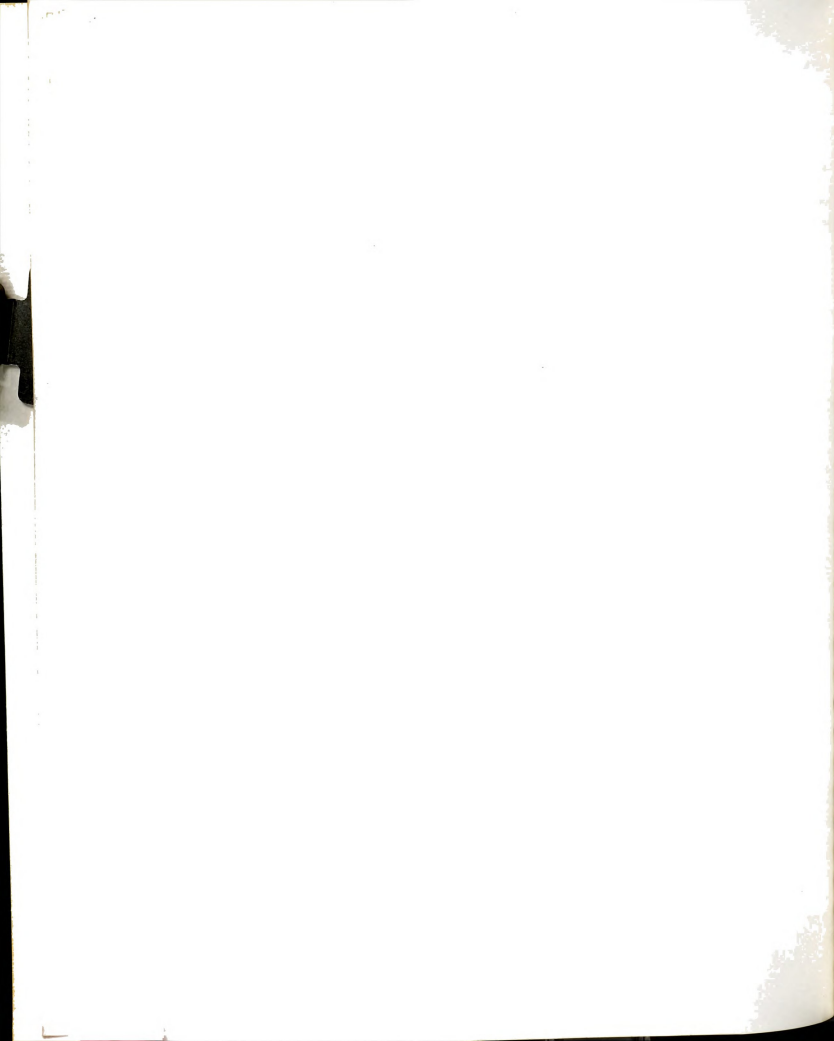
The cultivation of sugar cane historically has been concentrated in the Northwest of Argentina, which offers the advantages of a subtropical climate and a relative abundance of water for irrigation (see Map 2). The Litoral, including land bordering the Paraná River, also contains areas of cane cultivation but is of minor importance compared with the Northwest.

The zone centering immediately upon San Miguel de Tucumán offers unique advantages for sugar cane within the Argentine Northwest. The high Sierra de Aconquija rises just west of the city and intercepts the prevailing westward flow of air. The resulting precipitation on the Sierra and the snowfields at higher elevations in the Andes provide a constant water supply for streams which serve the Tucumán area. The water of these permanent rivers supplements the substantial but irregular rainfall received in Tucumán and prevents crop failure due to drought. To the east, rainfall and the water available from streams decrease rapidly.

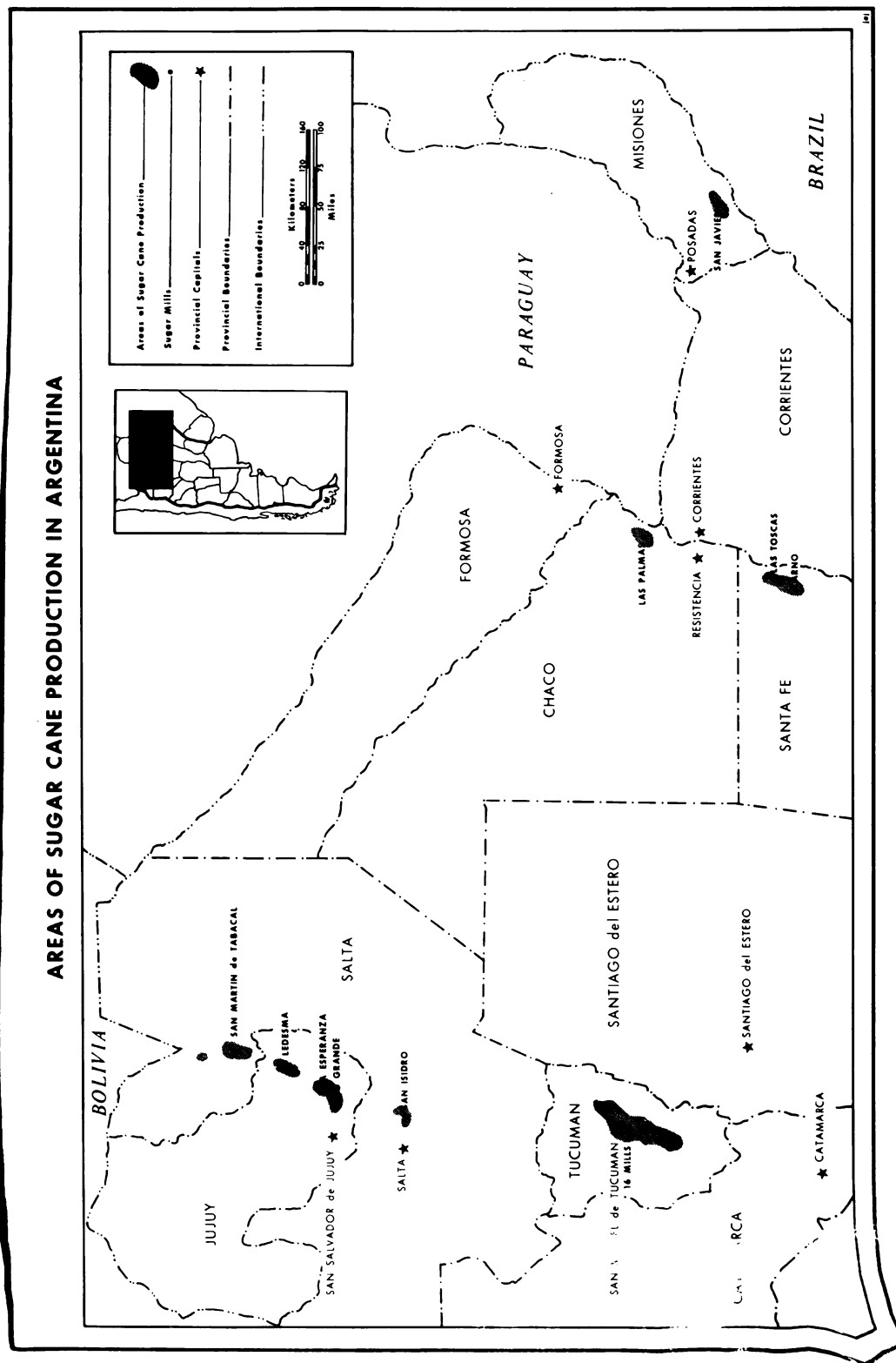


MAP 1





MAP 2





Frost-free conditions are found within a thirty-five mile radius of the city of Tucumán, and winter temperatures are modified at this location by a persistent cloud cover.¹³ In addition, fields near the base of the mountains are protected by air drainage across the sloping alluvial fans. Farther eastward the occurrence of frost increases markedly.

The province of Tucumán traditionally has been synonymous with sugar production in Argentina and has at times contributed more than 80 percent of the national total. With more than 50 percent of its cultivated area devoted to sugar cane, the province provides a prime example of a one-crop economy. The heavy demands for labor in the sugar industry have resulted in one of the most dense concentrations of rural population in all of Latin America.

During recent years a shift in sugar cane production northward to the Salta and Jujuy area has occurred, which if continued may have a serious effect upon the economy of Tucumán.¹⁴ The proportion of national cane production in Salta and Jujuy provinces increased from 28 to 38 percent between 1962/63 and 1968/69, while that of Tucumán fell from 66 to 58 percent. "The number of sugar mills in

¹³preston E. James, Latin America, 4th ed. (New York: The Odyssey Press, 1969), p. 611.

¹⁴The Salta-Jujuy area is referred to locally as the Norte. The sugar lands which occupy joined river valleys are called the Ramal.

Tucumán was reduced from 27 in 1966 to 19 in 1967 ..., " a drastic decrease in a single year.¹⁵ There are now only sixteen active mills within the province, and other closings seem imminent. It is hoped that this study of the phenomenon will contribute to an understanding of current conditions in Northwest Argentina and aid in development planning.

Problem and Objectives

This study constitutes a comparative regional analysis of the two major producing areas of Argentina, namely Tucumán and Salta-Jujuy. The general objectives are: 1) to pursue an academic and practical problem of geographical merit and 2) to provide a report useful for planning purposes within the Republic of Argentina. The author has sought to determine the nature and extent of the areal shift in sugar production, to isolate and weigh the factors contributing to this situation, and to analyze geographically the effects upon the two regions concerned. The working hypothesis was that the shift northward is chiefly a function of technological differences between the regions, in turn affected by distinct land ownership patterns.

Features studied and compared in each area include:

- 1) physical factors affecting production, such as water

¹⁵Bank of London and South America Review, Vol. 2, No. 21, September 1968, p. 506.

availability, soil characteristics, frost frequency, and elevation; 2) socio-historical factors, including land tenure systems, differences in population density, labor problems, and historical evolution of the sugar industry; 3) economic factors, such as production and processing techniques, transportation facilities, marketing arrangements and costs, and capital availability; and, 4) government policies affecting the industry.

Procedures

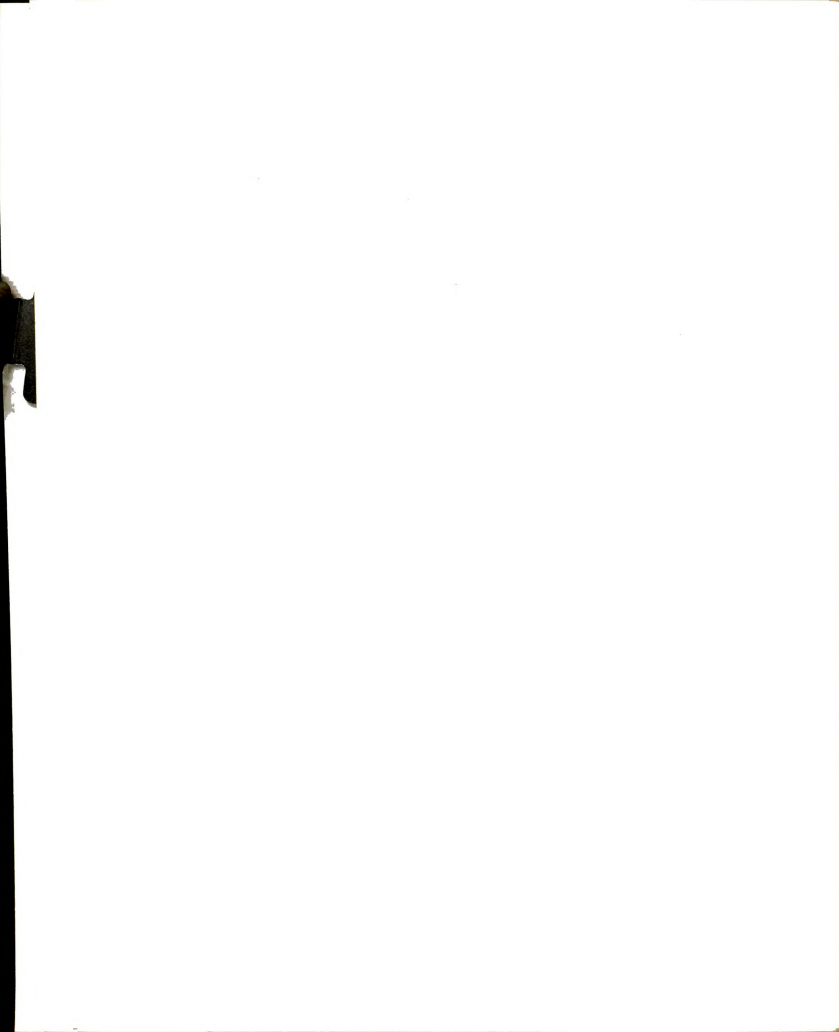
A survey of relevant literature and interviews with knowledgeable persons at Michigan State University were concluded prior to departure for Argentina. In addition, correspondence with interested professionals and appropriate agencies in Argentina was initiated. Added insights, potential comparisons, and valuable training for the study were gained in a one-week field problem concerning the sugar industry of the Dominican Republic, completed as an integral part of the Ph.D. program. Spanish language fluency was indispensable and had been achieved through previous residence and research in Latin America.

The research period in Argentina was from mid-October, 1969, through August, 1970. "Permanent residence" was established in San Miguel de Tucumán, the center of the major sugar producing area. Several trips, totaling about forty-five days, were made into the Salta-Jujuy area.

The bibliographical work was continued and intensified with the author's arrival in Tucumán. Contacts were made with the Department of Geography at the National University of Tucumán, which offered full cooperation, work space, and materials. The technical and administrative staff of the School of Agronomy professed great interest in the research plans and offered technical assistance. Likewise, the agricultural experiment station of Tucumán province provided library facilities and advice. Other appropriate agencies were visited, both to gather information and to establish working relationships.

Within the study areas the principal techniques used in data collection were personal interviews, air photo interpretation, the study of published documents, and direct observation. Air photographs were available for much of Tucumán province and, combined with field investigation, were used to delimit and map the producing areas. Historical documents were studied to determine changes in the land-use patterns. Statistics based upon the smallest political units, departamentos, were gathered and used to the extent possible (See Appendix).

The identification and analysis of change in the producing areas were handled through air photo analysis, published studies, and personal observation and mapping. A census of sugar cane growers had been undertaken in 1960, and another was underway in 1970. These aided in



differentiating changes within the departamentos. In addition, air photo coverage pertaining to a period of maximum expansion (1965) was available for most of the area. A grid system of sampling allowed direct comparison of this historical information with current patterns.

Analysis of the physical factors was accomplished through field observation, air photo interpretation, and interviews. Government agencies were contacted for technical information, and fairly detailed soils, hydrologic, and climatic data were gathered. This information was applied in greater detail in the analysis of selected sample areas.

Personal interviews and library research were the primary means of investigating the socio-historical factors. Approximately 160 interviews with individual growers and farm and factory workers were recorded with the use of prepared interview schedules. The evolution of land tenure was also investigated, and labor migration patterns were outlined.

Important insights into economic conditions affecting the industry were obtained by interviewing sugar mill owners and operators. Each mill, twenty-one in total, was classified according to production efficiency to determine areal variations. Transportation and marketing procedures were observed at all stages in the process. Capital resources available to the producer were checked by interviews on the farm and at the banks. Technological changes

and their effects on the industry were determined chiefly at the individual farm level.

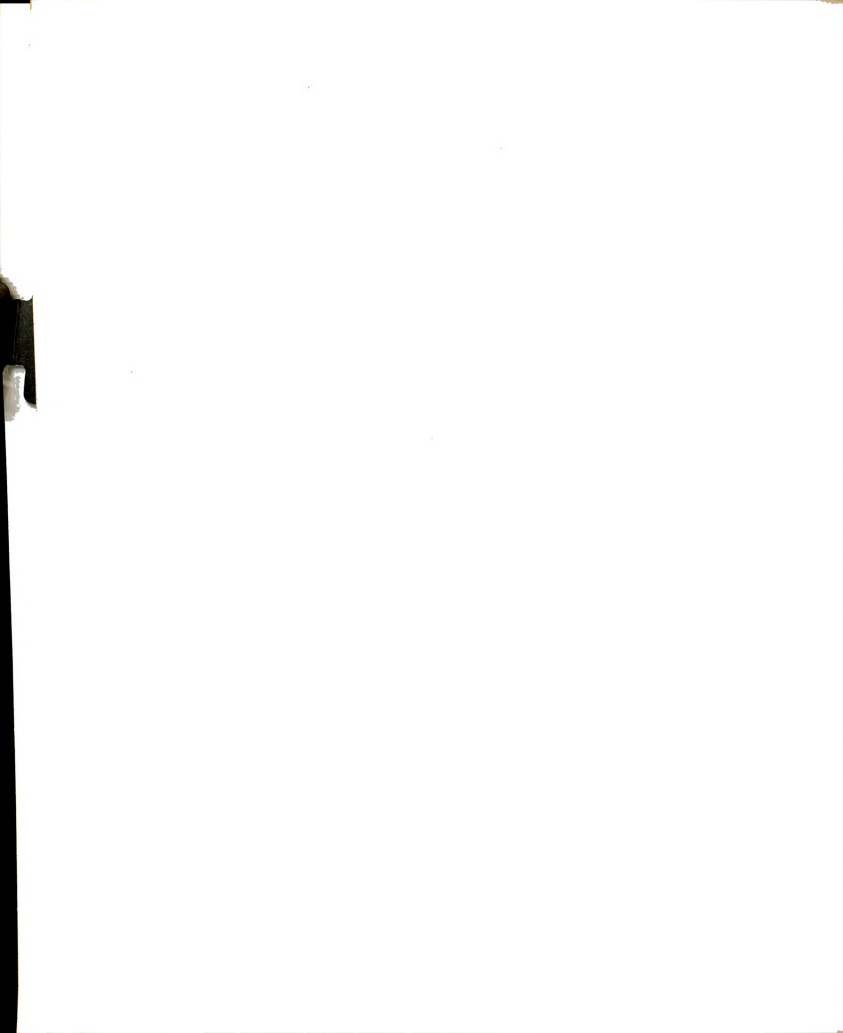
Government officials and university personnel were contacted for insights into current public policies regarding the sugar industry. The Tucumán newspapers also proved to be invaluable sources of information concerning current government positions, as was the monthly sugar industry journal.

The effects of change in the production zones were determined chiefly through direct observation and personal interviews. Industrial and agricultural diversification efforts were documented and mapped, as were other important areal trends.

Problems relevant to each aspect of the investigation were noted, and recommendations were formulated for inclusion in this report. It is anticipated that the study will be published in English as a doctoral dissertation at Michigan State University and in Spanish as a number in the Geography Monograph Series of the National University of Tucumán.

Related Research

Little current information directly related to the sugar industry of Northwest Argentina was found prior to initiation of field research. Production figures and general historical data were available but could be used only to indicate broad trends. United States Department of



Agriculture publications, plus International Sugar Council information, were most helpful but specific analytical studies were lacking. In the geographical literature, the region and the industry have been covered chiefly in broadly-based regional books.

Upon the author's arrival in Argentina an "information explosion" was experienced, particularly related to Tucumán. Pertinent Spanish language publications unavailable in Michigan appeared throughout the research period. Several complete historical accounts of the sugar industry's development provided a basis for understanding events through the middle 1950's. Technical agronomic bulletins and interpretive studies of crisis periods were available through the agricultural experiment station of Tucumán province and the agronomy school of the university. An active Institute of Economic Investigations had available several well delimited studies on economic aspects of the industry. Human aspects had not been neglected, either, as several recent articles by sociologists attempted to analyze social structure in the Tucumán sphere. The geography staff of the National University of Tucumán had published numerous small articles about the sugar industry. The sugar business so dominates the province that it would have been difficult to find a person who was not connected with it in some way, and myriad opinions concerning current problems were expressed. Altogether, no lack of information sources



was encountered, although statistical coverage and census materials were suspect.

On site the study developed into a problem of integration and synthesis. A need for an "objective" overview of the producing regions of the Northwest became obvious, but this was also a very difficult assignment.

CHAPTER II

HISTORICAL DEVELOPMENT

During the early colonial period, Northwest Argentina was characterized by a diversified and nearly self-sufficient agricultural economy. Explored and colonized in the second half of the sixteenth century by Spaniards crossing the Andes from Pacific Coast settlements, the Northwest was the most highly developed area in Argentina for nearly 200 years. Since this region held no easily exploitable mineral wealth, and relatively small Indian populations, it evolved as a supplier of such items as cotton, rice, wheat, corn and livestock for the Andean mining sites of Upper Peru (Bolivia) and Peru. The extensive grasslands of the Pampas were ideal for raising the necessary mules for the mines, while towns such as Santiago del Estero, Tucumán, Salta, and Jujuy served as intermediate points between the plains and the highland communities.

The advantages of an Atlantic port at Buenos Aires finally gained official Spanish recognition in the early 1700's, and traffic between the coast and Upper Peru intensified. With the increasing importance of external trade, the balance of power within Argentina began to shift to the coastal city. The towns located on the road from Buenos



Aires to Peru continued to grow due to their positions as trade centers (see Map 3). Goods traveled along the road either in large wooden wagons, carretas, which were a specialty of Tucumán, or by mules, which usually were bought and sold in the large mule fairs of Salta. It was probably by one of these means that imported processed sugar first entered the Northwest and at such exorbitant prices that experimentation with sugar cane was furthered.

Early Foundations: 1565-1820

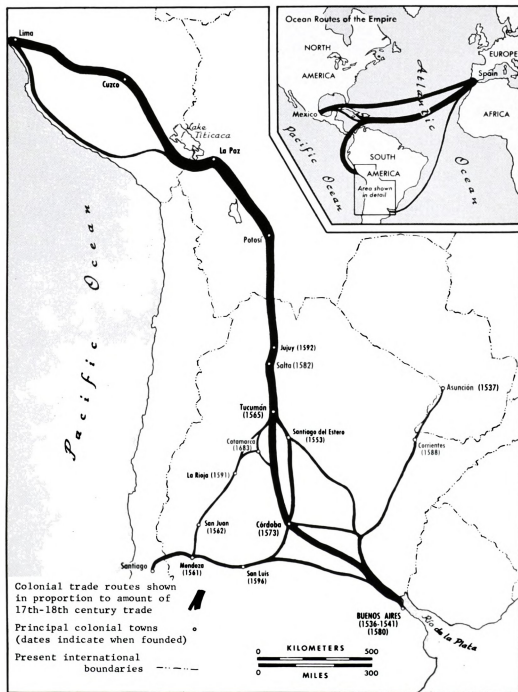
Sugar cane stock was an early arrival to Argentina but sugar remained a marginal crop for several centuries. Numerous versions of its diffusion to Argentina seem equally credible. One traces a route from Brazil to Paraguay with Cabeza de Vaca in 1542, and shortly thereafter to Tucumán. Another interpretation credits the conquistador Francisco Aguirre with bringing cane from Chile to the Northwest in 1553. The Jesuit order is also frequently viewed as responsible for introducing the plant, and Peru is postulated as the source region. Whatever the origin and route, sugar cultivation can be inferred by the late 1500's, when a bishop residing in Tucumán brought Negro slaves from Brazil to aid in working the cane.¹

¹Herbert Wilhelmy and Wilhelm Rohmeder, Die La Plata-Länder (Hamburg: Georg Westermann Verlag, 1963), p. 233. Early colonial plantings utilized a limited number of black slaves, but the prime labor source was the native Indian population. A limited number of imported blacks



MAP 3

SPANISH SETTLEMENTS AND TRADE ROUTES IN LA PLATA AND PERU



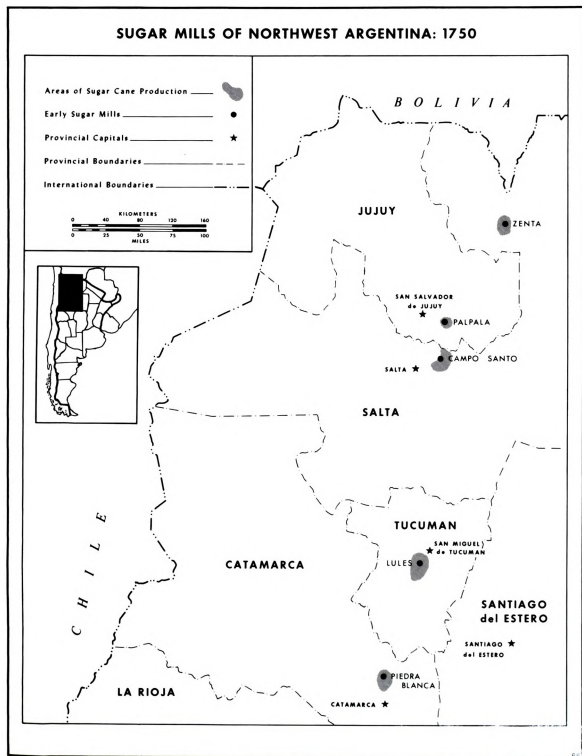
SOURCE: James R. Scobie, *ARGENTINA: A City and a Nation*, (New York: Oxford University Press, 1964), p. 52.

Small-scale garden plots of cane, mixed with a few larger holdings, were typical well into the eighteenth century. General problems of clearing forested land, a lack of technical knowledge, poor varieties, and a marginal climate were the most likely limitations on sugar acreage. The pattern of early cane plantings is difficult to reconstruct, but it seems certain that in Tucumán the cane was grown on lower mountain slopes near the capital city and along streams where irrigation water could supplement rainfall. In Salta and Jujuy small plots were found along suitable river valleys. Much of the cane at this time was consumed in its natural state, the sugar content being extracted by individuals chewing and sucking on the cane.

The major sustained interest in sugar cane cultivation was first assumed by the widely-spaced Jesuit missions although numerous individuals also maintained small cane fields. Missions in Tucumán (Lules) and Salta (Zenta-Orán), as well as in sufficiently humid provinces bordering the Río de la Plata system, provided bases for limited experimentation in cane growing and processing (see Map 4). By the late 1600's, a rudimentary sugar mill, or trapiche, was installed in Lules for the processing of cane, while another operated about the same time near the city of Jujuy. The trapiches were heavy wooden cylinders, usually of

were also reported in 1779. Francisco De Aparicio, ed., La Argentina, suma de geografía, Vol. 4 (Buenos Aires: Ediciones Geográficas Argentinas, 1944), p. 168.

MAP 4



durable quebracho wood, which were rotated by mules or oxen and served to squeeze the juice from the cane (see Figure 1). From this simple mill a given volume of cane juice was purified and marketed as miel (sugar honey), and the remainder was concentrated and slowly crystalized into a crude sugar. In addition, the concentrated juice served as the base for a sugar brandy, or aguardiente. This initial small-scale industrialization of sugar was maintained at Lules until 1767, when the Jesuits were expelled from all Spanish territories.

With the expulsion of the Jesuits, the driving force behind cane cultivation and processing was lost and cane growth in Tucumán entered a short period of near eclipse. The extent of this decline may be judged by the appearance of a "myth" surrounding the cultivation of cane in the province. It was widely stated that Tucumán was completely unsuited for sugar cane. Indeed, it is maintained that cane disappeared completely from the province, but this seems unlikely.²

There is little doubt that limited cane cultivation continued in various centers in Salta and Jujuy provinces, and some cane was also grown in Catamarca (see Map 4). The oldest permanent site of cane growing in Argentina is considered to be Campo Santo, Salta. This center boasted

²Emilio J. Schleh, Noticias sobre el azúcar en la Argentina (Buenos Aires: Centro Azucarero Argentino, 1945), p. 103.



Fig. 1.--Traditional Wooden Trapiche

a trapiche in the 1790's, and the same family still maintains a cane operation there. The northern area of Salta, surrounding the old Zenta mission, can claim even earlier cultivation of the crop but permanence is uncertain. In addition, the cane was not processed there but rather consumed by individuals, as was also the case in Jujuy. All efforts in Salta and Jujuy provinces during this period were of limited nature, with little actual sugar production, so claims to historical preeminence in the industry seem dubious.³

All of the incipient developments in sugar cane cultivation occurred against a backdrop of relative prosperity in the Northwest. The continued transportation functions of the major settlements on the road between the two Viceroyalties, Peru and Río de La Plata, provided the primary economic impetus. This commercial relationship, however, was to change drastically with independence.

Rudimentary Production: 1821-1875

The Argentine independence movement, begun in 1816, caused a complete disruption in the economy of the Northwest. Since this area served as a battlefield for most of the war's duration, 1810 to 1816, the entire countryside was literally ravaged. Not only were vital resources depleted, but connection with the most important commercial route of the continent was broken. The trade route to Upper Peru

³Ibid., p. 338.

was severed and was to remain so.⁴ Thus, a total reorientation was necessary for the Northwest, and the only logical action was to cultivate closer ties with Buenos Aires. This port city had gained in strength and importance during the hostilities by attracting increased trade with other nations. A prohibitive distance factor, plus a lack of concern for the interior by the porteños, however, mitigated against any extensive benefits for the Northwest.

The post-war transformation of the Northwest was effected chiefly through local initiative. The redevelopment of Tucumán, in particular, was closely tied with the efforts and activities of one man, Dr. José Eusebio Colombres. He was referred to as the Conqueror of Misery (vencedor de la miséria) for the role he played in this critical period. Bishop Colombres arrived in Tucumán in 1816 as a delegate from the neighboring province of Catamarca to the Independence Congress and remained there. Seeing the utter devastation and lack of direction of the province he determined to do something about it.

A Tucumano by birth, Colombres studied for the priesthood and obtained his doctorate in theology from the University of Córdoba. In 1807 he was assigned to the parish of Piedra Blanca in Catamarca where he came in contact with Antonio Molas, owner of the largest sugar

⁴ Augusto M. Bravo, La industria azucarera en Tucumán: Sus problemas sociales y sanitarios (Tucumán, 1966), p. 18.

operation of that time. Dating from the late 1700's, sugar cane was processed there to juice, sugar and aguardiente. Enough surplus was produced to export small quantities of sugar to neighboring provinces, including Tucumán.⁵ It seems likely, then, that in the nine years spent in Piedra Blanca Colombres acquired an interest in, and knowledge of, this "exotic" crop.⁶

Whatever the source of his inspiration and planting stock, Colombres did reinitiate the cultivation of cane at a viable scale within the province. This in itself was not an easy task as he had to fight the myth of unsuitability and at the same time create some enthusiasm for the crop. By 1820 he had installed a wooden trapiche on a small property at the edge of San Miguel de Tucumán and was freely distributing cane stock to interested persons. The existing commercial vacuum in the province and the promise of this "new" crop was such that cultivation expanded rapidly. Mills increased from one in 1820 to seven in 1827, thirteen by 1850 and twenty-four by the death of Colombres in 1859. This growth in number of mills directly reflected areal expansion, since nearly every grower was a processor of his own cane. By 1859 sugar cane was planted in large

⁵Schleh, Noticias, p. 338.

⁶Jorge Alfonso Domínguez and Agustín Hervás, Cooperativas agropecuarias de trabajo: Una alternativa de solución para el problema Tucumano (Tucumán: Instituto Nacional de Tecnología Agropecuaria, 1970), p. 19.

expanses of Cruz Alta and to the south had won both margins of the Lules River and was advancing toward Famaillá (Map 5).⁷ This evidence of success must have pleased Colombres greatly. His promotion of the industry did not go without official recognition, as Colombres was declared a meritorious citizen through an 1839 law of the Tucumán provincial congress:

To reward the important service that the citizen Dr. José Colombres gave to his country, acclimating sugar cane, promoting its cultivation, and providing the first example of its elaboration to sugar and aguardiente. With this he overcame a long standing and destructive myth by demonstrating with experience that Tucumán is apt for these products, and created a rich industry, that notably and progressively increased the public wealth... [This same act also made his farm free of taxes for twenty years].⁸

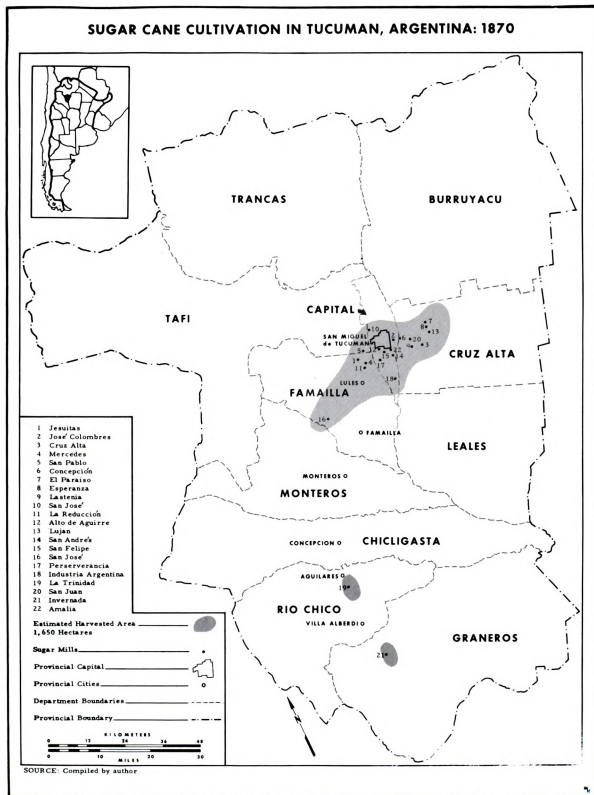
The prior fabrication of sugar by Cornejo in Salta, Zegada in Jujuy, and Molas in Catamarca did not lead to the development that occurred following the initiative of Colombres. He seems to truly deserve the title of Founder of the Argentine Sugar Industry.

Expansion in acreage and number of mills continued steadily after the death of Colombres. By 1870 an enumeration in Tucumán showed forty-six ingenios, and sugar had become the most important activity in the province in

⁷Horacio William Bliss, Evolución económica del Tucumán, Cursillo de Historia del Tucumán (Tucumán, 1968), p. 13.

⁸Universidad Nacional de Tucumán, Facultad de Derecho y Ciencias Sociales, La legislación laboral en Tucumán, Vol. 1 (Tucumán, 1969), p. 279.

SUGAR CANE CULTIVATION IN TUCUMAN, ARGENTINA: 1870



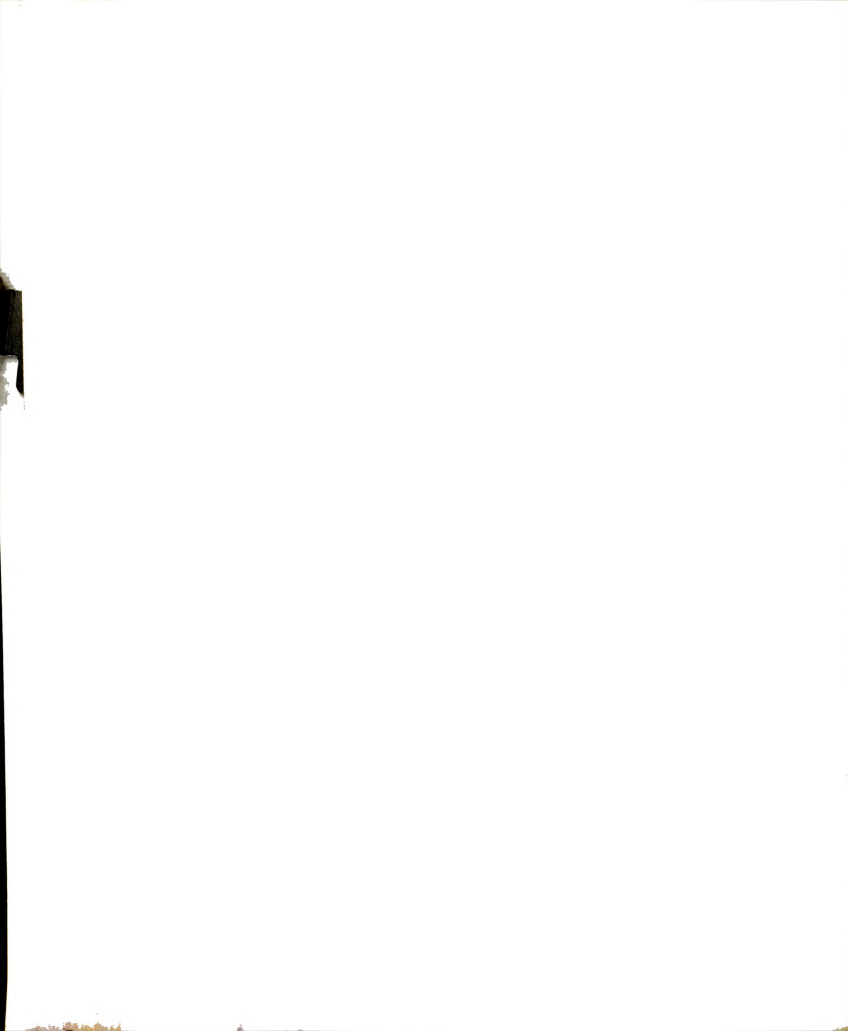
terms of capital and employment.⁹ Mills became diffused throughout the province, varying in distance from two to twenty kilometers from the capital city (Map 5). Statistics of 1870 also indicate that Tucumán exported considerable quantities of sugar and aguardiente to neighboring provinces.¹⁰

The political power of the planters in controlling the movement of sugar within and outside the province was already evident in 1834 when a tax was placed on sugar entering the province from "outside."¹¹ This would appear to be the earliest attempt at protecting the industry.

Most of the early expansion took place on a small scale, with little innovation other than a gradual supplanting of the wooden cylinders with metal ones. In the late 1850's, however, an attempt was made to adopt the most modern processing techniques available. A citizen of Tucumán, Don Baltazar Aguirre, acquired machinery in England and, lacking money to unload and transport the heavy goods to Tucumán, went into partnership with General Justo José de Urquiza. General Urquiza was president from 1854 to 1860 and was willing to back almost any enterprise to

¹⁰Schleh, Noticias, p. 198.

¹¹Bliss, Evolución, p. 14. Early imported sugar was listed as de la tierra or de Castilla, depending upon its arrival route by land from Upper Peru or by sea to Buenos Aires, and was naturally very expensive. This tax was most likely levied against either sugar from Salta or coming in from Cuba.



benefit the country. After the equipment had been in transit for nearly two months by carreta to Tucumán, the first mill to use modern machinery and processes became operational in 1858. Continuing financial problems and trouble with the water-powered mill plagued this attempt, however, and the mill ceased to function scarcely ten years after it began. Its well publicized troubles probably hindered further attempts at modernization for a brief period.

Expansion in the northern provinces of Salta and Jujuy was much more limited than that in Tucumán. There, production was concentrated along the Río San Francisco and in several other small valleys where conditions were favorable (Map 6). "All sites in the provinces [Salta and Jujuy] below 800 meters [2,624 feet] are considered apt for cultivation of cane but especially the large valley of the Río San Francisco from Campo Santo to the Río Bermejo."¹² By the early 1800's, the sugar produced in Salta met local needs but did not advance much beyond that stage during the remainder of the century. In fact, Salta "imported" sugar from Jujuy, although the owners of the sugar plantations there were Salteños. The most distant cane fields, those near the junction of the San Francisco and the Bermejo, served at this time only to meet the needs of local

¹²Schleh, Noticias, p. 290.

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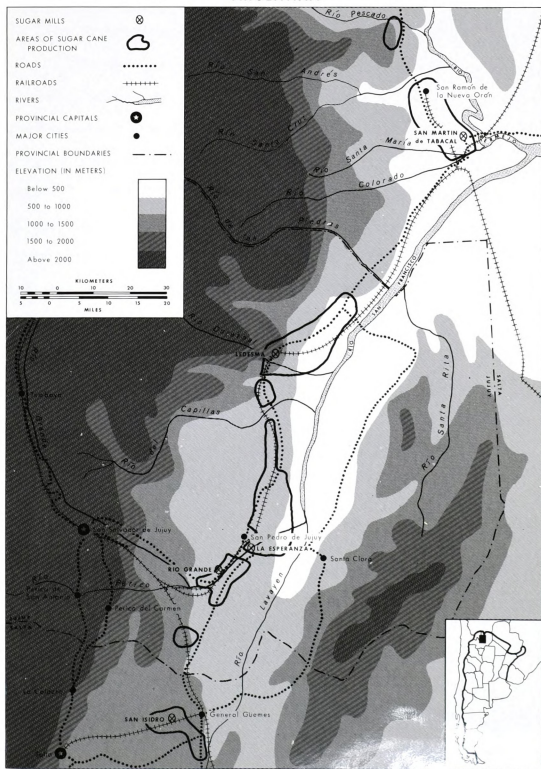
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Source: Compiled by Author

consumption. For the most part, owners of small trapiches in these areas were slow to acquire new equipment, but by 1870 some improvements had been made in individual mills.

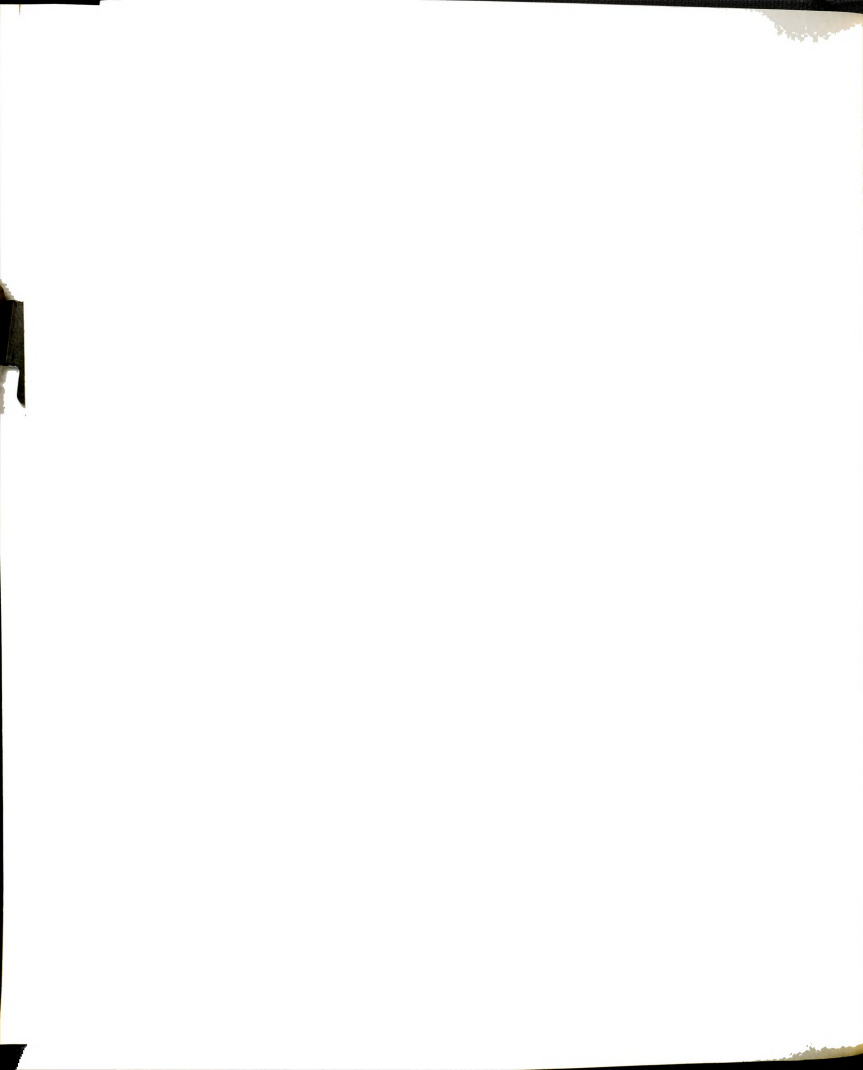
The labor employed on the early sugar "plantations" was drawn initially from the Indian population of each area and later from the Chaco tribes. Black slaves were also imported into each sugar area but did not reach significant numbers.¹³ The northern provinces used some Bolivian Indians during the harvest season and generally encountered no problems in obtaining sufficient help. A shortage of labor was a constant problem for Tucumán, however, so an early migration pattern of criollos (generally a white and Indian mixture) from neighboring provinces was created.

All phases of the industry in the Northwest were relatively inefficient during this period. Only gradual and sporadic technical change had reached the cane areas, and new inputs were therefore necessary to alter the situation.

Foundation of a Modern Industry: 1876-1900

The arrival of the railroad at Tucumán in 1876 signaled a period of rapid industrial transformation. Distances were effectively shortened; transportation costs

¹³Emilio J. Schleh, La industria azucarera en su primer centenario: 1821-1921 (Buenos Aires: Ferrari Hnos., 1921), p. 32.



were much reduced for all trade items, especially for heavy items such as machinery; and the marketing of sugar and its by-products in the urbanized litoral was facilitated. The sugar industry to this time had developed and slowly "modernized," despite a nearly prohibitive time-distance factor. Freight had been carried by the large wooden-wheeled carretas, pulled by oxen or mules and required two months to traverse the distance between Buenos Aires and Tucumán.¹⁴

A close correlation can be traced between the subsequent developments of the sugar industry and the railroad in Tucumán. The success of the first line, the Central Córdoba, was due chiefly to cane. By 1882, almost the total production of sugar (8,100 tons) was moved by this rail connection. In addition to the harvest, wood for the mills, machinery, and livestock were carried by this line. Within a decade of its establishment, four additional railroad companies were competing for business within the province. Construction of the first line was greatly influenced by the prior location of sugar plantings, but, with expansion of the rail network, location of new

¹⁴Emilio J. Schleh, "El primer censo descriptivo de Tucumán," La Industria Azucarera, Vol. 61, No. 748, February, 1956, p. 89. The distance between Buenos Aires and Tucumán is approximately 725 miles. Heavy machinery, however, was generally transhipped to the interior from Rosario, which is closer (570 miles) to Tucumán.

cane fields near the railroads became a dominant industrial factor.¹⁵

The railroad affected all existing cane operations to some extent. Naturally, change did not occur immediately, but by 1882, for example, all primitive wooden trapiches had disappeared from the landscape and the concentration of capital characteristic of the new period could be seen.¹⁶ The minor reform of the 1860's, involving the substitution of steel for wooden trapiches, had been within the reach of nearly all planters. When industrial conditions were altered by the new transport mode, however, all aspects of processing were affected and the changed competitive situation called for major new capital inputs. Although all trapiche owners must have aspired to remain industrialists, those with limited assets were relegated to the planter class.

The availability of capital and credit was a necessity for transformation of the industry. The initial investment risks involved purely local monies provided by individual and provincial banks. In addition, suitable

¹⁵J. S. Bosonetto, "Distribución de los ingenios azucareros Tucumanos" in Geographia una et varia, Publicaciones especiales II (Tucumán: Universidad Nacional de Tucumán, 1949), p. 49.

¹⁶Ramón Leoni Pinto, "La historiografía del Tucumán moderno," Revista de la Junta de Estudios Históricos de Tucumán, Vol. 2, No. 2, July 1968, p. 148.

credit terms were offered by the English and French machinery suppliers. Then, with proven success, some foreign interests and investors from other Argentine provinces began adding to the resources.¹⁷

One highly visible effect of the machinery revolution was a greatly increased plant capacity and a corresponding decline in the number of mills. The need to improve and modernize led to a reduction of mills from a maximum of eighty-two in 1877 to only thirty-four in 1881. This concentration occurred chiefly in the immediate environs of San Miguel de Tucumán, in the department of La Capital (see Table 1).

With improved transportation, the processing of cane became more diffuse. Prior to construction of the railroad, most mills were located within a relatively short distance of San Miguel de Tucumán. The majority of those founded after 1876, however, were not so restricted and followed the existing railway lines to good cane land.¹⁸ Only the northern sections of the province, where there was a lack of dependable water, remained without mills (in Table 1, Burruyácu and Taff departments).

¹⁷Horacio W. Bliss, "Evolución económica del Tucumán," Cursillo de Historia del Tucumán (Tucumán: Instituto Tucumano de Cultura Hispánica, 1968), p. 17.

¹⁸Bosonetto, Distribución, p. 52. This author used a twenty-five kilometer (approximately 16 miles) radius from San Miguel de Tucumán as the limit prior to 1876.

TABLE 1

DISTRIBUTION OF SUGAR MILLS IN TUCUMAN PROVINCE,
1870-1897

Department	1870	1874	1877	1881	1897
La Capital*.	39	54	60	28	3
Cruz Alta	-	-	-	-	15
Famaillá	10	12	16	5	6
Monteros	-	2	-	-	3
Chicligasta.	2	2	2	1	3
Río Chico	1	1	1	-	2
Graneros	1	1	1	-	1
Leales	-	-	1	-	1
Burruyácu.	1	1	1	-	-
Tafí	-	-	-	-	-
Totals.	54	73	82	34	34

Source: Emilio J. Schleh, Noticias historicas sobre el
azúcar en la Argentina (Buenos Aires: Centro
Azucarero Argentino, 1945), p. 207.

*Included Cruz Alta until 1887.

The new and growing industrial capacity demanded an increasing supply of raw material. Thus, sugar cane expanded steadily in acreage during this period. Of significance also was the tremendous increase in number of cultivators (Table 2). This indicates an increasing dependence of each ingenio upon independent growers, and



TABLE 2

NUMBER AND DISTRIBUTION OF CANE GROWERS IN TUCUMAN
PROVINCE, SELECTED YEARS, 1874-1895

Department	1874	1876	1877	1881	1882	1895
La Capital*	82	146	170	270	394	298
Cruz Alta	-	-	-	-	-	991
Famaillá	59	22	23	44	48	470
Monteros	22	1	-	20	24	210
Chicligasta	11	3	10	38	46	208
Río Chico	14	1	1	12	-	201
Graneros	1	1	1	5	4	4
Leales	10	1	1	3	4	139
Burruyácu	34	-	1	2	2	7
Tafí	-	-	-	-	-	102
Totals	233	175	207	394	522	2,630

Source: Emilio J. Schleh, Noticias históricas sobre el azúcar en la Argentina (Buenos Aires: Centro Azucarero Argentina, 1945), p. 208.

*Included Cruz Alta until 1887.

the trend was to continue. The largest expansion in number of growers occurred between 1888 and 1894, from 889 to 2,117. Such a dramatic increase can be explained only by referring to the social and organizational climate of the province.

By the mid-1880's there were three main groups involved in the industry: 1) the mill owners, who also generally owned extensive cane lands; 2) the independent cane planters, who grew cane to sell to the mills; and 3) the field and factory workers. The system of land tenure was in transition at this time. Much land was bought by industrialists so they could provide their own cane, and the complex of factory and cane land usually was included in the term ingenio. These large holdings never approached the importance typical of other sugar areas, however, and the latifundia did not become characteristic of the Tucumán cane region. In fact, the mill owners began to lease large segments of their cane lands to individuals about this time. By 1895, 240 colonias (leased properties) accounted for about 36 percent of the total cane land.¹⁹ The new group of renters naturally added numbers to the planter class, but it was the number of independent growers that really expanded. In a national report of 1882 it was stated that the cultivation of sugar cane in Tucumán and Santiago del Estero had been converted to a "public passion" and that there was a real enthusiasm to become a planter.²⁰ Everyone wanted to become involved in this glamour industry, and there was sufficient new land available to be cleared and planted.

¹⁹Schleh, Noticias, p. 208.

²⁰Bravo, La industria azucarera, p. 22.

The major limitations to the expansion of cane were: 1) the lack of laborers, 2) the bad state of roads and generally high transportation costs, and 3) the lack of water.²¹ Since each of these factors affected the location of sugar cane plantings, they are here dealt with briefly in turn.

As the industry gained force in Tucumán, a growing need for manpower occurred. Indian laborers were at first sought, but the numbers available from the Chaco and elsewhere were too variable to provide an adequate supply. Attempts were even made to use Indians conquered during the Patagonian campaigns. In 1879 at least 400 families were brought in from the pampas.²² Most of the Indians soon escaped or were generally unsatisfactory as workers. Thus, a phenomenon very unusual for a plantation economy was established. Workers came increasingly from the surrounding provinces and were chiefly white. Many laborers migrated seasonally to Tucumán for the harvest period, and a significant number stayed as permanent additions to the population of the province. A great increase in population occurred between the census years of 1869 and 1895, when

²¹Alfredo Bousquet, Memoria historica y descriptiva de la provincia de Tucumán, 1882, quoted in Schleh, E. J., Noticias, p. 236.

²²Manuel G. Soriano, "El trabajo de los indios en los ingenios azucareros de Tucumán," Revista de la Junta de Estudios Historicos de Tucumán, Vol. 2, No. 2, July, 1969, p. 114.

that of Tucumán grew from 108,953 to 215,742.

Transportation problems were only partially solved with the arrival of the railroad. Road networks of the sugar areas were poor and, since quick harvesting and transportation to the mill are necessities for good cane yields, this shortcoming became increasingly critical.

Changes in cultivation techniques accompanied the shift to modern processing machinery. Since the lack of water was definitely a limitation to cane expansion, emphasis was placed on improving the irrigation systems. Older ditches were transformed into useable canals, and nearly one-half of all irrigated cropland in Tucumán was devoted to cane in 1882.²³ This did not signify that all or even most of the cane fields were irrigated. On the contrary, most were not and natural precipitation was therefore extremely important.

Much expansion on land unsuitable for cane occurred during the period. A report of 1882 indicated a significant expansion in Santiago del Estero as well as in provinces along the Paraná River.²⁴ The example of Santiago del Estero is illustrative of a growing problem. There, much cane was grown during the boom years, and several mills were installed. Long and frequent frosts, with resulting low sugar yields, eventually forced the

²³Schleh, Noticias, p. 205.

²⁴Bravo, La industria azucarera, p. 23.

withdrawal of cane from this climatically marginal zone. Some remnants of the industry remain as stark reminders of that era of hope.

The expansion of cane elicited considerable clearing of new lands, but much of the growth occurred at the expense of other traditional crops. The increase in cane acreage relative to total cultivated land is documented in Table 3.

TABLE 3

TOTAL CULTIVATED AREA AND AREA IN SUGAR CANE IN
TUCUMÁN PROVINCE, SELECTED YEARS, 1872-1895

Year	Total Area (hectares)	Cane Area (hectares)	Cane as % of Total
1872	24,832	1,687	7%
1882	51,600	6,636	13%
1888	36,041	10,594	29%
1895	98,175	53,086	54%

Source: Emilio J. Schleh, Noticias históricas sobre el azúcar en la Argentina (Buenos Aires: Centro Azucarero Argentino, 1945), pp. 209-210.

The expansion of cane cultivation was especially notable between 1888 and 1895. During the latter year Tucumán province accounted for about 93 percent of all cultivated cane in the nation.²⁵ This dominance was not

²⁵Schleh, Noticias, p. 209.

always so complete. From 1872 to 1888 more than one-half of the Argentine sugar cane grown was from Tucumán, but during this period cane had its greatest development in other regions of the country.²⁶ These regions were also affected by the innovations and improvements in industrial machinery, but at different rates. For example, the first Argentine sugar refinery was founded in 1889 in Rosario, a break-in-bulk point for imports and exports on the Río Paraná. This centralized the refining process, and for a considerable period all raw sugar was transported to the river port and redistributed to various national and international destinations. The most important areas devoted to cane outside of Tucumán, however, were in Salta and Jujuy provinces. Northwestern provinces other than Tucumán also gained from the improved transportation network, but there was a natural lag since the railroad arrived later. The growth in area planted to cane can be seen in Table 4.

The area devoted to cane in Salta and Jujuy increased gradually, while a dramatic increase and decline occurred in Santiago del Estero. As previously stated, the boom ended quickly in the latter province, while the growth in the other two areas was indicative of their future importance. In these areas the system developed differently from that of Tucumán. There, large holdings

²⁶Ibid.

TABLE 4

SUGAR CANE AREA IN NORTHWEST ARGENTINA,
SELECTED YEARS, 1872-1895

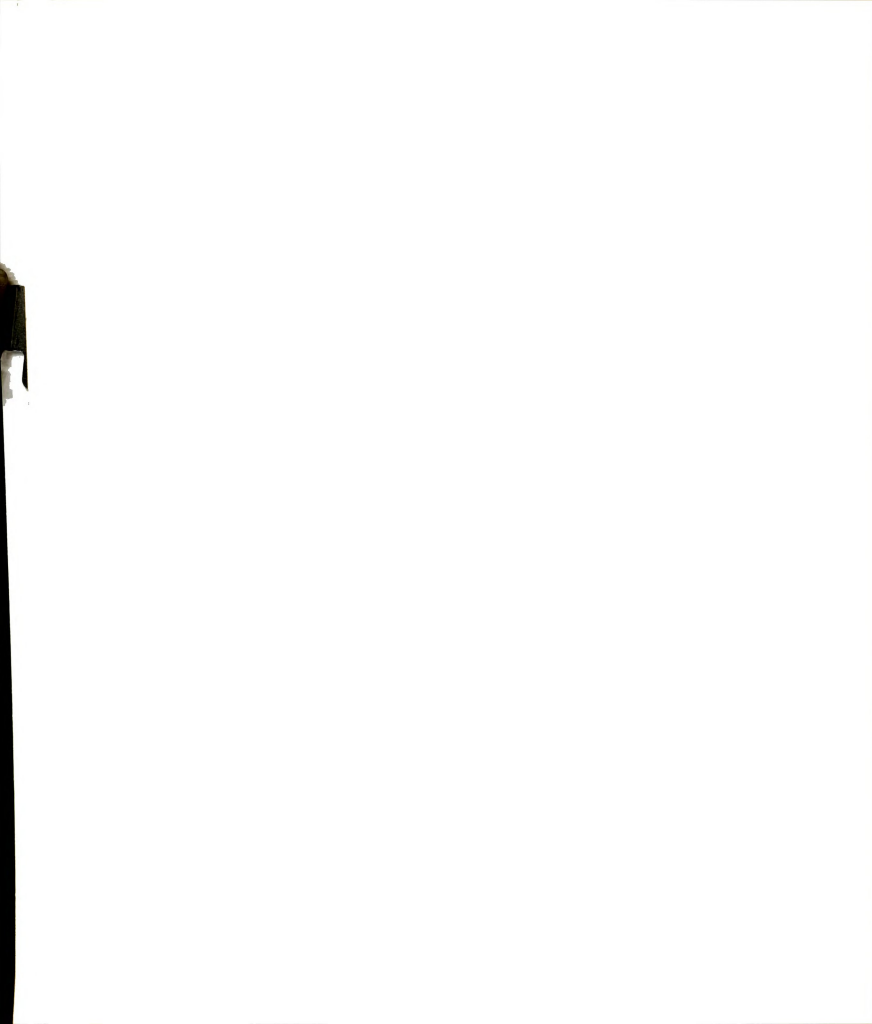
	Jujuy (hectares)	Salta (hectares)	Santiago del Estero (hectares)	Tucumán (hectares)
1872	338	251	17	1,687
1875	338	290	18	6,636
1888	974	302	2,925	10,594
1895	2,138	645	796	53,086

Source: Data compiled from Emilio J. Schleh, Noticias históricas sobre el azúcar en la Argentina (Buenos Aires: Centro Azucarero Argentino, 1945).

came the rule. In 1895 Jujuy's more than 2,000 hectares were divided among only sixteen plantations, and there were two mills to process the cane.²⁷ Also more typical of these areas was the near complete dependence for labor upon Indians from the Chaco, the Argentine Andes, and Bolivia. Most of the sugar produced stayed within the area and was used for local consumption.

Inter-regional differences in sugar yields became significant in the late 1800's. The average yields of the 1890's in Tucumán hovered around 5 percent, and it was projected that yields could not significantly surpass this figure. A report of 1889, however, stated that at least

²⁷Schleh, Noticias, p. 268.



ingenio reached yields of more than 7 percent sugar and enough additional alcohol to equal almost 9 percent in total.²⁸ This figure compared favorably with that of any other region in Argentina or the world at that time. Thus, it can be seen that even limitations on yields were beginning to break down.

Increasing national production can be documented throughout the early period of expansion. In fact, the most total commitment to cane, added to the easy credit required by industrialists, led to overexpansion, both industrial and agronomic. By 1895, a self-sufficiency in national sugar production was attained, thanks chiefly to plantings in Tucumán, and the savings in foreign imports were considerable (see Table 5).

TABLE 5
SUGAR IMPORTS INTO ARGENTINA, SELECTED YEARS
1870-1895

Year	Tons	Year	Tons
1870	19,599	1885	19,036
1885	23,631	1890	29,540
1890	30,533	1895	5,651

Source: Emilio J. Schleh, Noticias históricas sobre el azúcar en la Argentina (Buenos Aires: Centro Azucarero Argentino, 1945), p. 32.

²⁸ Ibid., p. 250.

In 1896, as a result of the rapid increase in production, the first great crisis in the industry was precipitated. A semi-artificial economic life had been established that took on increasingly dangerous overtones. Few industrialists could resist the easy credit available for establishment of mills, and few planters resisted the high earnings possible through cane cultivation. Drastic adjustment was needed, and the super-abundant harvests from 1894 to 1896 spelled the end of the boom. In Tucumán, the chief producing region, seven of the smaller mills were closed, and further steps toward industrial consolidation took place. The industry had reached a definite level of maturity.

Maturation Through Crises: 1901-1965

Smooth progress did not automatically follow the establishment of a firm industrial base. More characteristic of the subsequent period, about 1900 through 1965, were recurrent crises and adjustments. This further evolution of the sugar industry was influenced by many factors, but certain features stand out as keys to development: 1) Government controls affected all phases of the industry and directed much of the progress; 2) Cultivation was greatly influenced by agro-technical advances, particularly the introduction of new cane varieties; 3) Organizational conflicts within sectors of the industry as a whole, and between producing regions of the country,

contributed to production crises and to increased social awareness by the working class; and 4) Changing regional patterns in cultivation and harvesting created increasing competition.

Government Controls

The influence of the national government was critical to the development of the sugar industry through the 1900-1965 period. The overall goal was to maintain and protect a stable national production, and three chief means were used to attain this end: 1) customs duties levied on imported sugar, 2) subsidies for exportable production, and 3) direct regulation of production.²⁹ Each of these policies was utilized, either in concord or separately, depending on the circumstances.

Import duties, beginning in 1888, protected the industry during its period of most significant growth, but subsequent development required new and varied kinds of regulation. Surplus sugar production continued from 1896 through 1906 and resulted in the first regulatory laws. Numerous decrees were issued in the early 1900's and most were directed at the Tucumán cane region, since it completely dominated production at this time. For example, a 1902 law of Tucumán province placed a tax on each kilogram of

²⁹Roberto F. de Ullivari and Guillermo K. Voss, La producción azucarera Argentina: Necesidad de su regulación (Tucumán: Centro Regional Noroeste, 1966), p. 13.

ture sugar produced in excess of that 1902 harvest year. Stronger limitations followed, such as an absolute production quota, and the first crisis was eventually eased.

National pricing schemes affected all producing regions and all sectors of the industry. Both raw material and finished product prices were sometimes fixed by the government. In 1912, for example, a national law linked retail sugar prices to a given level of import duties. An increase in domestic prices allowed additional low-cost sugar into the country and thus effectively stabilized internal prices for years. Such an arrangement was deemed necessary to protect consumer interests in this basic food item.

Pricing policies between planter and mill owner became of increasing concern during this period. Prior to 1925 there was essentially a free market for the purchase of cane. Each mill offered fixed prices per ton of cut sugar cane. The independent grower could theoretically choose the mill with the "best" price. In reality, however, the small, elite group of industrialists was at a definite advantage and could quite easily manipulate prices. This colonial-type relationship led to increasing levels of conflict between growers and the ingenios which reached a peak in the mid-1920's. President Marcelo T. de Alvear was designated by the contending parties to arbitrate the differences. His detailed, written decision of 1928 settled

fixed prices for the sugar crop of 1926 and fixed norms for
 pure relationships between planters and industrialists.³⁰
 This ruling, known as the Laudo Alvear, was based upon a
 comprehensive study of the entire industry and is considered
 many to be the best conceived instrument for both culti-
 vor and ingenio to date.³¹ It fixed cane prices by a
 cost-basis formula according to costs engendered by each
 group. Attempts were made to revise this agreement in the
 1930's, but the Laudo Alvear was the essential regulator of
 the industry until the era of Juan Domingo Perón.

From 1945 to 1956 the basis of the pricing policy
 between grower and industrialist took an abrupt turn.
 During this period there was no incentive for higher sucrose
 yields because payment was based purely on the weight of
 cane delivered.³² The significance was that even small
 producers on marginal cane land could produce acceptable
 quantities when sucrose percentage had no importance. In
 effect this subsidized the small or inefficient grower,
 and by 1950 a formal compensatory fund was established to

³⁰"Laudo Alvear," in La legislación laboral en Tucumán, Vol. 3 (Tucumán: Universidad Nacional de Tucumán, 1969), pp. 171-221.

³¹Ullivari and Voss, La producción azucarera en Tucumán, p. 14.

³²Robert E. Evenson and Manuel L. Cordoní, Sugar Production in Argentina: A cursory Examination. Cuaderno 69-1. Facultad de Ciencias Económicas. (Tucumán: Universidad Nacional de Tucumán, 1969), p. 8.

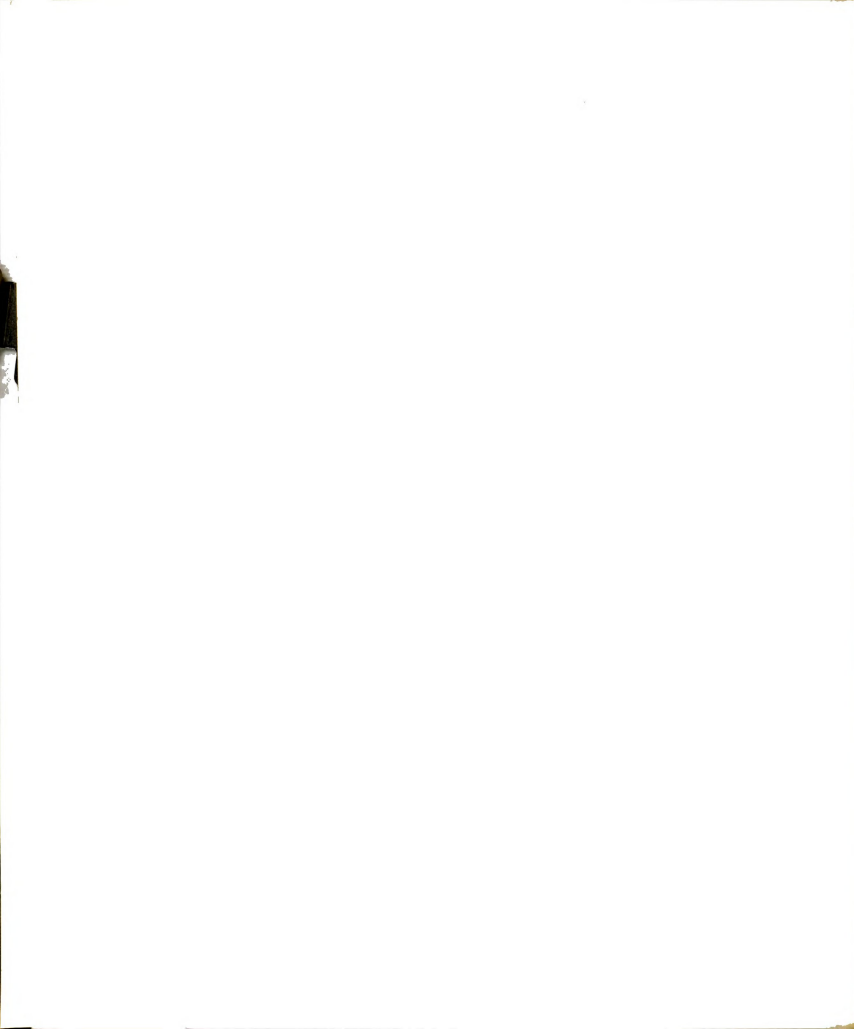
ver the producers with low sugar yields. The policy seemed to be mainly a populist move enabling the small producers to enjoy a limited measure of economic growth. The industry, in turn, attained a new look, as factory yields declined and acreage in cane increased.

A return to economic goals after the ouster of Perón used the reinstigation of payment according to sucrose yields by 1957. Planters again needed to find new, improved varieties and cultural practices, and ingenios were required up-date and improve extraction methods. Although minor changes have occurred since then, a basic concern with high yield and factory yields has been maintained.

Another period of superproduction in the late 1950's resulted in some variation in government policies. Surplus production became most acute in 1959, and a law was passed that year that again favored export with compensation. Continuing surpluses plagued the industry into the 1960's, but this situation fortunately coincided with several years of poor beet sugar harvests in Europe. Stockpiled Argentine sugar thus found an outlet at very favorable prices, although this artificial situation was not to last. In 1965, strict limits were placed on the amounts harvested and processed, and more drastic events were soon to come.

Pro-technical Advances

Variations in planting, harvesting, and processing techniques always accompany a progressive industry, and the



gentine sugar industry was no exception during this period. In most cases the changes were minor and difficult to document. A most significant area of change, however, was the evolution of sugar cane varieties.

Local cane varieties (criollas), or those introduced from the Spaniards, provided the entire supply of raw material harvested throughout the initial period of development. Adequate yields were attained until the mosaic disease greatly reduced production in the 1914 crop year. The search for varieties resistant to this plague resulted in the introduction of a "second generation" of cane, developed primarily in Java. Adoption was such that by 1918 about 90 percent of the production of Tucumán was from Javan varieties, and by 1928 they had almost entirely replaced the criolla varieties.³³ The accompanying higher yields resulted in renewed confidence within the industry and this was transposed on the landscape as increased cane acreage.³⁴

A second major ailment to seriously affect production was the insect-caused carbón, in the early 1940's. Fortunately, this occurrence coincided with the release of the first cane varieties developed by the Tucumán Experiment

³³Ibid., p. 2.

³⁴William E. Cross, "Informes relacionados con el conflicto fabril-cañero," Revista Industrial y Agrícola Tucumán, Vol. 19, No. 1-2, 1928, p. 37.



ation. Thus, in 1944 a sample census showed that Tucumán varieties accounted for 18 percent of the plantings and reached over 70 percent in 1953.³⁵ The most popular variety (Cuc 2645) was resistant to both of the major plagues but had a low yield of sucrose. This was no deterrent to planting, however, since the pricing scheme from 1945 to 1956 encouraged production by weight of cane and not by sugar content. It is possible to trace the importance of these heavy varieties into the early 1960's, when the Tucumán types were replaced by improved, high sugar content varieties from Florida, South Africa, and Brazil.³⁶ The necessity for imported strains is attributed to the fact that experimentation with high yielding varieties was discouraged in Tucumán during the period when pure weight was emphasized. The concern with "third generation" varieties with high sucrose content and early maturation has continued, and the Tucumán Experiment Station is again contributing to local improvements.

Organizations

Three basic segments of the sugar industry are the industrialists, planters and workers. Such distinctions are, in reality, a bit simplistic since, for example, many

³⁵Evenson and Cordoní, Sugar Production in Argentina, p. 3.

³⁶Ibid.



lles operate their own cane fields. However, these groupings do represent separate interests that have become institutionalized over time in specific organizations. The primary divisions have, in turn, formed finer organizational units and all offer insights into the maturation process of the industry (Figure 2).

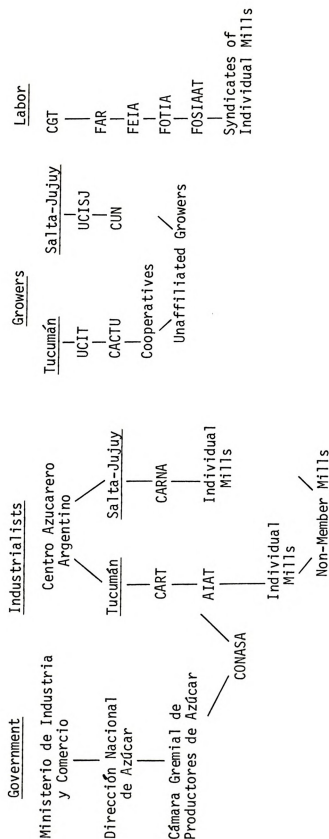
The first group to profit greatly from the industrial growth were the mill owners, or industrialists. This relatively small but powerful class controlled the early destiny of the industry. Relationships between mills about 1900 were far from cordial since each was fighting for a share of the local market. Yet, because of the limited total demand and a common foe, the necessity for organization was recognized.³⁷ The Centro Azucarero Argentino, initiated by two prominent Tucumán mill owners, was a grouping of owners formed in 1894 to defend the local industry's position relative to government policies, and particularly toward imported sugar.³⁸ Subsequently, an association of industrialists was formed in each major district, and the mills were also well represented on regional sugar councils.

The first challenge to the supremacy of the owner class came from the independent growers of Tucumán. As the

³⁷Leoni Pinto, "La historiografía," p. 152.

³⁸Universidad Nacional de Tucumán, Tucumán guía (Tucumán, 1970), p. 106.

ORGANIZATIONAL ELEMENTS OF THE ARGENTINE SUGAR INDUSTRY



Government-Industrialist

CONASA - Compañía Nacional Azucarera, S. A.

Industrialists

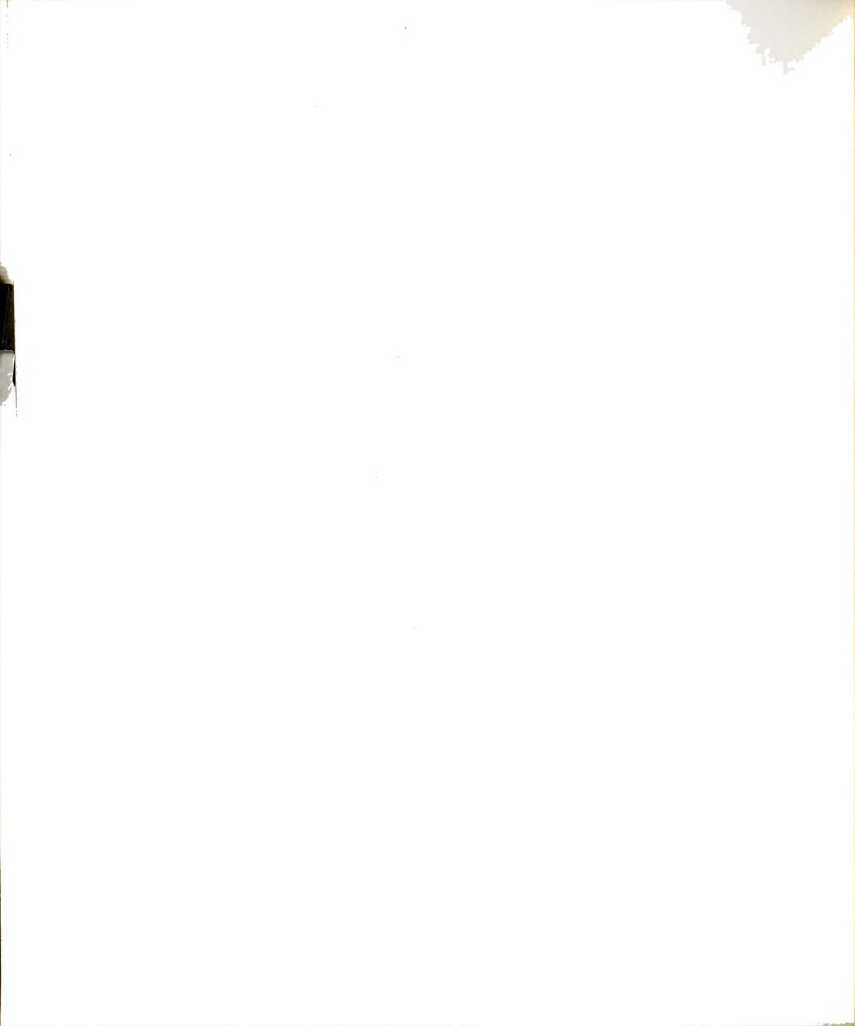
CART - Centro Azucarero Regional de Tucumán
CARNA - Centro Azucarero Regional del Norte Argentino
AIAT - Asociación de la Industria Azucarera de Tucumán

Growers

UCIT - Unión Cañeros Independientes de Tucumán
CACTU - Centro de Agricultores Cañeros de Tucumán
UCISU - Unión Cañeros Independientes de Salta y Jujuy
CUN - Cañeros Unidos del Norte

Labor

CGT - Confederación General de Trabajadores
FAR - Federación de Azúcar Regional
FEIA - Federación de Empleados de la Industria Azucarera (de Tucumán)
FOTIA - Federación Obrera Tucumana de la Industria Azucarera
FOSIAAT - Federación de Obreros del Surco de la Industria Azucarera y Agropecuarios de Tucumán



number of planters increased, from 2,630 in 1895 to over 5,000 in 1926, the potential power of organized action was seen.³⁹ The first effective union of cane growers, the Centro Cañero, was formed in 1917. The initial goal was to attain better access to, and better prices from, the mills. At this point the mill owners still held most of the power and, thus, active conflict between the groups seemed only a matter of time and circumstance. A major confrontation occurred during the 1926/27 crop year as the growers struck the mills and organized several marches on the city of Tucumán. Low prices and delayed payments for cane bought from the independent planters were the major reasons for the strike. The result of this turmoil was the establishment of a national policy which established norms for cane prices paid to the growers. These payments varied directly according to the market price for the final processed sugar. This same ruling, the Laudo Alvear, also stated that the mills had an obligation to grind the cane of independent growers. Thus, the planter attained an established and recognized position in the industry.

A partial reorganization of the growers union followed shortly after the 1927 victory, but the Centro Cañero lasted until 1945 when the Unión Cañeros Independientes de Tucumán (UCIT) was formed to represent the

³⁹Leoni Pinto, "La historiografía," p. 155.



planters. This union became dominated by the much more numerous and "activist" small growers and, thus, the larger independents and some of the medium-sized operators split into their own group, the Centro de Agricultores Cañeros de Tucumán (CACTU). These two groups represented the cane farmers of Tucumán throughout this period.

The workers, not surprisingly, were the last segment of the industry to begin the organizational process. The factory workers affiliated with the Federación Obrera Tucumana de la Industria Azucarera (FOTIA) in 1942, and the field workers formed their own union, the Federación de Obreros del Surco de la Industria Azucarera e Agropecuarios de Tucumán (FOSIAAT), two years later. Both groups tended to associate with the small planter class in pressing for changes within the industry.⁴⁰ Even further splintering occurred as the office employees of the mills organized separately. In addition, many mills began individual syndicates to represent the various working groups.

Through organization, the almost total power wielded initially by the owner group was diffused throughout the process from field to factory. This meant essentially that all sectors began to participate more fully in the

⁴⁰Miguel Murmis and Carlos Waisman, "Monoproducción agro-industrial, crisis y clase obrera: La industria azucarera tucumana," Revista Latinoamericana de Sociología, Vol 5, No. 2, 1969, p. 363.

economic progress of the industry. It also lead to more infighting among the various sectors.

Changing Regional Patterns of Cultivation and Harvest

At the turn of the century, the major sugar producing zones were well established. Most significant changes between 1900 and 1965 can be understood through inter-regional comparisons of Tucumán and Salta-Jujuy.

One new occurrence in the sugar industry of Argentina during this period concerns experimentation with the sugar beet. Some studies were conducted in Tucumán beginning about 1917 and lasted approximately nine years before being discontinued.⁴¹ Actual production of beet sugar began in 1929 when two mills, one in the province of Mendoza and the other in the Río Negro Valley, started operations. Beet sugar output reached a high of 4,900 tons in 1935, but by 1940, with only the Río Negro mill in operation, production had declined to 2,190 tons and ceased completely in 1941.⁴² Unfavorable growing conditions and strong opposition from the cane areas are reasons most often given for this rapid decline. Actually, sugar beets

⁴¹William E. Cross, "Experimentos con la remolacha azucarera en Tucumán," Revista Industrial y Agrícola de Tucumán, Vol. 13, No. 7-8, 1923, p. 132.

⁴²U.S. Tariff Commission, Agricultural, Pastoral and Forest Industries in Argentina (Washington, D.C.: Government Printing Office, 1947), p. 50.



never became more than a mild threat to the established cane areas.

Among the traditional cane producing areas, Tucumán retained the dominant position throughout this period, but an element of competition was injected. The progression of planted area and sugar production for the two major regions can be seen in Figures 3 and 4. Data from 1913, for example, show that Tucumán province accounted for approximately 84 percent of the cane acreage and 82 percent of the sugar produced. This same year, Salta and Jujuy had 10 percent of the planted area and 14 percent of the annual production.⁴³ By 1941 Tucumán had slightly over 80 percent of the acreage planted but yielded only 65.6 percent of sugar milled, while Salta and Jujuy had 11.5 percent of the area cultivated but produced 29.1 percent of the sugar.⁴⁴ Even higher percentages for the two northern provinces followed in the late 1950's and early 1960's.

The variation in total area harvested is due almost entirely to gains or losses in Tucumán, while increases in the North occurred slowly but steadily (see Figure 3). Cultivation in Salta and Jujuy started from a low base but

⁴³Ernesto Tornquist & Co., Ltd., The Economic Development of the Argentine Republic in the Last Fifty Years (Buenos Aires, 1919), p. 55.

⁴⁴International Sugar Council, National Sugar Economies and Policies, Vol. 1 of The World Sugar Economy: Structure and Policies (London: International Sugar Council, 1963), p. 177.



Figure 3. Cane Area Harvested in Tucumán and Salta—Jujuy Provinces, 1900—1973

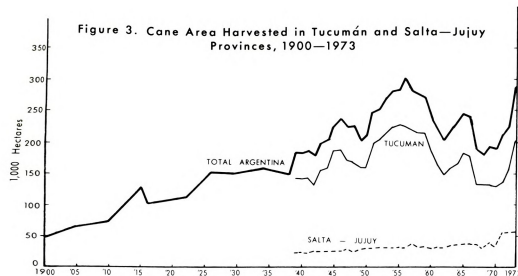
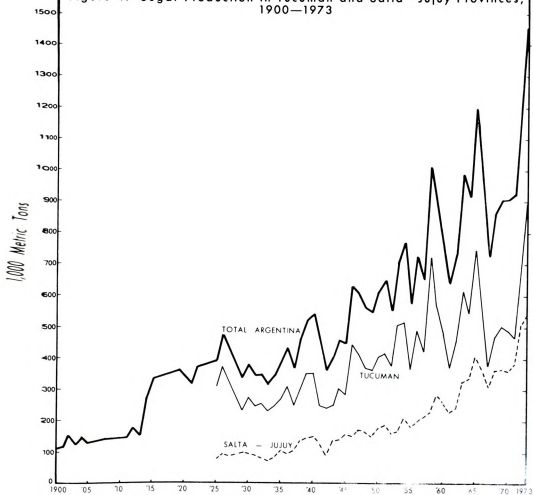


Figure 4. Sugar Production in Tucumán and Salta—Jujuy Provinces, 1900—1973



Source: La Industria Azucarera and Compilation by Author.

doubled between 1910 and 1940, and nearly doubled again by 1965. This growth took place without any dramatic yearly increments, and at its peak Salta and Jujuy accounted for about 20 percent of the total Argentine area devoted to the crop. Cane acreage in Tucumán also doubled between 1910 and 1940 and then rose erratically to a maximum in 1955, when over 80 percent of its cultivated land was in cane. Following that peak of about 230,000 hectares, the area in cane declined for seven consecutive years and then began increasing again with the 1963 crop year.

Production figures are even more graphic than those showing cultivated area. Large yearly variations have been characteristic of sugar production in Tucumán, and these shifts have been mirrored in the national figures (see Figure 4). It is noteworthy that maximum production did not coincide with the maximum area harvested. Obviously other variables, such as climatic factors, must be investigated to explain the fluctuations. Production in Salta and Jujuy varied little in comparison with Tucumán, showing a slow but steady upward trend. Thus, by the 1960's the North had improved its position considerably, while Tucumán exhibited signs of relative stagnation.

Increasing competition between Tucumán and the North became especially pronounced during and after the Perón era. At this time the majority of the northern mills were in better financial condition than those of Tucumán. By

ignoring the full requirements of the Regulatory Fund of 1950, which compensated inefficient growers and mills with contributions made by the most productive operations, the ingenios of Salta and Jujuy gained further strength relative to Tucumán.⁴⁵ Then, with change in government policies in 1959 from paying by weight of raw cane to placing a premium on yields per ton of cane, the entire industry was forced to acquire new, efficient equipment or close down. This policy naturally favored the mills that could most afford the changes, and many ingenios in Tucumán went heavily into debt. The improved milling capacity, plus associated varietal changes and improvement in agricultural practices, resulted in higher production in the 1960's. This added to surpluses of sugar that had accumulated since 1959. Fortunately, the crisis was alleviated by an abnormally poor 1963 European crop year, which allowed Argentine sugar to be exported at record prices. This set of circumstances led to increased plantings in all cane areas and, combined with several years of mild winter in Tucumán, resulted in the accumulation of considerable surpluses again in 1965.

⁴⁵ Estación Experimental Agrícola de Tucumán. Bases para el desarrollo agrario de la provincia de Tucumán, Publicación Miscelanea No. 29 (Tucumán, 1968), p. 17.

Current Developments: 1966-1974

The harvest of 1965, which left a surplus of about 400,000 tons in excess of domestic consumption drastically changed the sugar industry. Prior to this date any excess would have been exported, but only at a considerable loss since national production costs were about five times higher than the usual international price for sugar.⁴⁶ Compounding this problem, a general economic-financial crisis in Tucumán during the mid-1960's led to acts of violence. Workers forcefully occupied a number of mills that were behind in wage and cane payments. As noted previously, all sugar factories needed to improve their equipment, and many had to borrow large sums from the national bank. A few were so far in debt that their obligations were difficult, if not impossible, to meet. In government circles these conditions were intolerable and a new mentality was at work to provide a "solution."

Two overriding goals governed thoughts at the policy-making level: 1) A rationalization of the sugar industry as whole, and 2) a structural transformation of the Tucumán economy. Toward these ends a number of strong actions were designed.

⁴⁶Roberto F. de Ullivarri and Guillermo Kenning Voss, Caña de azúcar: Documento básico, Instituto Nacional de Tecnología Agropecuaria, Centro Regional del Noroeste (Tucumán, 1966), p. 33.

The most dramatic move occurred very early on August 22, 1966, with the sugar harvest perhaps three-quarters finished in Tucumán. Federal troops were quickly and unexpectedly dispersed to the seven most financially unsettled ingenios. These mills were occupied and given seventy-two hours to cease operation for the season.⁴⁷ The armed take-over reduced the number of operating factories in Tucumán from twenty-six to nineteen. Three other important steps were taken by the government: 1) a decrease of production in Tucumán by 30 percent and in Salta-Jujuy by 17 percent, relative to the 1965 harvest (followed by a 10 percent reduction the next year); 2) a limitation on exports, allowing shipments only to fill the quota of the high-priced market in the United States; and, 3) the expropriation of production quotas (cupos) from approximately 7,000 mini-farmers in Tucumán.

Naturally these measures had severe repercussions in the industry and particularly within the province of Tucumán. Some of the important and lasting results were:

1) A reduction in the amount of land devoted to cane in Tucumán. The area dropped to about 130,000 hectares in 1967 from more than 190,000 in 1965 and nearly 250,000 in 1955.

2) The elimination of about 7,000 small cane growers who had production quotas under 8,064 kilograms.⁴⁸ This meant both a deterioration of

⁴⁷Ley 16.926/ (22/8/66). Published in La Industria Azucarera, September 1966, p. 229.

⁴⁸Estación Experimental Agrícola de Tucumán, Bases, p. 22.



planted cane fields and a potentially great social problem.

3) The creation of a problem concerning the nearly 60,000 hectares of former cane land.

4) The existence of a vast pool of unoccupied persons, estimated at about 40,000 field and industrial workers. Associated with this was a considerable exodus of manpower to other provinces.⁴⁹

5) A drastic reduction of income for the province as a consequence of the production limits.

Government actions thus may have settled certain problems within the industry but certainly created others. Several of the militarily occupied factories were subsequently allowed to reopen but others, seeing the handwriting, ceased operations. Therefore, by 1968 the number of functioning mills was reduced from nineteen to seventeen, and in 1969 this number was further reduced by one (Map 7). The number of factories stabilized at sixteen, but financial problems and associated worker unrest continued in certain cases. In May, 1970, three ingenios were expropriated and placed under a government entity, the Compañía Nacional Azucarera, S. A. (CONASA), to be run in a financially sane and disciplined manner. Later, two more Tucumán mills and two in the Litoral were placed under this agency.

The "rationalization" of the industry was to be accompanied by a structural transformation of the Tucumán economy. Measures taken in this regard were less definitive in nature but, in general, consisted of a concerted effort

⁴⁹Ibid.

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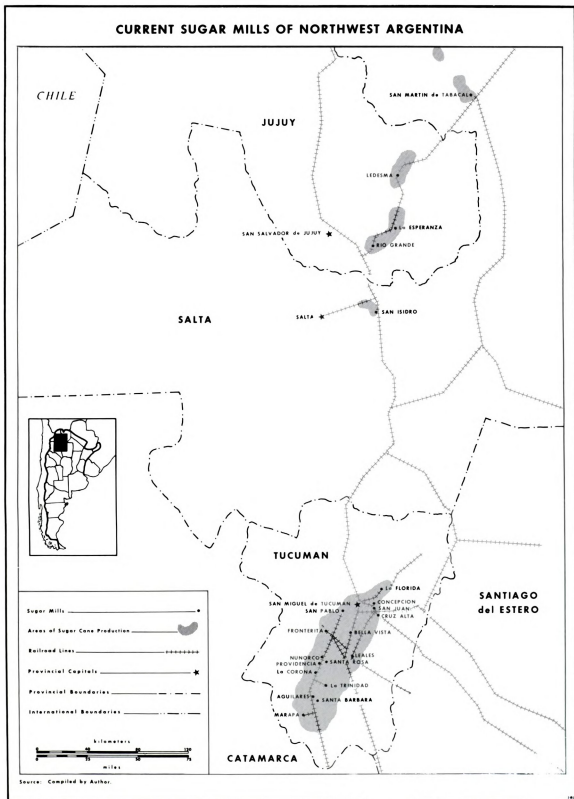
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MAP 7

CURRENT SUGAR MILLS OF NORTHWEST ARGENTINA





to diversify both the industrial and agricultural bases of the province. Responsibility for attracting new industrial concerns was placed in a joint national and provincial commission, called Operativo Tucumano. Efforts to diversify the agricultural sector remained with the existing mechanisms, namely the experiment station and the Ministry of Agriculture.

The effect of all the government actions on the regional sugar balance was to greatly strengthen the position of Salta and Jujuy. This can be seen in Figures 3 and 4, p. 59, as both acreage and production in these northern provinces increased considerably. Production recovered slightly in Tucumán, but its proportion of the national total has been reduced to slightly over 50 percent. A heightened verbal battle between representatives of the two major producing zones has also been characteristic of this latest stage, and each region has vied to attract the attention of the federal government.

The recent history of the sugar cane industry is best understood as a reaction and adjustment to the government actions of 1966. The changes have been significant and serve as the basis for the remainder of this dissertation.



CHAPTER III

AGRO-TECHNICAL ASPECTS AND MARKETING

Planting patterns for sugar cane are affected greatly by the agricultural characteristics of the crop and customary regional practices of cultivation. Sugar cane generally has a wide tolerance of physical environments within the tropics and sub-tropics, but since Northwest Argentina is near the southern margin of acceptability for cane growth, it is presumably "marginal" with respect to important growth elements.¹ The limited areas devoted to cane planting in Argentina tend to support the idea of physical marginality. Even within the study areas, however, cultural practices were observed to be far from uniform. Distinctions must be made between the methods and techniques used in Tucumán and those of Salta-Jujuy. Many differences are simply a matter of degree, however, and are not discussed unless considered significant to the study.

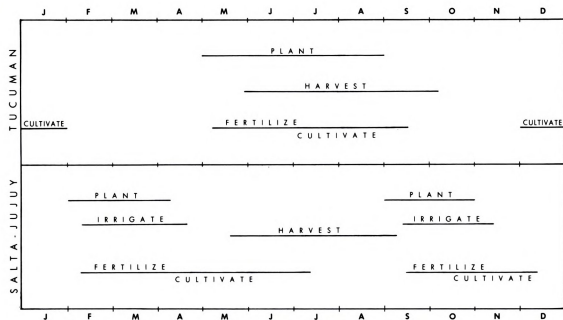
A normal sequence of cultural practices may be noted in the agricultural calendar presented in Figure 5. Significant differences in the timing and duration of planting and

¹International Sugar Council, The World Sugar Economy: Structure and Policies, Vol. II, The World Picture (London: The International Sugar Council, 1963), pp. 5 and 6.



harvesting, and minor variations in cultivation schedules, typify practices in the two areas.

FIGURE 5
AGRICULTURAL CALENDAR FOR SUGAR CANE IN
TUCUMAN AND SALTA-JUJUY PROVINCES



Source: Compiled by author.

Planting and Cultivation

Sugar cane under normal circumstances is a perennial crop. In Argentina, the life of the yearly cane crop is cut short in many areas by frost, but the "seed" is not affected and ratoon crops can be generated. On the average,



a planting in Northwest Argentina is harvested for six or seven years and in former times even up to seventeen consecutive years.² The first year's crop (caña planta) generally yields less than the second, in direct contrast with the situation in prime cane areas such as those of the Dominican Republic.³ Yields from the subsequent ratoon crops (caña soca) remain relatively steady over the succeeding six or seven years.

Soil preparation for planting is similar in both cane areas but accomplished differently. Almost complete mechanization characterizes the two northern provinces, while Tucumán still depends to a large degree on animal power, both mules and oxen. Care in working the fields is closely correlated with the extent of irrigation. Irrigated fields, for example, must be carefully leveled. This is typical of Salta and Jujuy, where irrigation is the norm, while less than 30 percent of the cane area in Tucumán receives this extra care.⁴ Planting furrows vary in depth

²William E. Cross, "Tucumán agrícola e industrial," Revista Industrial y Agrícola de Tucumán, Vol. 26, No. 4-6, 1936, p. 85.

³Dominican Republic, Evolución de la industria azucarera en la República Dominicana (Santo Domingo: Editora del Caribe, 1968), p. 17. The author spent a week researching the sugar industry of the Dominican Republic in March, 1969.

⁴Estación Experimental Agrícola de Tucumán, La mecanización en el cultivo y la cosecha de la caña de azúcar, Publicación miscelanea, No. 24 (Tucumán, 1967), p. 3.



according to soil fertility, while the distance between rows also differs but has decreased somewhat over time. Standard rows are 100 meters in length and traditionally are oriented in a north-south direction to take advantage of exposure to the sun.⁵

The "seed" used in planting is selected carefully from healthy mature canes so each plant will meet specifications of proper maturation, disease resistance and sugar yields. The chosen canes are then cut in lengths of roughly two feet and usually include at least three joints from which the new stalks will grow. Placement of the pieces in the furrows is normally done by hand, and the density of planting depends chiefly upon soil characteristics. Planting in Tucumán is spread out over the winter months from May to September, while the process is concentrated in February and March in Salta and Jujuy (see Figure 5).

Cultivation is necessary during the early growth stages, and increasing amounts of fertilizer are applied simultaneously. Nitrogenous fertilizers now are applied on more than 50 percent of the cane area.⁶ These applications also affect weed growth. Thus, greater usage of herbicides

⁵William E. Cross, "El cultivo de la caña de azúcar en la República Argentina," Revista Industrial y Agrícola de Tucumán, Vol. 19, No. 7-8, 1939, p. 183.

⁶William E. Cross, "Informe sobre la industria azucarera de la Argentina en los últimos diez años" La Industria Azucarera, Vol. 66, No. 802, 1960, p. 395.



has followed, since annual weeding is prohibitively expensive on large holdings. Once the cane grows tall enough to shade the inter-row area further weeding becomes unnecessary.

Very little care is needed for cultivating sugar cane relative to most other crops. Increasing mechanization throughout the industry requires fewer man hours during the preparation and growth periods. These stages are labor intensive today only for the small family farmer.

Harvesting

The harvest season, or zafra, causes radical changes in the appearance of the producing provinces. The harvest period demands a large number of workers, and a seasonal in-migration of considerable magnitude therefore occurs. Zafreros are attracted not only from the province of Tucumán but also from neighboring provinces, and even Bolivian laborers are drawn into Salta and Jujuy. These seasonal migrants are particularly visible in Tucumán as they arrive in mule-drawn, large wheeled carts, piled high with possessions and family members (see Figure 6). Normally the picture is completed by several dogs trailing the procession. Neither major producing area was ever dependent upon black laborers, which makes them almost unique among cane areas of the world. This fact even

⁷International Sugar Council, The World Picture, p. 13.





Fig. 6. Zafreros Arriving in Tucumán Province



Fig. 7. Working Cargadero in Tucumán Province



caused the globe-trotting Theodore Roosevelt to comment on the lack of "exploitation" in the sugar industry, as he passed through the area in 1913.⁸

The working sugar mills also transform the province. Distinctive smoke trails rise from the ingenio stacks as the calderas are stoked up for the round-the-clock work hours of the zafra. The olfactory senses also note the beginning of the harvest, as a typical molasses odor pervades the environs of each mill. Life in the villages surrounding most ingenios is also affected by new animation. After a long day's work violent arguments break out not infrequently, with the result that machetes are sometimes drawn and blood is spilled. Additional testimony to the frenzy of this period is the cane strewn along all roads and the sudden appearance of make-shift huts for the seasonal laborers.

The basics of the harvest itself are quite similar in all the cane areas, but differences arise in the degree of mechanization. In preparation for cutting, the cane is normally burned to rid the fields of dried leaves accumulated around the base of the canes. This process, incidentally, also rids the canebreaks of snakes and other inhabitants that might inhibit the work of the cane cutters! The

⁸Augusto M. Bravo, La industria azucarera in Tucumán: Sus problemas sociales y sanitarios (Tucumán, 1966), p. 42.



burning does not significantly harm the cane since the stalk contains a large volume, nearly 70 percent, of water.

The great majority of the cane is cut by hand, although increasing amounts are being harvested by mechanical cutters. This mechanization process in the field is more advanced in the large holdings of the North than in Tucumán. Where cane is still harvested manually, experienced workers are desired, since the cutting requires some artistry. The stalks are cut at ground level by machetes, and the growing end (the despunte, which may be used as cattle feed) is lopped off. The remainder of the stalk is quickly cleaned of remaining leaves and may then be sliced in two if deemed too long. The cut cane is usually piled neatly to facilitate the succeeding loading process. Zafreiros often work in teams and are given the responsibility for harvesting a certain area by the foreman (capatáz). Often wives and children help, sometimes by wielding a machete but more frequently by helping pile the cut cane.

Once cut and piled, methods of transfer to the mill vary greatly. The crudest, and the method most used by small cañeros, is to load the cane by hand into the typical large-wheeled carretas. Each full load (fardo) contains about three tons of raw material. The carts with iron-rimmed wheels are slowly disappearing from the cane areas, and metal carts with pneumatic tires are replacing them. These are more easily pulled and cause much less damage to the



roads. The construction of good paved roads was reportedly retarded in Tucumán because the iron cart wheels quickly broke up pavement.⁹ The filled carts are pulled by mules or oxen either directly to the mill or to a gathering station (cargadero). Animal power has been replaced in many areas by tractors, which improve efficiency by their capacity to pull up to six or seven filled carts.

The cane accumulated at the gathering stations is often transferred to trucks, or, in isolated cases, to railroad cars and carried to the mills. During the harvest the rather odd shaped cargaderos are crowded with waiting wagons, carts and large stalks of bundled cane which await transfer to the next transport mode (see Figure 7, p. 72). The cane trucks normally have a capacity ranging from twenty to thirty-two tons, which may be doubled with an additional trailer. The larger capacity is necessary since the estimated average distance from any canefield to a cargadero is about four kilometers (two and one-half miles), and from each cargadero to the factory averages almost seventeen kilometers (ten and six-tenths miles).¹⁰

⁹Conversation with Professor Teodoro R. Ricci, Tucumán, August 5, 1970.

¹⁰Roberto F. de Ullivarri and Guillermo K. Voss, Caña de azúcar: Documento básico (Tucumán: Instituto Nacional de Tecnología Agropecuaria, 1966), p. 22.



When the cane reaches the mill it frequently meets a bottleneck. The "typical" ingenio has cane piled high in the plaza (canchón), while lines of trucks and carts tie up movement around the entrances. The result is that cane frequently lies in the hot sun for more than a day. Attempts to speed up the operation, and thus to improve factory yields, include the use of large, mechanically loaded trucks which can dump their load directly onto conveyor belts. Then, the problem becomes a logistical one of proper scheduling. Greater use of portable cranes would help to speed up traditional operations at the mill.

Three major distinctions can be made in the harvesting and transfer of cane from the fields to the mills: 1) A manual system in which the cane is cut, piled and loaded entirely by hand, chiefly visible in Tucumán but present to some extent in both zones; 2) a mixed system in which the cane is cut and piled by hand but loaded mechanically, which is used with variations in all zones; and 3) an entirely mechanized system, in which the cane is cut and loaded by machine. This system is most prevalent in Jujuy but is also used in certain mills of Tucumán (see Figures 8-11).

The field methods of Ingenio Esperanza in Jujuy are the most mechanized of any encountered. An industrial trend is definitely toward more capital intensive methods of harvesting, with a declining emphasis upon manual labor.





Fig. 8. Manual Harvest of Sugar Cane



Fig. 9. Manual Loading of Sugar Cane





Fig. 10. Mechanized Loading of Sugar Cane in Salta Province.



Fig. 11. Mechanized Piling of Sugar Cane, La Esperanza, Jujuy.



Therefore, Esperanza provides an important example. Much of the harvest is still cut manually, although the management has been experimenting with various mechanical harvestors. Yet, the process from field to mill is highly mechanized. Large bulldozers push the cut cane to the margins of access roads where a moveable crane transfers the cane to large trucks. The trucks are weighed at the mill and their loads tilted onto conveyor belts. The cane then passes through a water spray to rid it of dirt and other accumulated material picked up in the mechanical loading process. The latter technique was learned through three years of experience, according to company officials.¹¹ This system could serve as a model for the rest of the industry.

The industry as a whole maintains a system of transfer from field to mill that is far less than ideal. In Tucumán, particularly, the movement of cane from the field is slow and inefficient. Any improvements resulting in less time loss between cutting and milling would add to factory yields. Most of the northern mills transfer the cane to factory via fleets of trucks or privately-owned railroad systems (Figures 12 and 13). In general, this results in fresher cane to grind than is the case in

¹¹Conversation with Agron. Héctor Jeréz, Sub-Administrator of Ingenio La Esperanza, Jujuy, July 10, 1970.

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Fig. 12. Field-to-Mill Transfer of Cane by Rail, Jujuy Province.



Fig. 13. Field-to-Mill Transfer of Cane by Truck, Jujuy Province.



Tucumán. In Salta and Jujuy the average cane crushed has been cut less than forty-eight hours, while estimates for Tucumán approach or surpass seventy-two hours.¹² Particularly in the very hot weather of late summer, long delays can have a negative effect on factory yields.¹³

The harvest period lasts approximately five months, and during this time the mills are seldom quiet. Each mill has a recognized daily capacity, and the goal is to grind near capacity throughout the harvest period (Table 6). In reality, an individual factory does not operate close to capacity except in unusual circumstances, and the harvest period is therefore prolonged. A tendency within the industry is to increase milling capacities, and the goal is to minimize the actual number of harvest days. This would ideally result in higher factory yields.

Processing

Outward and interior appearances of sugar mills can vary immensely, but the process of making sugar is essentially the same regardless of aesthetics. The scale of operations and modernity may differ, but four major operations summarize the industrialization of the raw

¹²Ullivarri and Voss, Caña de azúcar, p. 24.

¹³Roberto F. de Ullivarri, Recomendaciones para la zafra azucarera, Estación Experimental Agrícola de Tucumán, Circular No. 152 (Tucumán, 1957), p. 2.



TABLE 6

AVERAGE EFFECTIVE CANE MILLING IN TUCUMAN, SALTA
AND JUJUY PROVINCES, SELECTED YEARS, 1965-1973

Mills	1965	1967	1969	1971	1973
	(Metric Tons - Daily)				
Tucumán Province					
Aguilares	2,302	2,509	3,075	3,221	3,286
Amalia	2,459	1,391	---	---	---
Bella Vista	4,284	4,347	4,160	3,362	3,709
Concepción	10,497	10,725	12,337	12,109	12,598
Cruz Alta	1,724	1,791	1,767	1,892	1,840
Esperanza	1,415	---	---	---	---
La Corona	4,156	4,163	4,206	4,319	4,832
La Florida	3,242	3,190	2,952	3,832	2,945
La Fronterita	4,453	4,544	4,292	4,397	5,286
La Providencia	3,856	3,743	3,837	3,761	4,411
La Trinidad	4,186	3,386	3,132	3,052	3,755
Lastenia	1,863	---	---	---	---
Leales	2,513	2,263	2,384	2,419	2,510
Los Ralos	2,029	---	---	---	---
Marapa	1,846	1,615	1,657	1,983	2,115
Mercedes	1,541	---	---	---	---
Nueva Baviera	1,686	---	---	---	---
Nuñorco	2,137	2,327	2,267	2,377	2,605
San Antonio	2,909	---	---	---	---
San José	1,819	---	---	---	---
San Juan	2,381	2,377	2,619	2,492	2,844
San Pablo	4,426	4,537	4,588	3,981	4,806
San Ramón	2,097	2,442	---	---	---
Santa Ana	2,237	---	---	---	---
Santa Bárbara	2,823	2,905	3,130	3,281	3,719
Santa Lucia	2,689	2,558	---	---	---
Santa Rosa	3,128	3,012	2,782	3,261	3,499
Jujuy Province					
La Esperanza	4,467	4,669	4,225	4,301	4,690
Ledesma	12,423	13,798	13,824	13,455	12,443
Río Grande	1,710	1,664	2,370	2,521	2,604
Salta Province					
San Isidro	1,668	1,789	1,746	1,787	1,787
San Martín	5,468	5,850	5,769	7,532	7,191



sugar cane: 1) extraction of the juice by large crushers (trapiches), 2) purification and filtration of the juice, 3) concentration of the juice to crystalize the sugar, and 4) centrifuging and refining the sugar produced.

Numerous useful by-products are generated by the milling process. The fibrous remnants of cane (bagazo) contain vestiges of sugar and moisture and a high cellulose content. The bagasse is frequently used as supplementary fuel for the ovens, but in several special cases it is also used as a raw material for paper fabrication. A solid residue of the purification and filtration process, cachaza, can be spread in the fields as a fertilizer or utilized as a source of vegetable wax.¹⁴ The sticky fluid that yields no more sugar crystals is either sold as molasses or sent to the distillery for the manufacture of alcohol.

Distinctive classes of sugar are the end products of the ingenio. These may be identified according to sucrose content: 1) pilé, a specially compacted sugar that contains 100 percent sucrose; 2) refined granulated, with a content of 99.8 percent, and a brilliant even-grained appearance; 3) second cooking (azúcar de segunda) with a yellowish coloring and a sucrose content of 98 percent; 4) crude sugar, containing 96.8 percent sucrose and a

¹⁴Personal interview with Ing. Sergio Gonzalez Zigarán, Ledesma Sugar Mill, May 16, 1970.



yellowish-brown cast; and 5) third cooking (de tercera) with a percentage of ninety-five and a brownish, rather large-grained appearance.¹⁵ All, except the pilé, are marketed in fifty kilogram sacks, usually made of paper but sometimes of jute.

Transportation and Storage

Competition between two transport modes characterizes the movement of sugar from the mill. The railroad was the chief transporter of both cane and sugar throughout most of the industry's evolution. The Ferrocarril Belgrano remains the largest rail carrier of sugar today, while the only other significant rail line, the Ferrocarril Mitre, carries less than one-fourth the tonnage of the Belgrano. The percentage of the total harvest moved by rail has declined over time, so that in 1971/72 trucks accounted for nearly half the total tonnage. For the second time in ten years, the tonnage carried by truck in that year surpassed that transported by the Belgrano railroad.¹⁶ The railroad is more economical for large tonnages, but the truck has become increasingly competitive over long hauls and the trend indicates that trucking will continue to increase at the expense of the railroad.

¹⁵Mimeographed report of the Centro Azucarera del Norte, División de Producción, no date.

¹⁶"El azúcar Argentino en cifras; Zafra 1972," La Industria Azucarera, Vol. 79, No. 931, 1972.



For individual mills the mix of transportation modes varies greatly. Since, in general, the mills of Salta and Jujuy have greater capacities, and distance to the major market of Buenos Aires is also greater than from Tucumán, a larger percentage of the northern sugar moves by rail.¹⁷ The decision regarding transportation frequently is not that of the mills, however, since many award transportation concessions to individuals, who are then in charge of getting the sugar to the desired locations.

Each mill normally maintains several large storehouses for the processed sugar, both at the production site and in Buenos Aires. Production quotas are assigned and checks are made by federal inspectors at the mill and in the storage areas. Irregularities have been discovered, however, as indicated by a 1970 scandal.¹⁸ One of the companies in doubtful financial straits was found with far less sugar in its Buenos Aires warehouse than had been reported. Some illicit sales had obviously taken place and several individuals were indicted.

¹⁷Conversation with Ing. Agosto Paz, Ingenio San Martín de Tabacal, Salta, August 14, 1970.

¹⁸La Gaceta, Tucumán, May 14, 1970.



Consumption and Marketing

Government quotas regulate the industry by tying production to levels of national consumption. Per capita consumption of sugar had stabilized at around thirty-five kilograms in the 1950's, but by 1972 it had reached about thirty-nine kilograms.¹⁹ These figures are above average for Latin America and below only the consumption figures of North America.²⁰ Low levels of population growth, about 1.5 percent, indicate a limited growth potential for the industry.²¹ Prices are also regulated by the government and have been held at quite constant levels, to the dismay of the industry and its workers.

The only outlet other than the national market for Argentine sugar is the United States. United States prices were considerably above those of the world market up to 1974 and even the high cost producers of Argentina could therefore profitably export to the northern giant. Argentina is allotted a yearly quota which varies according to the supply situation of other United States sources, but

¹⁹"El azúcar Argentino en cifras; Zafra 1972," La Industria Azucarera, 1972.

²⁰Albert Viton, "World Sugar Outlook for the 1970's," Sugar y Azúcar, 1969, p. 14.

²¹Population Reference Bureau, World Population Figures-1972, July, 1972.



in 1972 it was over 85,000 short tons.²² As is the case in most other sugar producing nations, Argentina wishes to maintain and increase its share of the U.S. market!²³

²²La Industria Azucarera, Vol. 79, No. 931, December, 1972, p. 195.

²³In June, 1974, Congress abolished the forty year Old U.S. Sugar Act which had provided subsidies to both domestic and foreign producers. Thus, each country now has to compete for the U.S. market.



CHAPTER IV

ANALYSIS OF INTER-REGIONAL CHANGE

Relationships among the major sugar areas of the Argentine Northwest are currently undergoing great change. The province of Tucumán has traditionally led all others in production, but Salta and Jujuy have become increasingly important and recent government actions have punctuated this growing competitiveness. The resulting economic gains of the two northern provinces have mirrored growing problems in Tucumán, and historically based regional jealousies have been fanned. A new balance within the industry is being attained, however, one that should benefit the Northwest as a whole.

Areal Differentiation Within the Northwest

As recently as the 1965/66 harvest year Tucumán accounted for more than 75 percent of all land planted to sugar cane and a somewhat smaller percentage of total sugar production.¹ A relatively large, contiguous area within Tucumán is suitable for the cultivation of cane, while in Salta and Jujuy (the Norte) sugar land is restricted to

¹"El azúcar Argentino en cifras," La Industria Azucarera, Vol. 79, No. 931, 1972.



rather narrow river valleys where irrigation is required. Thus, expansion of planted area has been limited in the two more northerly provinces, while land devoted to cane in Tucumán has expanded and contracted with apparent ease. Salta and Jujuy are characterized by limited areas planted to cane but subdivided into large individual holdings, whereas the opposite conditions are typical of Tucumán. The sugar areas of the Norte are also located in distinct, semi-isolated sectors of the respective provinces and are not closely connected with the remainder of each political unit. They are, instead, linked directly with Buenos Aires. On the other hand, sugar cane has been, and remains, the centrally located and dominant activity of Tucumán. Tucumán is in the orbit of Buenos Aires, but its sugar industry is integrated with the rest of the province.

Regional differences in yields and overall productivity have favored the Norte. Almost every economic indicator reflects this point. For example, productivity per worker, as measured in tons of sugar produced divided by the number of cane workers in each province, shows almost a two-fold advantage for the two northern provinces in comparison with Tucumán.² Results such as these have been attained largely through more efficient production

²Adolfo Canitrot and Juan Sommer, Diagnóstico de la situación económica de la Provincia de Tucumán, Instituto Torcuato Di Tella (Buenos Aires: 1972), p. 113.



methods and capital intensive, large-scale efforts in the harvesting and marketing stages.

The "growing edge" of the industry in the late 1960's overwhelmingly favored Salta and Jujuy, but more recent figures of plantings and production give a less conclusive picture (Table 7). Both planted area and sugar production showed a downward trend in percentage but a considerable absolute gain in Tucumán between 1969 and 1971. Jujuy has exhibited the most steady expansion in production and planted area, while Salta has shown smaller but steady increases.

Industrial Consolidation in Tucumán

After completion of the railroad in 1876, with the corresponding beginning of a modern sugar industry, the number of active mills in Tucumán varied from a high of thirty-four to the present low of sixteen. Simple trapiches reached a numerical peak in Tucumán in 1877, but a drastic decline to about twenty larger units occurred in the following year, due to adjustments resulting from availability of the new transport mode.³ New industrial establishments raised the total to thirty-four mills by 1894, and shortly thereafter relative stability was attained.

³J. C. Bosonetto, "Distribución de los ingenios azucareros Tucumanos," in Geographia Una Et Varia (Tucumán: Universidad Nacional de Tucumán, 1949), p. 50.



TABLE 7

SUGAR AREA AND PRODUCTION IN TUCUMAN, SALTA AND JUJUY PROVINCES, 1962/63-1971/72

Planted Area - Hectares.										Sugar Production - Metric Tons					
		Tucumán		Jujuy		Salta		Tucumán		Jujuy		Salta			
Year	(Has.)	(% total)	(Has.)	(% total)	(Has.)	(% total)	(Has.)	(% total)	(Tons)	(% total)	(Tons)	(% total)	(Tons)	(% total)	
1962/63	165,200	72.4	25,100	11.2	13,600	6.1	616,409	62.2	227,453	22.9	93,998	9.5	93,998	9.5	
1963/64	167,900	72.7	26,500	11.5	13,100	5.7	541,680	58.8	241,979	26.2	95,905	10.4	95,905	10.4	
1964/65	186,100	74.5	26,200	10.5	14,000	5.6	749,575	61.9	302,294	25.0	103,683	8.5	103,683	8.5	
1965/66	180,000	74.3	27,000	11.1	14,000	5.8	541,104	56.2	269,823	28.0	95,484	9.9	95,484	9.9	
1966/67	186,000	71.1	26,200	13.7	13,800	7.2	378,107	51.7	240,830	32.9	76,740	10.5	76,740	10.5	
1967/68	135,600	73.2	21,000	11.3	13,500	7.3	472,947	53.9	276,569	31.7	98,209	11.4	98,209	11.4	
1968/69	135,600	69.5	26,500	13.6	16,200	8.3	503,733	52.6	270,084	29.8	99,689	10.9	99,689	10.9	
1969/70	133,600	69.6	32,100	11.5	16,300	8.5	491,232	52.1	259,113	28.5	105,354	11.7	105,354	11.7	
1970/71	146,600	68.5	30,500	14.4	17,000	8.0	468,271	50.6	280,084	31.5	105,354	11.7	105,354	11.7	
1971/72	157,100	68.6	30,700	13.4	17,200	7.5	429,578	52.0	381,482	31.5	134,685	11.2	134,685	11.2	

Source: La Industria Azucarera, 1962-1973.



From 1900 to 1966 the number of sugar factories varied from twenty-six to twenty-nine. Despite this slight variation in total numbers, a progression of closings and new attempts kept the industry in flux. Several mills began production in the 1920's and the latest, Leales, opened for the 1936 harvest. Most of the later entries are still functioning, which probably indicates the advantages of new equipment and knowledge.

Additions or subtractions in number of sugar mills in Tucumán did not necessarily reflect increases or decreases in sugar production. Factory capacities tended to expand steadily, and even with reduced numbers the seemingly inevitable crises of over-production continued through the mid-1960's. The bumper crop of 1965 (Table 7) resulted in government intervention in 1966, when seven mills were forceably closed. Additional closures occurred in subsequent years so that just sixteen mills have been in operation in Tucumán since the 1969 harvest. This induced industrial consolidation naturally affected all sugar operations in the province, and numerous adjustments followed.

Spatial Change

The areas of cane production in Tucumán, and the distribution of working cane mills within these areas, have evolved and changed over time. The factories have been concentrated around the provincial capital and have



spread in a linear fashion along the base of the Andean foothills. Those mills closed in and after 1966 show no apparent spatial pattern, although the heaviest toll was taken east of San Miguel de Tucumán (Map 8). The remaining ingenios are more dispersed. Although not stated as an objective, this selective thinning has had the effect of reducing territorial competition and has expanded the raw material hinterlands of the remaining mills. Enough mills still operate in close proximity to each other, however, to indicate that the government actions were not spatially conceived.

The existing mills vary greatly in total capacity, modernity and average yields. The first two of these features are random in nature, while factory yields are related to climatic and other physical variables.

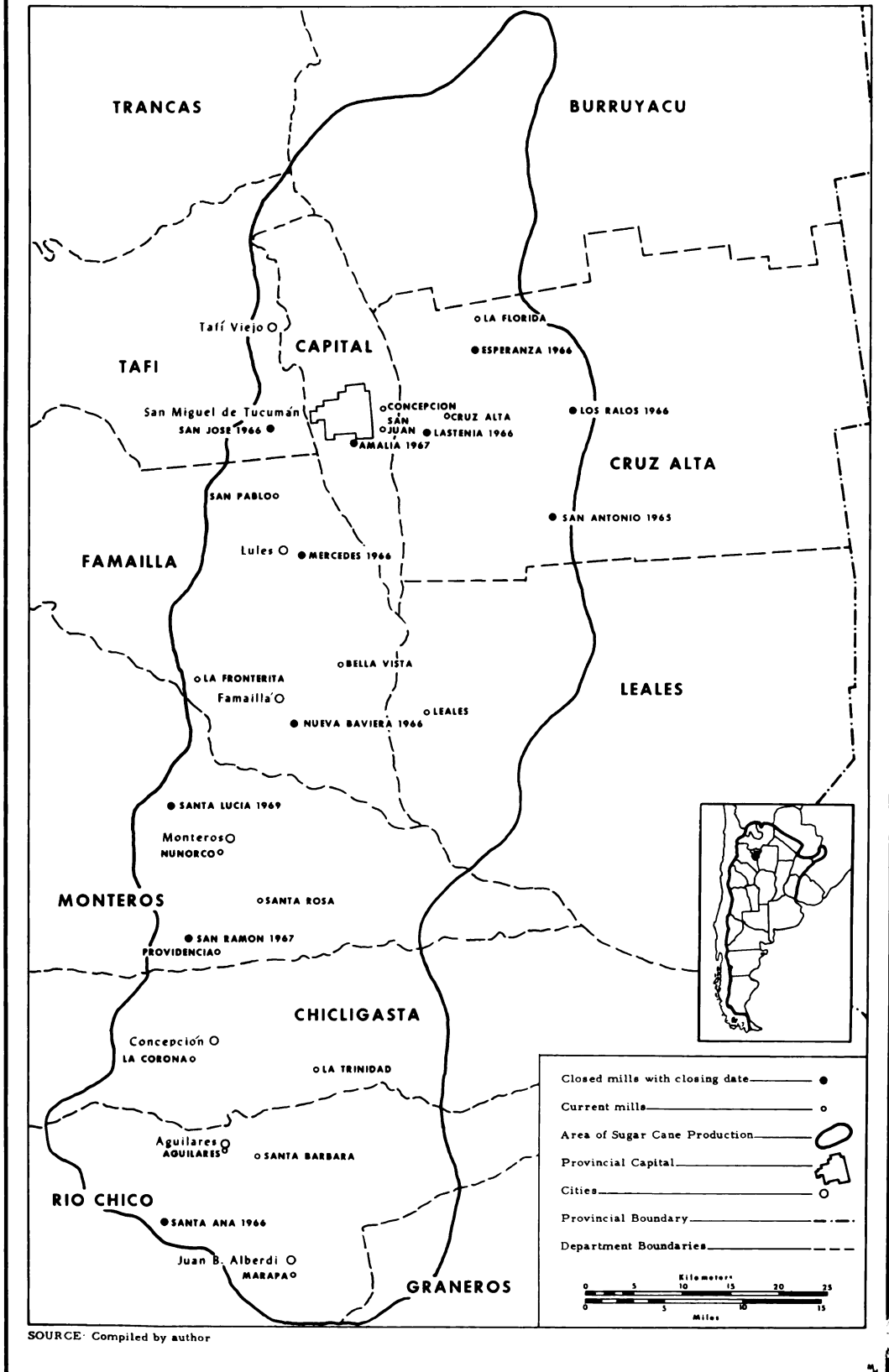
A contraction in planted acreage has occurred in Tucumán since the boom years of the late 1960's, but renewed expansion seems to have taken place since 1971 (Table 7, p.91). It has been estimated that roughly 50,000 hectares of sugar cane land were withdrawn from production following the government action of 1966.⁴ This decrease in cane area between 1965 and 1970 has been documented through the use of provincial cane censuses, an

⁴Personal Interview with Ing. Ploper, Secretary of Agriculture of Tucumán Province, Tucumán, August 7, 1970.



MAP 8

SUGAR MILL CLOSINGS IN TUCUMAN PROVINCE: 1965 - 1970





analysis of 1965 air photos compared with personal observation in 1970, personal interviews, and the comparative use of previous studies.

In general, restrictions in planted acreage were most notable in three main areas within Tucumán: the northern production zones, the eastern areas, and the southern section of the province. Each of these areas might be considered climatically marginal for sugar cane, since precipitation is minimal and temperatures severe. In addition to their limiting climatic elements these areas contain a large number of very small farms (minifundia). The government actions of 1966 eliminated the sugar quotas of most minifundistas, thus reducing the area devoted to cane in all sections of Tucumán and particularly in the marginal zones.

Specific reductions in cane land can be seen in selected areas of the province. Changes in Cruz Alta department east of the provincial capital, were somewhat typical between 1960 and 1970.⁵ In 1960 at least 28 percent of the department was devoted to sugar cane, while only 17.8 percent was planted to cane in 1970.⁶ The decline

⁵Although the data compared are for 1960 and 1970 it can be safely assumed that most of the change occurred between 1965 and 1970.

⁶Cámara Gremial de Productores de Azúcar, Censo de explotaciones cañeras, 1960-61 (Tucumán, 1961) and Censo año 1970, preliminary (Tucumán, 1970).



is especially impressive considering that the 1970 census covered more areas than the earlier census.

The area of Tucumán surrounding the small town of Simoca was greatly affected by the "new order." The numerous cane minifundias there were devastated, as can be seen in Map 9 showing the lands devoted to cane in 1965 and 1970. A number of fields were still planted to sugar cane in 1970, even though the farmers were without sugar quotas. Since no other crops were known to be as remunerative as cane, many hoped that the quotas would be restored. Thus, they remained prepared and hopefully could sell their small harvest despite the restrictions.⁷

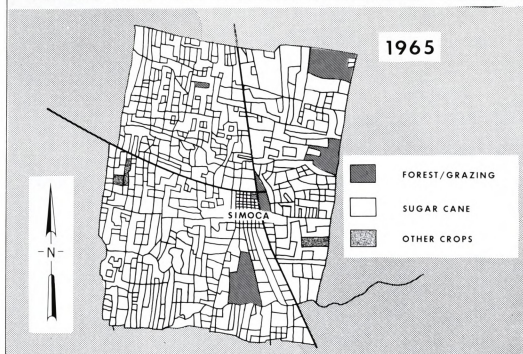
National Route 38 south from San Miguel de Tucumán traverses some of the best cane land in the province. While sugar still dominates in Tucumán, a considerable contraction in the cane area has occurred south of the city of Juan B. Alberdi (Map 10). Extremely scattered and small plots of sugar cane are characteristic of this area.

Map 11 and Table 8 summarize data gathered from a number of cane producing areas. Greatest change seems to have taken place in those climatically marginal areas where large numbers of minifundia were located, although some movement out of cane cultivation has occurred throughout the province.

⁷Personal interview with Mario Alvarez, cane farmer, Simoca, July 14, 1970. Nearly all the small cane farmers interviewed expressed similar sentiments.



CHANGES IN SUGAR CANE PRODUCTION, SIMOCA, TUCUMAN: 1965-1970



Source : Air Photo 3-C-317-1401 (1965), (Buenos Aires : Comisión de Cartografía, 1965).

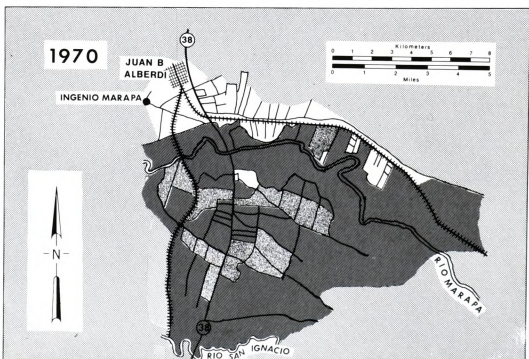


MAP 10

CHANGES IN SUGAR CANE PRODUCTION, JUAN B. ALBERDI, TUCUMAN:
1965-1970

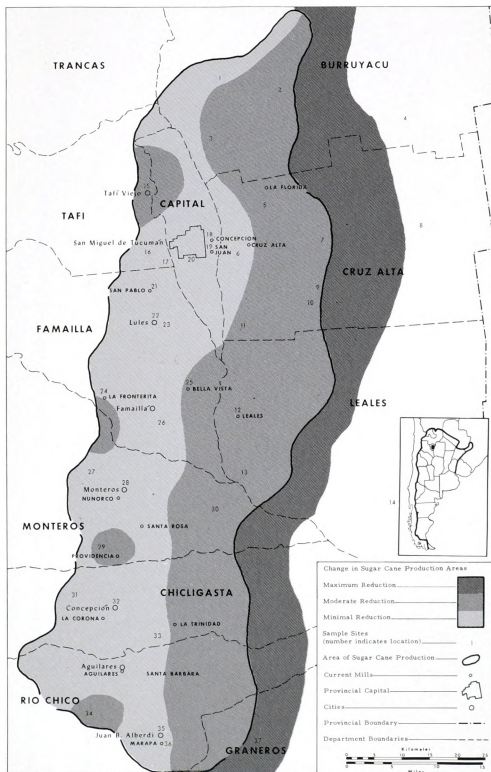


Source: Air Photo 3-C-316-2464 (1965), (Buenos Aires: Comisión de Cartografía, 1965).





CHANGES IN SUGAR CANE PRODUCTION, TUCUMAN PROVINCE: 1965 - 1970



Source: Compiled by Author

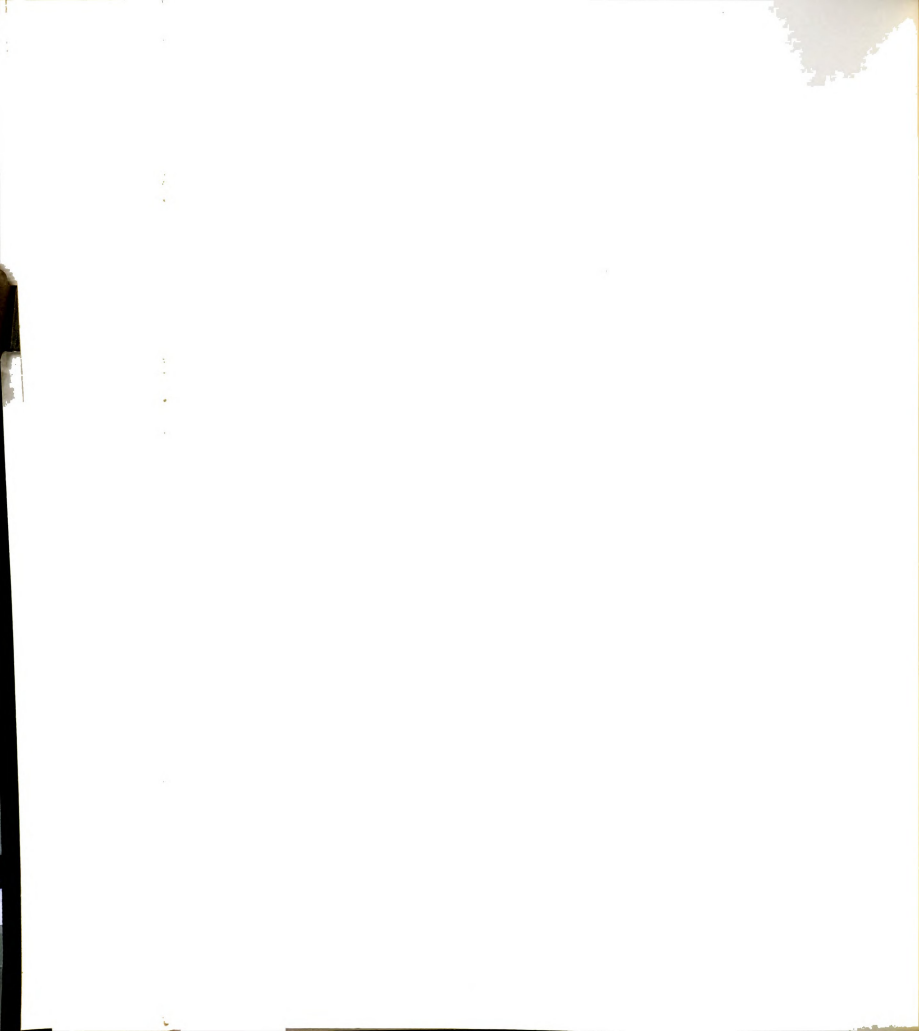


TABLE 8

CHANGES IN SUGAR CANE PRODUCTION, TUCUMAN PROVINCE: 1965-1970

East of Río Salí			West of Río Salí		
Departments	Sites*	Degree of Change**	Departments	Sites*	Degree of Change**
Burruyacu	1. El Naranjo	Moderate	Tafí	15. Tafí Viejo	Moderate
	2. La Ramada	Moderate		16. San José	Minimal
	3. El Timbó	Moderate		17. Manatí	Minimal
	4. Virginia	Maximum		18. Río Salí	Minimal
Cruz Alta	5. Esperanza	Moderate	Capital	19. San Juan	Minimal
	6. Lastenia	Minimal		20. Amalia	Minimal
	7. Los Ralos	Maximum		21. San Pablo	Minimal
	8. Cañete	Maximum		22. Lules	Moderate
Leales	9. Ranchillos	Maximum	Famillá	23. Mercedes	Moderate
	10. San Antonio	Moderate		24. Fronterita	Minimal
	11. Los Bulacios	Moderate		25. Bella Vista	Moderate
	12. Santa Rosa de Leales	Moderate		26. Nueva Baviera	Minimal
	13. Leales	Moderate		27. Santa Lucia	Minimal
			Monteros		



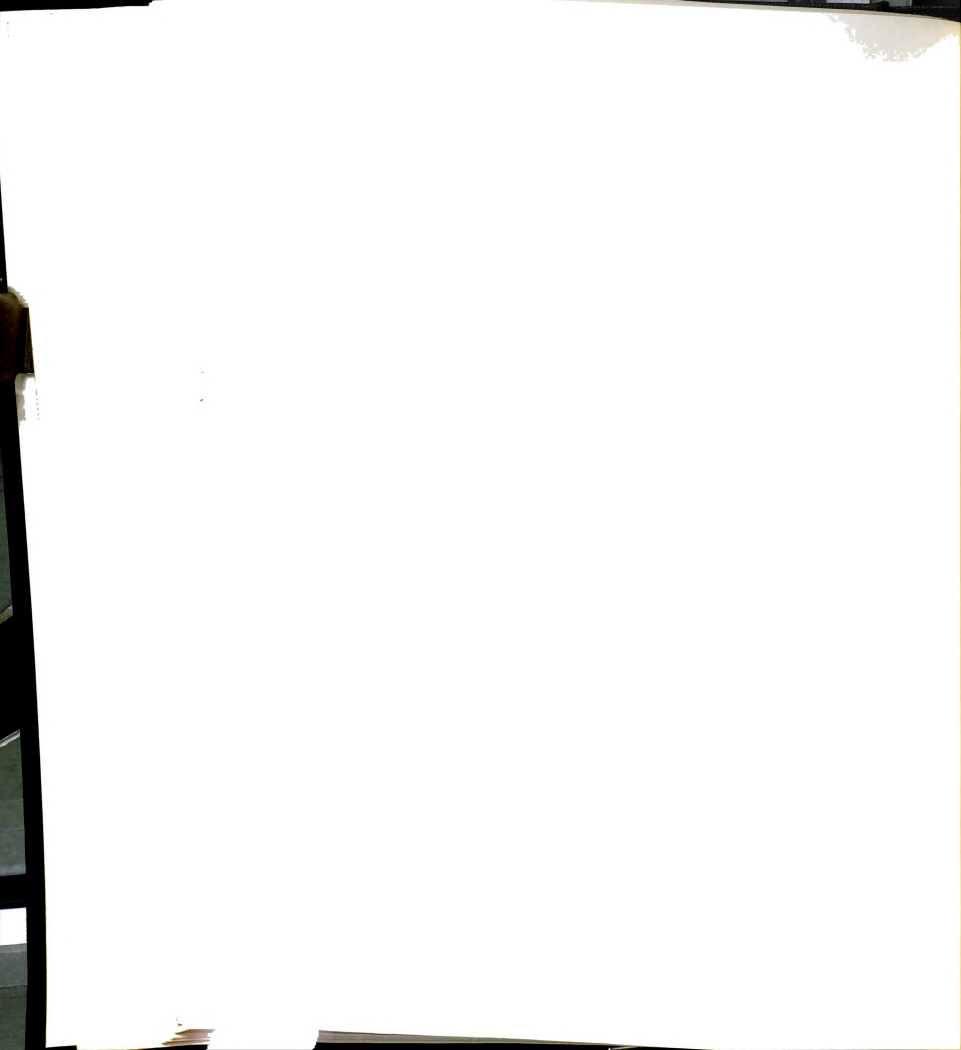
TABLE 8--Continued

East of Río Salí		West of Río Salí	
Departments	Sites*	Degree of Change**	Degree of Change**
14. Los Puestos		Maximum	Minimal
	28. Monteros		Minimal
	29. San Ramón		Moderate
	30. Simoca		Moderate
	Chicligasta		Minimal
	31. El Molino		Minimal
	32. Concepción		Minimal
	33. La Trinidad		Minimal
	Río Chico		Moderate
	34. Santa Ana		Maximum
	35. J. B. Alberdi		Minimal
	36. Marapa		Maximum
	Graneros		Maximum
	37. Graneros		Maximum

Source: Compiled by author.

*Specific areas investigated, Traverses along roads were also taken.

**The sample sites were observed in 1970 and patterns were compared with information from 1965. Air photos and artifacts on the landscape were the major historical documents. Degree of change was determined as a rough percentage reduction in area planted to cane. (0-10% minimal change, 10-30% moderate change; 30% and above maximum change).



Visual signs of spatial shifts within the province are numerous and striking. Artifacts such as abandoned cane loaders (cargaderos) are seen throughout the province, especially in areas on the margin of cultivation. Fields of short, yellowed, irregular and weedy cane indicate retired fields which are occasionally used for cattle grazing (Figure 14). Perhaps most graphic, however, are the older and recently closed mills with broken windows, sagging gates and smokeless stacks testifying to formerly more prosperous, or at least more expansive, times (Figure 15).

Production Change

Despite uncertainty in the industry and changing sugar policies, the past decade has been characterized by increasing productivity in Tucumán. This has been accomplished largely through the application of successful agricultural research to field practices. Particularly, the relative significance of individual cane varieties changed markedly between 1960 and 1970. Varieties developed in experimental stations in the Northwest are earlier maturing, yet produce a relatively high yielding crop. The shift to new varieties can be noted in a comparison between varietal censuses taken in the department of Cruz Alta in 1960 and 1970.





Fig. 14. Abandoned Sugar Cane Field in Tucumán Province.



Fig. 15. Abandoned Ingenio in Tucumán Province.

TABLE 9

SUGAR CANE VARIETIES IN CRUZ ALTA DEPARTMENT,
TUCUMAN: 1960 AND 1970

1960		1970	
Variety	Area (Rows of Cane)*	Variety	Area (Rows of Cane)*
Tuc. 2645	733,427	N.A. 56/79	471,575
Co. 421	272,593	N.Co. 310	194,352
C.P. 34/120	114,690	N.A. 56/30	131,391
C.P. 29/116	89,121	Tuc. 2645	86,850
P.R. 902	61,536	C.P. 48/103	46,677
Tuc. 3342	51,364	C.P. 34/120	44,788
C.B. 36/4	35,112	N.A. 56/19	17,287
C.P. 43/74	34,864	N.A. 56/62	8,751
Co. 413	20,415	Various	263,500
Various	455,657		
Total	1,868,779		1,265,171

Source: Cámara Gremial de Productores de Azúcar,
Censo de productores cañeros, año 1970,
preliminary (Tucumán, 1970).

*Each row (surco) is 100 meters long. There are approximately fifty-five surcos in each hectare (2.47 acres).

A near complete change occurred in just a ten-year period. The switch to new varieties seems to have occurred about 1959, when everyone was concerned with increasing both agricultural and factory yields.⁸ The Tucumán 2645 variety fell from favor quickly but never dropped out of production completely. It declined from nearly 40 percent of the planted area of Tucumán province in 1960 to only

⁸W. Kenning; R. F. de Ullivari and C. A. Artaza, "Variedades de caña de azúcar para Tucumán: Algunas resultados del INTA," La Industria Azucarera, Vol. 71, No. 869, 1966, p. 97.

17 percent by 1963 and less than 10 percent in 1970.⁹

Farmers had obtained great success with this variety and were loathe to give it up, even though it was not an early maturing cane and was quite susceptible to frosts.¹⁰

Varieties such as N.A. (Norte Argentina) 56/79 not only surpassed the 2645 in sugar yields but also matured sooner. Another replacement variety, C.P. (Canal Point) 48/103, was the earliest of the 1970 clones but needed a particularly fertile soil and more water than most. Thus, it was not as adaptable to Tucumán conditions. Normally the larger growers, as well as some small farmers, planted several varieties which differed in maturation time and other characteristics so the harvest period could be staggered to minimize the risk of crop failure.

Four elements seem most important in the continual improvement of cane varieties for Tucumán: precocity (early maturation), resistance to frost, ability to grow with minimal water supply, and disease resistance. All characteristics are the subject of research at the Tucumán Agricultural Experiment Station.

Planting the new varieties has resulted in greater sugar production per unit area, except during unusually

⁹Cámara Gremial de Productores de Azúcar, Censos, 1961 and 1971.

¹⁰Personal interview with Prof. C. Santamarina, Tucumán, July 24, 1970.

severe and early winters.¹¹ Tucumán in 1969, for example, obtained a total average yield of 3,700 kilograms per hectare and showed a general upward trend, but that was still less than one-third of the yields reported in Jujuy (Tables 10, 11 and 12). It is in field production that Tucumán compares least favorably with the two northern provinces. Yields increased slowly following elimination of the Sugar Regulating Fund in 1958, but there are still some obstacles to yields comparable with those of Salta and Jujuy. Factory yields on the other hand increased considerably during the 1960's in Tucumán and now approach those of the Norte. Experiments have shown that Tucumán is capable of producing as much sugar per unit area as the supposedly more favored areas of Salta and Jujuy.¹²

The land tenure system is particularly important in explaining current low yields, but changing harvest techniques and methods also have affected overall production patterns in Tucumán. Capital intensive harvesting methods are gradually being introduced on the large farms and ingenio lands of the province. In fact, there appears

¹¹Three productivity measures are normally quoted: 1) tonnage of useable cane produced per hectare, 2) factory yield of sugar, in kilograms per ton of cane, and 3) total yield, obtained by multiplying the two previous measures and stated in tons of sugar per hectare.

¹²Experiments undertaken by the Tucumán Agricultural Experiment Station and by INTA (Instituto Nacional de Tecnología Agropecuaria) in various sections of Tucumán province.



TABLE 10

AGRICULTURAL YIELDS OF SUGAR CANE IN TUCUMAN,
SALTA AND JUJUY PROVINCES: 1960-1972

Year	Tucumán Province (Tons of cane per hectare)	Salta Province	Jujuy Province
1960	34.4	70.6	82.9
1961	33.4	75.3	80.6
1962	39.7	63.4	81.5
1963	44.7	78.8	83.5
1964	41.9	72.7	95.3
1965	46.7	66.1	105.9
1966	34.0	74.7	98.0
1967	34.6	53.6	81.7
1968	35.7	62.2	110.7
1969	38.8	53.9	120.5
1970	40.2	62.1	105.5
1971	35.9	58.2	82.5
1972	41.8	71.5	111.3

Source: Based on data from the Centro Azucarero Argentino

TABLE 11

FACTORY YIELDS OF SUGAR IN TUCUMAN, SALTA
AND JUJUY PROVINCES, 1960-1972

Year	Tucumán Province (Kilograms of sugar per 100 kilograms of cane)	Salta Province	Jujuy Province
1960	7.46	10.06	9.96
1961	6.67	9.28	8.39
1962	7.65	9.54	9.56
1963	8.51	10.74	9.96
1964	7.69	10.06	9.58
1965	8.62	11.09	10.89
1966	8.85	10.54	10.20
1967	8.04	10.38	11.26
1968	9.78	11.69	11.90
1969	9.58	11.10	10.42

TABLE 11--Continued

Year	Tucumán Province (Kilograms of sugar per 100 kilograms of cane)	Salta Province	Jujuy Province
1970	9.14	10.50	11.12
1971	9.29	10.66	11.18
1972	9.59	10.95	11.16

Source: "El azúcar Argentino en cifras: Zafra 1972"
La Industria Azucarera, Vol. 79, No. 931,
 December 1972.

TABLE 12

SUGAR YIELDS PER HECTARE IN TUCUMAN, SALTA
 AND JUJUY PROVINCES, 1960-1972

Year	Tucumán Province (Tons of sugar per hectare)	Salta Province	Jujuy Province
1960	2.6	7.0	8.3
1961	2.2	6.9	6.8
1962	3.0	6.0	7.8
1963	3.8	8.2	8.4
1964	3.2	7.3	9.1
1965	4.0	7.3	11.5
1966	3.0	6.8	10.0
1967	2.8	5.6	9.2
1968	3.5	7.3	13.2
1969	3.7	6.0	12.5
1970	3.7	6.5	11.7
1971	3.3	6.2	9.2
1972	4.0	7.8	12.5

Source: Based on data from the Centro Azucarero
 Argentino.

to be some mechanization taking place that can not really be justified on a cost-benefit basis.¹³ Mechanical loading of cane is fairly widespread while mechanical cutting, which was initiated at San Pablo ingenio about 1964, is infrequently used to-date. For most of the small and medium-sized operations, labor intensive methods seem most applicable but the trend is definitely toward increased mechanization.

Structural Change

The organizational structure of the industry has been altered substantially, especially in the past decade. Traditionally, some formal grouping or more subtle cooperation has occurred among factory owners, chiefly to exert more effective control over the industry. For example, CAT (Compañía Azucarera Tucumana) included three Tucumán mills, while the Nougúes family at one time controlled two mills in Tucumán, one in the Litoral and extensive cane lands in Salta. This traditional "free-enterprise" system was disrupted in 1970 with the expropriation of several mills by the national government, which occurred just four years after the forceable closing of seven mills within the province. On May 20, 1970, the government took over the three CAT mills and established a government agency to operate them. Seven months later, in

¹³Canitrot and Sommer, Diagnóstico, p. 82.

December, 1970, two additional factories were added to the list administered by CONASA (Corporación Nacional Azucarera, S.A.).¹⁴ The official justification for this action was to rescue financially troubled institutions from potential bankruptcy. This would also save hundreds of jobs for the province, which was important since Tucumán has a much higher unemployment rate than that of any other province of the country.¹⁵ Although the primary objective quoted for the creation of CONASA was a social one, the economic justification must have played a significant role as well. Expropriation has meant that the government is now the largest producer of sugar in the province. This situation has obvious and potentially dangerous implications for the industry, but problems to date have been minimal.

Changes have also transpired in the labor sector of the industry. A relative transposition of influence occurred as the number of small producers was officially reduced. Since the quotas of more than 7,000 small cane farmers were eliminated, the union representing the minifundista (UCIT) declined greatly in importance

¹⁴The expropriated mills of CAT included La Florida, Santa Rosa and La Trinidad. The two added later were Bella Vista and San Juan.

¹⁵Unemployment figures for Tucumán province were 14.7 percent in April, 1972, and 11.7 percent in October of the same year. Bank of London and South America Review, Vol. 7, No. 74, 1973, p. 52.



following 1966. The union encompassing the larger cane growers (CACTU) has gained in influence as a result.

Each element in the Tucumán sugar industry seems to have gained an effective voice during the 1960's. This is not to say that each is fully or fairly represented in decision making relevant to the industry, but a greater participation by all sectors does seem a relatively new characteristic of the sugar industry.

Industrial Expansion in Salta and Jujuy

The area devoted to sugar cane in Salta and Jujuy has increased slowly, while overall sugar production has expanded more rapidly. The industry in these two provinces is dominated by three large sugar mills, but two smaller mills are also in operation.¹⁶ The mills have remained unchanged in number and location since 1919 when the northernmost and newest ingenio, San Martín de Tabacal, came into production. They include the oldest continuously operating mill in the country, San Isidro, and the largest in both capacity and production, Ledesma. The industry in the Norte has remained concentrated in few hands, and in many respects sugar has continued as a frontier crop on the periphery of each province. The region as a whole, however, has consistently gained in production and

¹⁶In Jujuy, La Esperanza and Ledesma are large while Río Grande is medium-sized in capacity. In Salta, San Martín is large and San Isidro is a small mill.

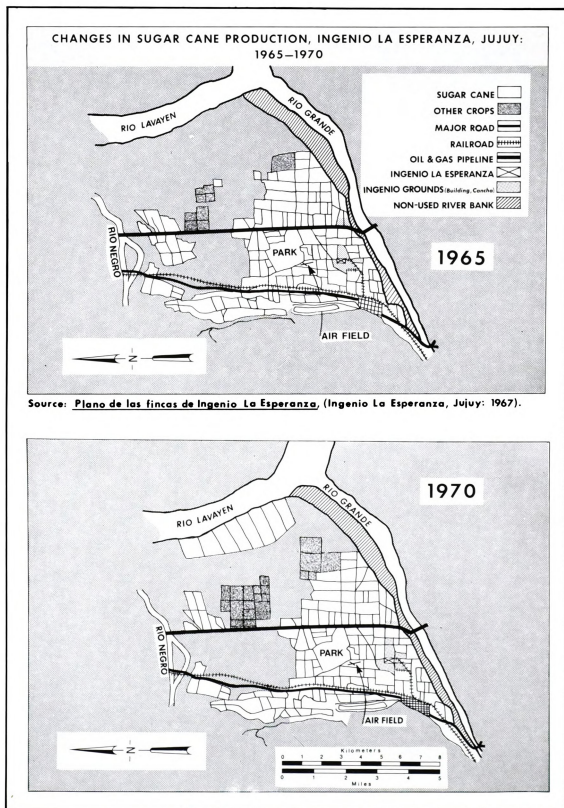


importance at the national level. During the traumatic period of the middle 1960's in Tucumán, the sugar industry in Salta and Jujuy gained impetus, but gradually. Slow evolution rather than drastic change is the key phrase for the Norte.

Spatial Change

The sugar area of the Norte has remained relatively stable and is focused on the five ingenios of the region. The events of 1966 in Tucumán, however, did effect some change in the northern sugar zones. A decrease in area and production occurred immediately after the 1966 policy change, but the trend has been generally upward since then (Table 7, p. 91). The mills of the Norte grow on their own land most of the cane they grind, and the major increases in area, therefore, have been associated with the ingenios. All of the mills in Salta and Jujuy expanded their cropland after 1966, although the three largest were best able to invest in additional sugar cane. Cane plantings here require a heavy capital investment since all of the crop must be irrigated. This in effect limited expansion to areas accessible to a reliable source of water and to growers of considerable financial means. The larger mills, qualified on both counts, took advantage of the decreased acreage in Tucumán by increasing their own cane land. Map 12 shows the cropland surrounding Ingenio La Esperanza and indicates areas of recent expansion and clearing.

MAP 12



During this study period several mills were clearing forest land, or monte, to further expand their cropland. For example, in 1970 San Martín de Tabacal was in the process of clearing about 1,000 hectares.¹⁷ This expansion can be seen clearly in the increased area planted to cane in 1971 and 1972 (Table 7, p. 91).

An estimated thirty to thirty-five independent growers form part of the industry in Salta and Jujuy. Indications are that most of them expanded cultivation to the best of their ability from 1965 to 1970 but accounted for a very small part of total production.¹⁸

Production Change

An increase in sugar production characterized the Norte during the past decade. This trend is shown in Table 13. The great variation in factory capacities is also notable, as is the considerable increase in production in 1971 and 1972.

Field yields of cane are much higher in the Norte than in Tucumán (Table 10, p. 107). Factory yields are also higher, as efficient factory operations and effective coordination between the cutting of cane and the actual

¹⁷Personal interview with Ing. Jim Lord, Ingenio San Martín de Tabacal, Salta, March 19, 1970.

¹⁸Conversation with Ricardo Leach, cane grower and former part owner of Ingenio La Esperanza, San Pedro de Jujuy, July 18, 1970.



TABLE 13

SUGAR PRODUCTION IN SALTA AND JUJUY PROVINCES, 1963-1972

Year	Jujuy				Salta	
	La Esperanza	Ledesma	Río Grande (1000's of net kilos)	San Isidro	San Martín	Total
1963	51,202	148,537	27,713	13,632	80,366	321,450
1964	58,617	155,136	28,226	15,721	80,184	337,884
1965	70,523	196,409	35,362	18,202	84,481	404,977
1966	58,945	178,458	32,421	16,729	78,755	365,308
1967	56,401	153,850	30,669	11,769	64,971	317,560
1968	61,934	181,266	33,368	13,015	85,195	374,378
1969	63,397	170,402	36,285	17,064	81,624	368,772
1970	60,232	160,032	38,879	15,984	90,370	365,497
1971	62,724	181,429	35,851	14,380	91,080	385,464
1972	86,657	250,790	44,035	20,636	114,049	516,167

Source: La Industria Azucarera, 1963-1972.



milling assures that the freshest cane possible enters the mill.

Productivity in the field is closely correlated with cane varieties. Most of the mills concentrate upon early maturing varieties, but some medium and rather long term cane is also grown. Clones currently planted are chiefly products of Argentine experimentation. The northern mills support an agricultural experiment station at Santa Rosa, in Salta, which has helped in the testing and development of suitable new varieties. Different considerations prevail in the Norte than in Tucumán, since mechanical harvesting is much more widespread. In addition to having a high sugar content, the cane should ideally grow straight for the cutting machines to operate properly.

Attempts at total mechanization of the cane harvest reflect an on-going effort to replace the imported worker with a machine. La Esperanza is the leader in mechanizing the harvest phase but reports difficulty in finding a harvester adaptable to the special soil and cane varieties of the area. Minor problems also occur, such as use of a harvester that cut the cane in such small pieces that the factory trapiches become clogged.¹⁹

¹⁹Personal interview with Agron. Héctor Jeréz, Sub-Administrator of Ingenio La Esperana, Jujuy, May 21, 1970.



Structural Change

The northern provinces were traditionally at a disadvantage politically with respect to Tucumán. Because of the economic influence of the Tucumán sugar harvest on surrounding provinces, the sugar interests of Tucumán could always count on regional delegate support in the national assembly. Salta and Jujuy, on the other hand, could count on no additional constituency, since their labor force was drawn chiefly from Bolivia. Thus, the political influence of Salta and Jujuy was usually secondary to that of Tucumán. This condition has been gradually changing. Because of their better financial position and relative lack of scandal, the Norte has received more favorable national press. In addition, the larger industrial units of Salta and Jujuy with investments and interests outside the realm of sugar have gained in direct influence. Ledesma, not only the largest individual sugar mill in the country but also a major producer of paper (which is in short supply in the country), wields particularly great power on the national scene.

The industrialists of the Norte are the chief spokesmen for their industry. Few important splintering influences are found, since there are relatively few independent growers and the largest segment of the workers are still Bolivians with no base for political organization within Argentina. Thus, the Norte can speak

with essentially one voice.

Present Conditions

The sugar industry of the Northwest was drastically changed in 1966. Most affected was Tucumán where seven mills were closed, more than 7,000 small farmers were dispossessed of their sugar quotas, and the cane plantings were reduced by more than 50,000 hectares. Some 150,000 people emigrated from the province to Buenos Aires and other urban centers, and thousands more were left unemployed. Naturally, an abrupt decrease in the gross domestic product of the province likewise occurred.²⁰ The amazing thing was that few active protests or disturbances ensued! In Salta and Jujuy these events caused a momentary waver in sugar production, but the Norte certainly benefited both directly and indirectly from the troubles of Tucumán.

These events were important psychologically, as well as economically. The supremacy of Tucumán in a traditional industry was challenged not only by the North but with the backing of the national government. Some statements expressing unwarranted persecution were found in Tucumán newspaper accounts of the time, but the basic feeling seemed to be that there was a certain amount of justice in the actions. It was recognized that elements

¹⁸La Gaceta, Tucumán, April 17, 1970.

of the industry in Tucumán needed, at the least, some basic reform. Thus, although the action affected the livelihood of many people, there was an acceptance of the government position. Diversification was viewed as a necessary step as long as sugar remained an essential part of the economy.

The North emerged considerably strengthened and with a larger percentage of the total Argentine sugar production after 1966. An optimistic attitude about the future of the industry also pervaded that region. People seemed confident that sugar was based firmly in the North and only wished for larger quotas. It was rather incongruous, however, that in several years Salta and Jujuy were unable to meet their assigned quotas and the deficits were met by sugar from Tucumán.

Areal expansion was limited by government restrictions on overall production, so the resulting changes were greatly tempered. Contractions in cultivated sugar cane in Tucumán were the most notable effects on the landscape, but other subtle changes occurred both there and in Salta and Jujuy.

CHAPTER V

PHYSICAL FACTORS INFLUENCING CHANGE

Sugar cane thrives in a tropical environment, but the crop can be grown commercially in subtropical and even mild, humid-continental zones such as Louisiana and Northwest Argentina. Although the Argentine production area of the Litoral extends even farther poleward, the Northwest is considered near the southern limit for cane.¹ The sugar zones of Tucumán extend to about 27° 20' South Latitude, while the planted areas of the Norte reach to 23° South, just north of the Tropic of Capricorn (Louisiana cane lands extend to about 30° North Latitude). Under these latitudinal constraints, the physical and climatic characteristics become especially important parameters for sugar production.

Differences in physical conditions within the Northwest have frequently been used to question the propriety of cane production in Tucumán province. "In (Argentina) cane is generally grown on loams and sandy loams of high

¹International Sugar Council, The World Sugar Economy: Structure and Policies, Vol. II, The World Picture (London: International Sugar Council, 1963), p. 5. E. W. Shanahan, South America, 2nd ed. (New York: Dutton and Co., 1939), p. 211, states that Tucumán lies "at extreme southern limit" for South American sugar cane production.

fertility but climatic conditions due to the latitude and altitude exclude high yields. This is especially true for Tucumán where winter frosts shorten the growing season and prevent the cane from ripening."² The validity of this and other such statements requires further analysis.

Production Differences Between Regions

As previously indicated, production in the Norte greatly exceeds that of Tucumán on a unit area basis. Measures of crop yields and industrial productivity portray major differences among the producing zones.

Yields

The crop yields of Tucumán are lower than those of either Salta or Jujuy (Table 10, p. 107). The average yields in Tucumán, measured in tons of cane per hectare, over a period of five years ranged from 15.7 tons in 1968 to 41.8 tons in 1972. The corresponding figures for Salta and Jujuy also show yearly variations but are much higher than those for Tucumán during the same period (Table 14).

The regional differences in yield indicate more than casual variations. A partial explanation may lie with the physical characteristics of each region.

²International Sugar Council, The World Picture, p. 66.

TABLE 14

FIELD YIELDS OF SUGAR CANE IN NORTHWEST
ARGENTINA, 1968-1972

Year	Tucumán Province (Tons of cane per hectare)	Salta Province	Jujuy Province
1968	35.7	62.2	110.7
1969	38.8	53.9	120.5
1970	40.2	62.1	105.5
1971	35.9	58.2	82.5
1972	41.8	71.5	111.3

Source: La Industria Azucarera, 1973.

Productivity

The crude sugar output in the factories from a hectare of cane gives an indication of agricultural, as well as industrial, efficiency within each producing region. From smaller planted areas both Salta and Jujuy produce proportionately more sugar than Tucumán, as shown in Table 15 (See also Tables 11 and 12, pp. 107-108).

Production figures indicate a great difference between Tucumán and the two northern provinces and a considerable contrast between Salta and Jujuy. Physical elements may also help explain these variations. Climatic and edaphic influences are especially important, while physiographic limitations also exist.

TABLE 15

SUGAR OUTPUT PER HECTARE IN TUCUMAN, SALTA AND
JUJUY PROVINCES, 1968-1972

Year	Tucumán Province (Tons of sugar per hectare)	Salta Province	Jujuy Province
1968	3.5	7.3	13.2
1969	3.7	6.0	12.5
1970	3.7	6.5	11.7
1971	3.3	6.2	9.2
1972	4.0	7.8	12.5

Source: La Industria Azucarera, 1973.

Climatic Influences

Although sugar cane has a history as long and continuous in Tucumán as in any other province of Argentina, the question of climatic suitability has recurred frequently. Dr. Colombres had to fight the idea of inclement conditions in order to reintroduce cane as a cash crop to Tucumán about 1820, after a fifty year hiatus. Elements of the climatic argument have resurfaced today in comparisons of the producing zones. Existing conditions in Tucumán and Salta-Jujuy merit some examination.

Precipitation

Sugar cane grows best in hot moist climates where a period of heavy rainfall is followed by a dry season.

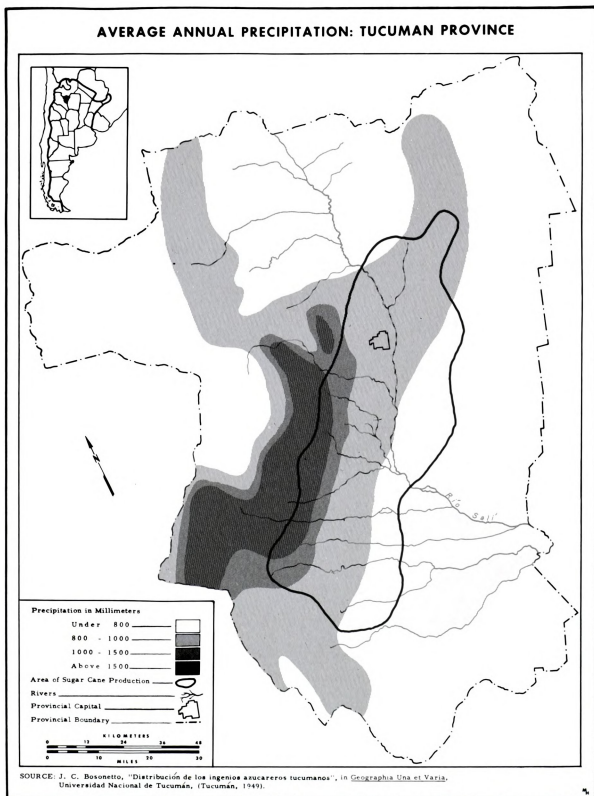


Ideal precipitation amounts vary with location, but at least 1000 millimeters (almost forty inches) are normally desirable. Limited sections in the producing areas of the Northwest match these optimal natural conditions.

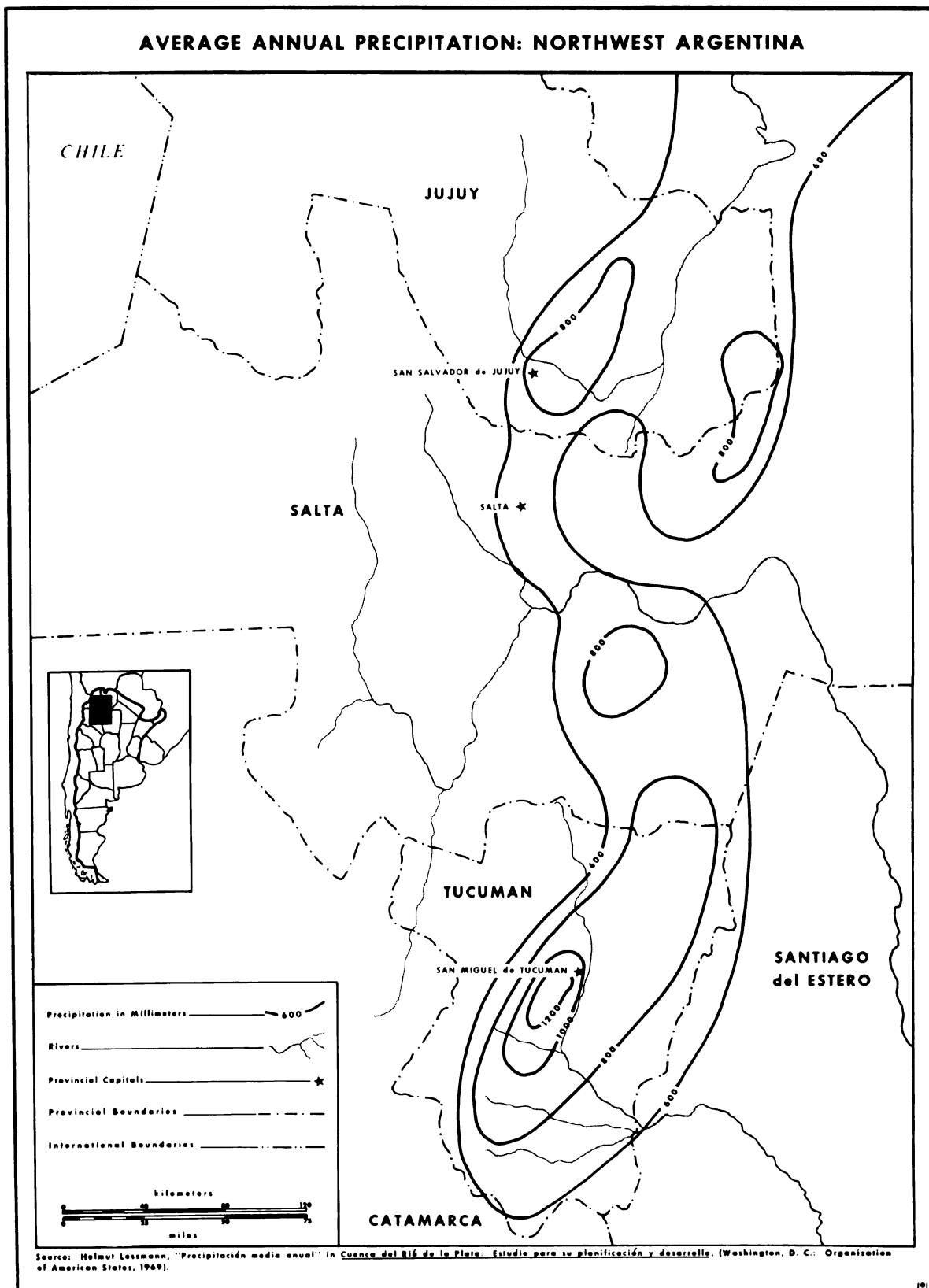
A wide variation in rainfall exists within and between major producing areas. An isohyet map of Tucumán (Map 13) shows that most of the cane area receives more than 850 millimeters (thirty-five inches), while all land planted to cane receives from 650 to 1500 millimeters (about twenty-five to sixty inches). The prime zones appear to record from 1000 to 1500 millimeters (forty to sixty inches), while a decrease in precipitation becomes an absolute limit to the south and east. Total rainfall in the sugar zones of Salta and Jujuy is quite low, in general, and extremely varied. The range is from about 500 millimeters (twenty inches) at Ingenio San Isidro, in Salta, the southernmost location, to 1200 millimeters (forty-eight inches) at Finca Abra Grande, Salta, at the northern end of the Argentine sugar area (Map 14).

Precipitation records kept in the sugar zones vary widely in availability, length and reliability. More complete data exist for the heavily populated province of Tucumán than for the relatively isolated production zones of Salta and Jujuy. For example, monthly rainfall totals for the city of Tucumán extend from 1884, whereas lengthy records for the sugar areas of Salta-Jujuy are difficult to find.

AVERAGE ANNUAL PRECIPITATION: TUCUMAN PROVINCE



MAP 14



While total precipitation is an important climatic indicator, the proper distribution of moisture throughout the year is equally desirable for the crop. Cane needs abundant water in the period of growth and relative dryness during maturation. Particularly after initial budding the leafy plant requires greater amounts, and if the rain fails there can be extensive losses. On the other hand, too much water during the mature plant stage can lead to a sharp decline in sugar yields. Distribution of precipitation in Salta and Jujuy is nearly ideal, with most rain from October to April and very little during the maturation and harvesting period from May through August. In Tucumán, the rainfall also occurs mainly in the summer but amounts are higher during the harvest period. Irrigation there is used only sparingly, in contrast with the North.

The major value of irrigation is that water application can be regulated to periods of plant need. It is likely that the crop will be especially well developed under irrigation. Thus, the need for irrigation in the Norte and the availability of water is correlated with high overall yields. The highest sugar yields of the nation correspond to the irrigated lands of the North. Through irrigation the growing season of these areas is extended, and this affects yields. Areas suitable for irrigation are restricted, however, and all ingenios of the Norte lack sufficient water for expansion. Water is

obtained primarily from nearby rivers, although wells are occasionally utilized and water transported from more distant streams is used in one instance.³

Although precipitation is both more abundant and dependable in Tucumán, this is not a clear-cut advantage. Cane yields of the province could undoubtedly be increased with more extensive irrigation. Only an estimated 30 percent of the cane in Tucumán receives supplemental irrigation, leaving most of the crop to the vagaries of nature.

Temperature

Temperature regimes are critical at the limits of crop cultivation. Summer temperatures in the Argentine Northwest compare favorably with those of prime growing areas elsewhere in the world, but the differences lie in the winter temperatures. In both Tucumán and Salta-Jujuy the growing season is an important variant in each crop year, since neither zone is frost-free. The plant matures and the sucrose increases with the approach of cool weather, but severe damage occurs with a frost. Crop losses are greatest with immature cane since further growth is retarded or stopped at a period when the sugar content is low. Once the cane has reached maturity a frost does minimal

³Personal interview with Ing. Jim Lord, Ingenio San Martín de Tabacal, March 19, 1970. A joint project of Finca Abra Grande and San Martín de Tabacal was to bring irrigation water twenty-six miles from the Río Pescado, a tributary of the Río Bermejo (see Map 6, p. 31).



harm, although the crop must be harvested and transported to the factory as soon as possible to avoid inversion of some of the sugars. Little control can be exerted over the frosts, but resulting adjustments have included the development and use of early maturing varieties.

The severity of a frost depends chiefly on the absolute temperature and the number of freezing hours maintained. Only the first of these measurements is available, and the following table indicates minimum temperatures reported by various sugar mills of the Northwest.

TABLE 16
NUMBER OF YEARLY FREEZES AND MINIMUM TEMPERATURES
AT SELECTED CANE SITES IN TUCUMAN, SALTA
AND JUJUY PROVINCES

Locations	Average No. of Yearly Freezes	Minimum Recorded Temperature (1950- 1970)
Leales, Tucumán	16	17.6°F
Villa Alberdi, Tucumán	12	19.4°
Monteros, Tucumán	6	21.0°
San Miguel de Tucumán	4	21.0°
Tabacal, Salta	6	26.6°
Campo Santo, Salta	6	24.8°
Ledesma, Jujuy	3	26.6°
La Esperanza, Jujuy	3	26.6°
Río Grande, Jujuy	5	24.8°

Source: La Industria Azucarera, 1950-1950 and Roberto F. de Ullivarri, and Carlos M. Guerineau, Zonas para la futura expansión azucarera argentina (Buenos Aires: Instituto Nacional de Tecnología Agropecuaria, 1960).



Sporadic records kept at the sugar mills made a detailed analysis of temperatures difficult, if not impossible. Every mill visited maintains a simple weather station that records daily temperatures and precipitation. Most include maximum and minimum readings for the ingenio grounds, and some also have a station or stations in the campo (fields). Frequently the instruments are attended only on an irregular basis. In fact, many mill operators see no reason to keep accurate weather records since most plantings are initiated and maintained on the basis of hard experience.

Existing records corroborate generally lower temperatures for specific areas in Tucumán than for sugar zones of the Norte. Frosts are somewhat less likely in Salta and Jujuy. Since 1960, the lowest recorded temperature in Salta and Jujuy was a -2° C. (28.4° F) at San Isidro, Salta, in July, 1962.⁴ Temperatures below freezing in the Norte were most often reported for San Isidro and Río Grande, the two smallest operations within the northern region. This might suggest a less favorable location, which in turn limits the cane areas, or it might simply connote a "bad" placement of the recording station! There is also a considerable range in low temperatures recorded by the sugar mills of Tucumán. The mills in the eastern

⁴La Industria Azucarera, 1960-1970.

and southern sugar zones of the province, such as Leales, generally record the lower temperatures.

The effects of low temperatures (frost) on a sugar cane field is highly visible on the landscape. A brown coloration gives the affected areas the appearance of ripe grain fields. Where cane is grown on slopes, as in Tucumán, the frost line often is apparent part way up the foothills (see Figures 16 and 17). Because of air drainage the up-slope cane is less affected by light frosts, while that planted in the lower areas turns tell-tale brown.

Other Factors Related to Climate

Altitudinal limits for sugar cane depend upon specific site characteristics. Cane is grown commercially in the world at sites near sea level and over 1300 meters (4,250 feet).⁵ Since temperatures decrease with increasing elevation, this factor can be especially critical in higher latitudes. The differences in elevation among the producing zones of the Argentine Northwest are relatively small but not inconsequential. Selected altitudes of sugar areas include: 410 meters (1,340 feet) at San Pablo, Tucumán; 460 meters (1,504 feet) at Ledesma, Jujuy; and 310 meters (1,014 feet) at San Martín de Tabacal, Salta. The absolute

⁵W. Knoche and V. Borsacov. Estudio comparativo de climas apropiados para el cultivo de la caña de azúcar segun una nueva clasificación climática. Boletín No. 30, Estación Experimental Agrícola de Tucumán (Tucumán, 1940), p. 12.





Fig. 16. Frost Line in Cane Fields in Tucumán Province-West.



Fig. 17. Frost Line in Cane Fields of Tucumán Province-East.

variation in Tucumán province alone is substantial (Map 15). Localities with economic production are found at elevations ranging from about 350 to over 600 meters (about 1,150 to 1,950 feet), and small areas with particularly favorable orientations are found near 700 meters (roughly 2,300 feet).⁶ In Tucumán there seems to be some relationship between increasing elevation and slightly higher precipitation totals, while average temperatures are affected only slightly.⁷ In Salta and Jujuy local variation on individual ingenios is slight since irrigation is maintained on relatively restricted and level areas. There is, however, considerable variation within the region. For example, at Ledesma and Esperanza, in Jujuy, respective elevations are 460 meters and 560 meters (1,504 and 1,834 feet). In this case, precipitation totals are slightly greater at the lower site.⁸ Thus, the limited examples from Tucumán and Jujuy indicate no consistent relationship between elevation and climatic elements.

For rapid maturation of cane, the number of hours of sunshine is very important, especially during the late

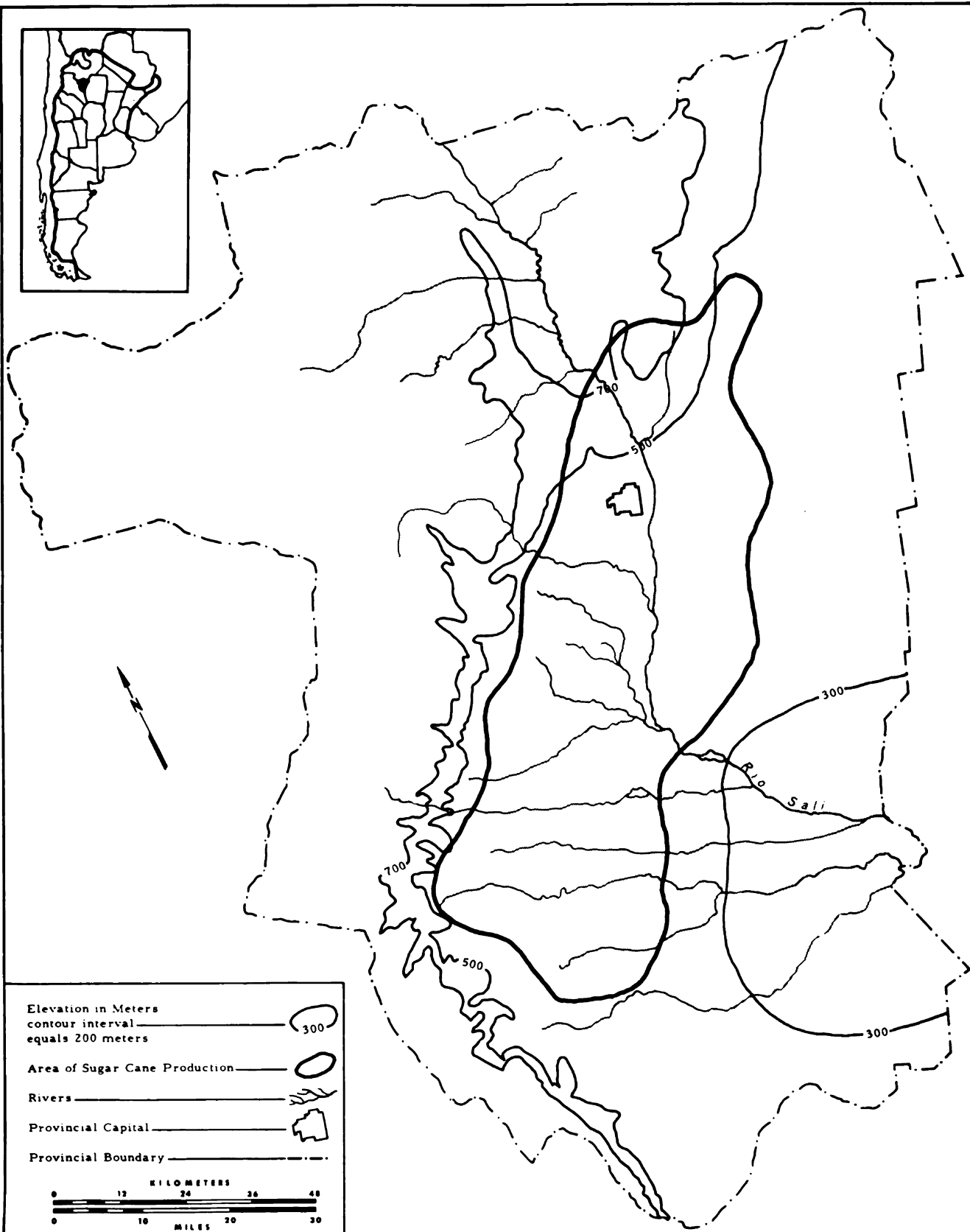
⁶Estela B. de Santamarina, Características morfológicas y climáticas del área cañera de Tucumán. Mimeographed report (Tucumán, 1967), p. 1.

⁷Ibid., p. 7.

⁸Personal interviews at sugar mills Ledesma and La Esperanza.

MAP 15

ELEVATION AND SUGAR CANE PRODUCTION IN TUCUMAN PROVINCE



SOURCE: Compiled by author



growth stages. The northern provinces have more sun hours than does Tucumán. Due to heavier autumn rains and associated cloud cover in Tucumán, maturation is somewhat retarded.⁹ No statistics other than precipitation totals are available to support this observation, but it is often suggested by agriculturalists as a decided advantage of the northern zones.¹⁰

Other factors generally accepted as restrictions to cane growth include the degree of slope and specific exposure. Planting on slopes is not desirable since erosion is intense during the early planting stages when the soil surface is exposed between rows. Exposure to the prevailing winds, rainfall and sunlight are also influential in limiting cane growth.

Edaphic Influences

Soils in the sugar regions of the Northwest have some fundamental similarities. All areas are associated with the Andean foothills and are generally overlain with alluvial materials. Differences do exist, however, in the information available about the areas. Detailed soil surveys have been undertaken in Tucumán, while

⁹Manfredo A. L. Reichart, "El suelo en el cultivo de la caña de azúcar," Revista Agronómica del Noroeste Argentino, Vol. 7, No. 1-2, 1970, p. 112.

¹⁰Interview with Ing. Jorge Mariotti, Division of Sugar Cane, School of Agronomy, Universidad de Tucumán, Tucumán, January 7, 1970.

investigations in the Salta and Jujuy canelands have been sketchy at best.

The planted areas of Tucumán are classified generally as mollisols, having thick, dark, organic A horizons.¹¹ The soils are friable, contain few stones, and are of relatively high natural fertility. The major element most commonly lacking is phosphorus, with minor deficiencies of calcium in certain soil types. The chief limitations for the planting and growth of cane, aside from lack of water, are exhibited in areas with high water tables and excessively salty soil horizons.¹² Subsoils are generally of moderate texture, allowing good water retention yet adequate drainage, but extensive areas have more impermeable subsoils which result in a drainage problem. The poorly drained and salty soils are located chiefly along the Río Salí, at the eastern margin of continuous cane plantings (Map 16).

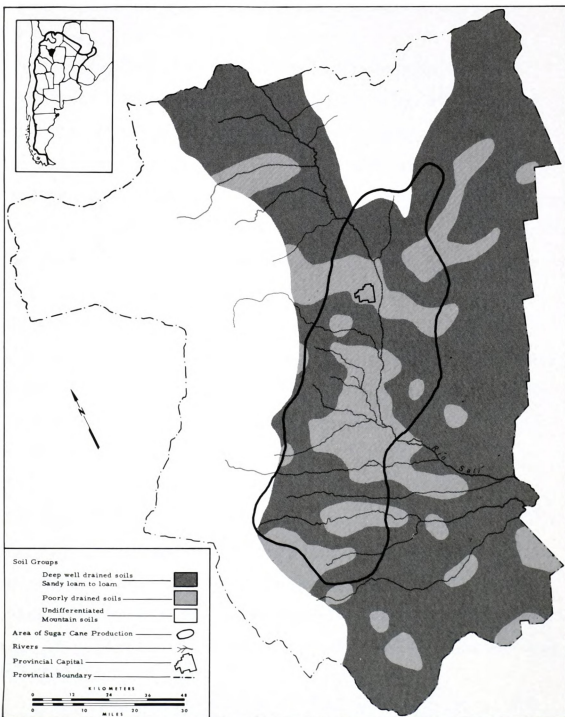
The soils of Tucumán have been under continuous cultivation for several hundred years. Sugar cane has exclusively occupied a large area for more than 100 years, and fertilization has been used only sparingly. Soil renewal is now much needed, and research at the Tucumán Agricultural Experiment Station has indicated that nitrogen

¹¹Natalio Mikenburg, Bosquejo de distribución de los suelos de Tucumán y capacidad de uso actual, Publicación No. 53, Instituto de Suelos y Agrotécnica, Ministerio de Agricultura y Ganadería (Buenos Aires, 1957), p. 4.

¹²Ibid., p. 8.



SOILS AND SUGAR CANE PRODUCTION IN TUCUMAN PROVINCE



SOURCE: Natalio Mikenberg, *Resumen de distribución de los Suelos de Tucumán y capacidad de uso actual*, Instituto de Suelos y Agroecología, Ministerio de Agricultura y Ganadería, (Buenos Aires, 1957).



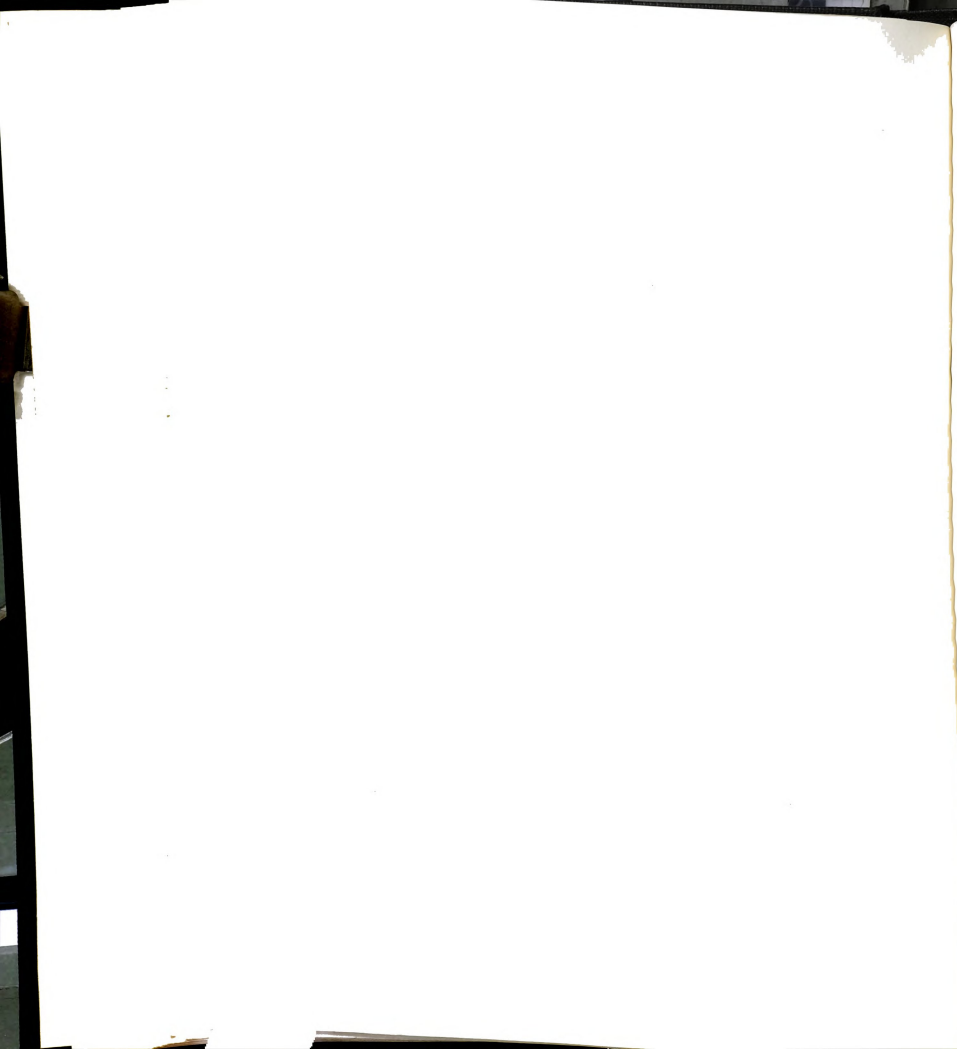
is the element most commonly lacking. Studies concerning other elements have not been conclusive for cane, but further research on artificial fertilization is being conducted.

Many soils in Salta and Jujuy compare favorably with those of Tucumán. Most of the area is well drained, which is particularly important since irrigation is practiced on nearly all the planted acreage. An advantage accrues to most ingenios in the North since they are in the process of opening new land. The soils are generally fresh and need few additional nutrients. Some lands have been cultivated as long as those in Tucumán, however, and all mills maintain continuous fertilization programs. Many send cachaza (the solid residue left from the purification of cane juice) back to the fields in the irrigation water, for instance. Detailed soil surveys may eventually indicate more specific needs when, and if, yields decline.

In summary, the differences in yields between Tucumán and Salta-Jujuy are related directly to climatic and edaphic conditions.¹³ In northern Salta the climatic and edaphic conditions are favorable for attaining high sugar yields. The judicious use of water gives this area a growing period of approximately 250 days.¹⁴ The growing

¹³This is the thesis of Manfredo Reichart in his previously cited article "El suelo en el cultivo de la caña de azúcar," 1970.

¹⁴Reichart, "El suelo", p. 139.



season is extended over the expected "natural" norm up to two months through the use of irrigation. The new plantings and ratoon crops receive irrigation water during September and November. This gives cane growers of Salta at least one month's advantage over those of Tucumán. During the period of maturation and harvest, approximately 150 days, the temperature is relatively low and therefore induces sugar accumulation. Reduced precipitation during this period further aids the process. The very important soil conditions of water retention and nutrient levels are also favorable in the North.

In Tucumán, the growth period approximates 195 days.¹⁵ A more regular rainfall than in Salta and Jujuy helps to compensate for the shorter period of growth, but there is a lower soil fertility due to the many years of cane cultivation. Also, more precipitation is received during the maturation period than is true of the Norte, which further restricts the accumulation of sugar.

Cane growing in both regions is limited by frosts, but the total physical environment in Salta and Jujuy is more favorable for good cane yields than that of Tucumán. However, more detailed and "scientific" investigations are still needed.

¹⁵Ibid., p. 140.



CHAPTER VI

SOCIO-HISTORICAL FACTORS INFLUENCING CHANGE

The evolution of many human and institutional factors in the cane areas of the Northwest has been directly or indirectly tied to change within the sugar industry. Although complicated and liable to gross generalizations, the contrasting social history of the producing zones has likewise greatly influenced industry developments.

Demographic Characteristics

The population of Tucumán, Salta and Jujuy provinces varies markedly in size, composition and general distribution, as shown in Table 17.

Tucumán is the most populous province of the Northwest and, perhaps more significantly, has the highest population density of the entire country. Salta and Jujuy are both larger in area than Tucumán and much less densely populated. All three provinces have high percentages of rural population, but Tucumán exhibits a more concentrated settlement pattern (Map 17). An intermingling of urban centers and dense rural settlement is distinctive only of Tucumán within Argentina and, in fact, is a pattern seldom seen elsewhere in Latin America. The greatest density of

TABLE 17

POPULATION CHARACTERISTICS OF TUCUMAN, SALTA
AND JUJUY PROVINCES, 1960

Province	Total Inhabitants	Area (km ²)	Inhabitants/km ²	% Rural
Tucumán	773,972	22,524	34.4	46
Salta	412,854	154,775	2.7	45
Jujuy	241,462	53,219	4.5	51

Source: Dirección Nacional de Estadística y Censos,
Censo Nacional de Población, 1960, (Buenos
Aires, 1962).

TABLE 18

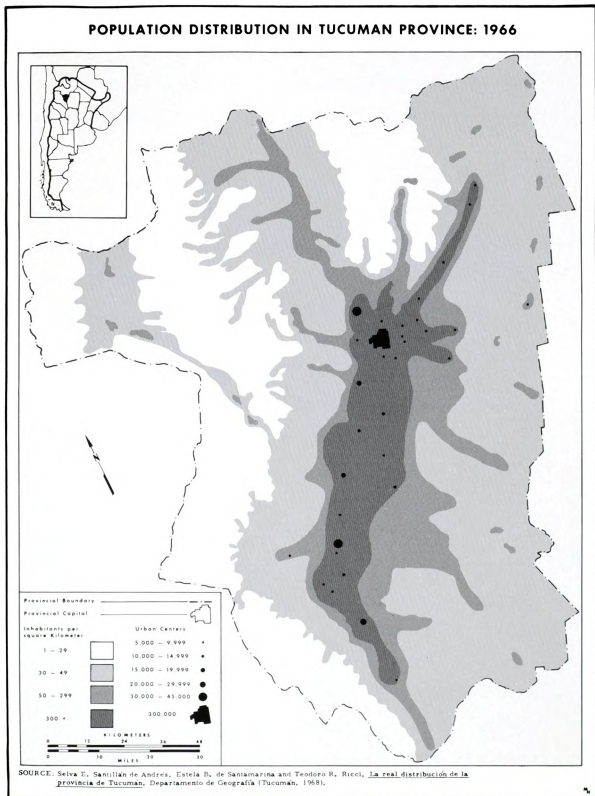
SELECTED URBAN CENTERS OF THE SUGAR CANE AREAS
OF TUCUMAN, SALTA AND JUJUY PROVINCES

Population*		Population*	
<u>Tucumán Province</u>		<u>Salta Province</u>	
San Miguel de Tucumán	300,000+	San Ramón de la Nueva Orán	16,900
Concepción	40,000	General Güemes	10,425
Villa Alberdi	24,000	Tabacal	6,900
Tafí Viejo	35,000		
Monteros	16,000	<u>Jujuy Province</u>	
Famaillá	13,200	San Pedro de Jujuy	20,000
		Ledesma	12,000

*1968 provincial estimates.



POPULATION DISTRIBUTION IN TUCUMAN PROVINCE: 1966





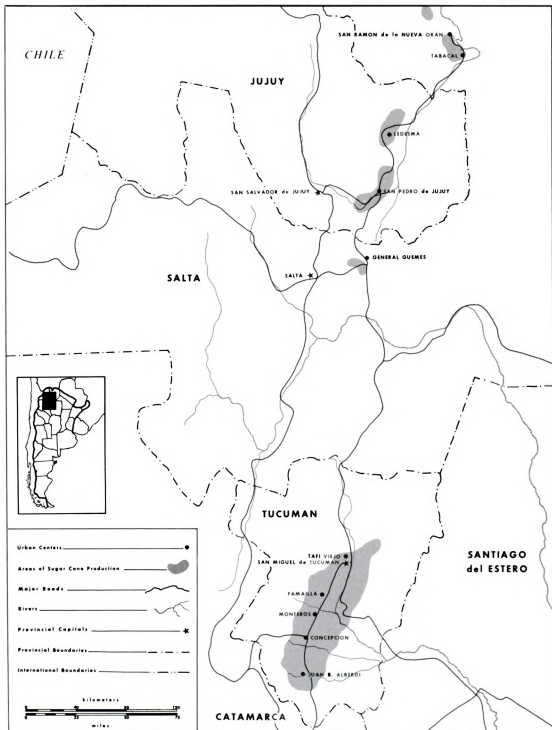
population in Tucumán coincides with the cane areas, while production zones of Salta and Jujuy contain small percentages of their respective populations. The cane areas of Salta and Jujuy are also more completely rural, as indicated by the relatively small size of cities within the region.

All of the cities in Tucumán are found directly within the sugar producing areas of the province, while two of the cities in Salta, Orán and Güemes, are peripheral to the production zones of that province. Both the Salta and Jujuy cane areas are sparsely served with urban functions (Map 18).

In Tucumán, population growth has occurred sporadically, and interesting parallels can be drawn with the expansion of the sugar industry (Table 19).

With a healthy and expanding industry a large labor force was needed, and this could not be supplied from the existing population base. Attempts were made to employ laborers from many sources, but the "solution" came chiefly from the surrounding provinces. The greatest demand for labor occurs during the harvest period, which coincides with the otherwise relatively inactive winter season. This timing proved quite attractive to the underemployed of the region. A large part of the labor force was necessarily transitory, but many workers remained permanently within the province. The population growth of Tucumán obviously cannot be explained only by these

SELECTED URBAN CENTERS IN SUGAR AREAS OF NORTHWEST ARGENTINA



Source: Rafael Lozano, "Producción media anual" in Cuadro del S.E. de la Plata: Estudio para la planificación y desarrollo (Washington, D. C.: Organization of American States, 1969).



TABLE 19

GROWTH OF POPULATION AND THE SUGAR INDUSTRY
IN TUCUMAN PROVINCE, SELECTED YEARS,
1869-1968

Year	Population	No. Sugar Mills	Area in Cane
1869	108,953	12	1,000 cuadras*
1895	215,742	34	53,086 has.
1914	332,933	28	105,000 has.
1947	593,371	28	192,000 has.
1960**	773,972	27	228,000 has.
1968	773,913	16	135,000 has.

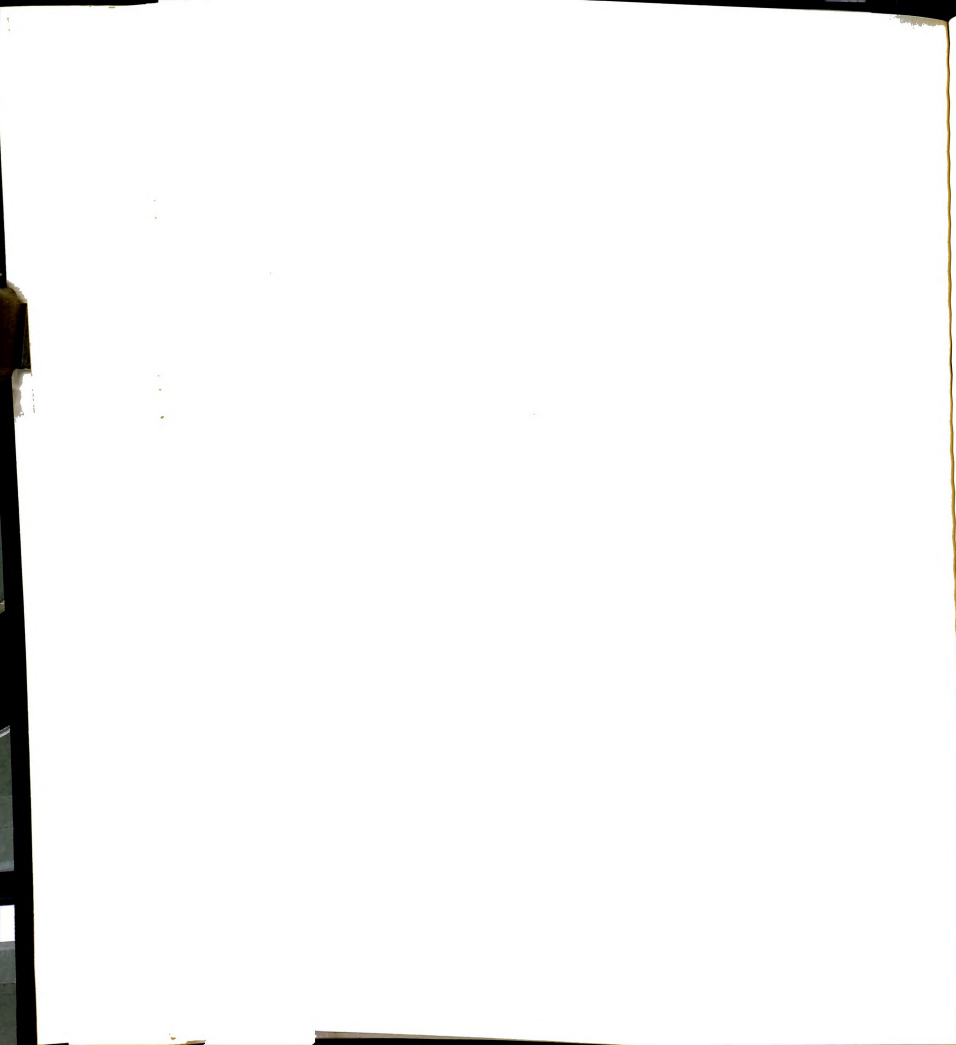
Source: Compiled by author from varied sources.

* A cuadra is a measure previously used in Argentina and approximately 130 square meters.

** Seasonality of the sugar harvest causes difficulty for census takers. It is hypothesized that the 1960 census overestimated permanent populations, since the count occurred in September when the zafra is in full operation.

additions, since European immigration of the late 1800's added large numbers, for example, but there is little doubt that the economic impulse of the sugar industry was the major factor behind population increases.

The transitory labor situation of Tucumán may have been an important population variable, particularly in hard times. It is likely that many of the newcomers felt neither the ties nor the desire to remain during stagnant or declining periods in the industry and thus provided the bulk of the emigrants. Although impossible to document, it



is also probable that many of the thousands who left the province after the 1966 government intervention fit that category. Most who left apparently followed other crops or decided to join the crowded suburbs surrounding Buenos Aires.¹

The sugar areas of Salta and Jujuy are relatively isolated from the major population centers of the two provinces. This fact plus a small local population meant problems for the seasonally labor intensive industry. The sugar mills there, as in Tucumán, imported various groups of people for the harvest period. Since there are no major populated areas nearby, it was perhaps natural that the employers turned to Bolivia as a source of labor. Importation of Bolivians is still common but is declining in relative importance, since many Bolivians have remained in the mill towns and are becoming Argentine citizens.

Variations in labor demands, which often result in attempts at replacing manual labor with machines, have had only a minimal effect in Salta and Jujuy. This is due chiefly to the dependence on foreign laborers who never were incorporated into the fabric of the province but maintained their economic and social interaction within the structure of the sugar mills. Thus, industrial "progress" in the Norte has been and is considerably less painful to the human element of the area than in Tucumán.

¹La Gaceta, Tucumán, March 20, 1970.



The development of a "surplus" population in Tucumán has not been paralleled in Salta and Jujuy. Closer control over labor numbers by the large mills of the Norte, and the greater use of "disposable" temporary workers, has led to a more stable population in that area. Unemployment figures for the provinces tend to bear this out: in 1968 Tucumán averaged 11 percent unemployed, while Salta and Jujuy averaged 5 and 6 percent, respectively.² These figures most accurately represent the great influence of the sugar industry in Tucumán and its more modest role in Salta and Jujuy.

Land Tenure

The contrasting population distribution in the cane producing regions is closely tied with ownership patterns and farm sizes typical of each area. The many small landowners of Tucumán are reflected in the most densely inhabited rural landscape in Argentina, while the large estates of the Norte dominate the restricted arable river valleys and effect a relatively sparse settlement pattern. The evolution of these two very different systems offers important insights into the sugar industry.

²Censo provincial de Tucumán, 1968, and Bank of London and South America Review, Vol. 3, No. 31, July 1969, p. 442.



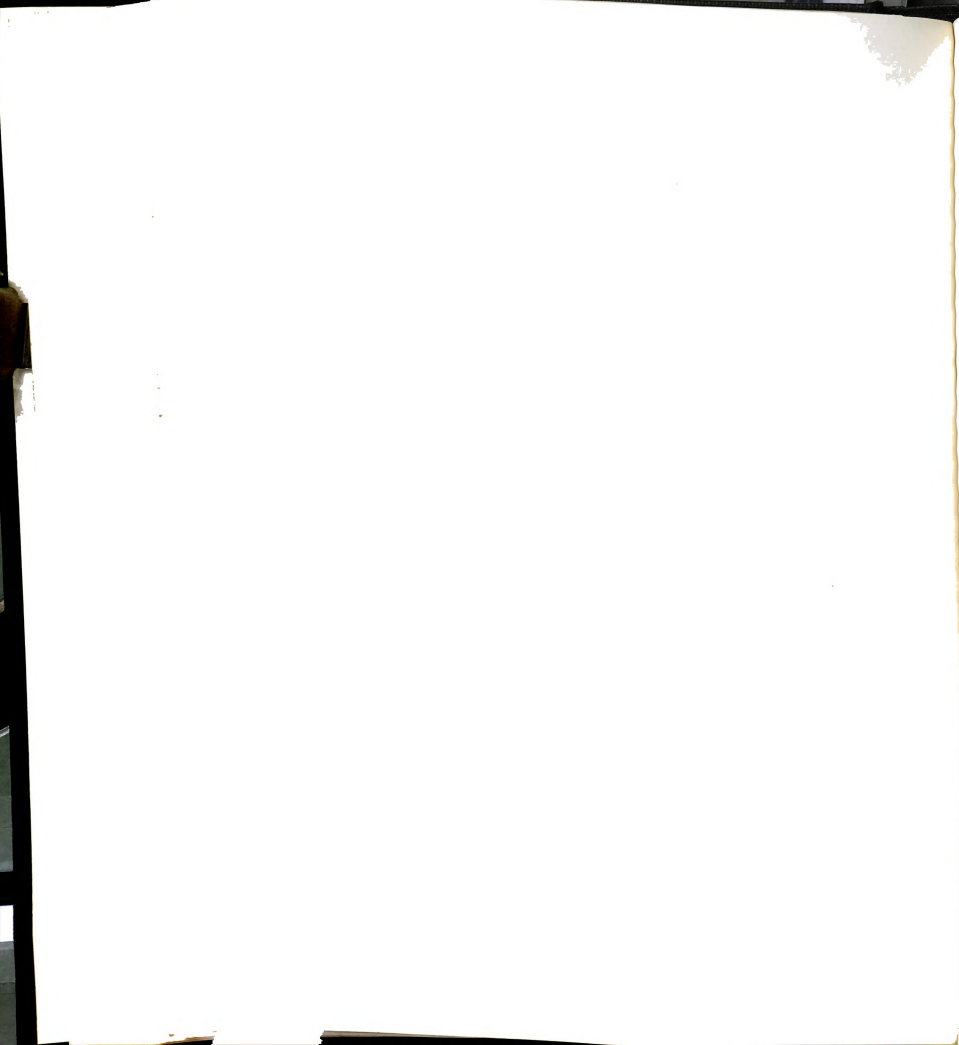
Property Size

Extensive land grants were not characteristic of the early settlement patterns of the Northwest. Over time, however, some large holdings were developed. These latifundios were and are dominant only in the two northern provinces of the region.

The latifundio could not be considered typical of Tucumán in any historical period. The vegetation mixture of subtropical forest, scrub forest and occasional lush grasslands was difficult to prepare for agriculture. Scattered agricultural holdings surrounded the city of San Miguel de Tucumán in its early days, but the non-cultivated land was considered property of all.³ During the mid-1800's the more prosperous tradesmen and farmers acquired large land holdings, but it was later that the railroad and the expanding sugar industry physically transformed the landscape of the province. Great amounts of land were cleared and sugar cane was planted extensively. Rapid transport made intensive cane growing highly profitable.

The big agricultural breakthrough corresponded with an increase in the number of cane planters. In 1874, two years prior to the arrival of the railroad, only 233

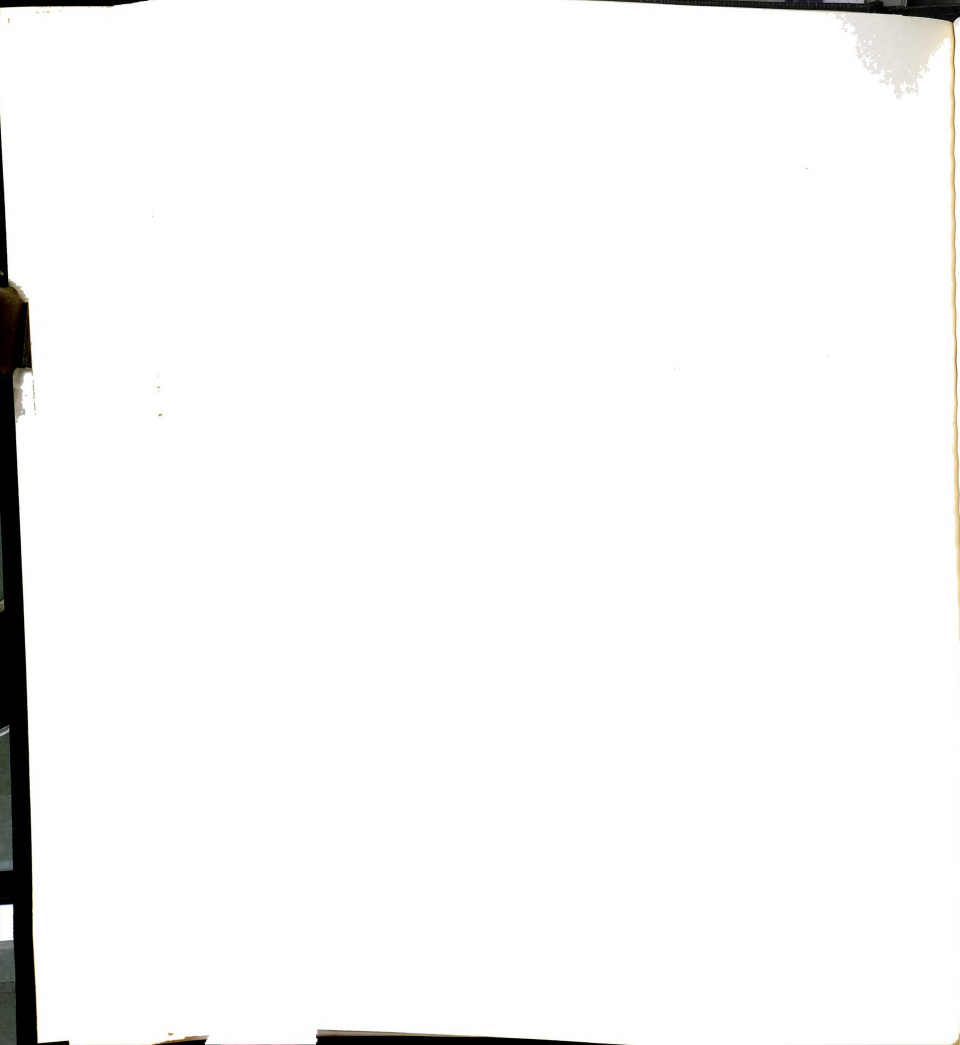
³Ricardo Jaimes Freyre, El Tucumán en 1810, Noticias históricas de documentos inéditos. (Tucumán, 1909) quoted in Teodoro R. Ricci, Evolución de la ciudad de San Miguel de Tucumán (Tucumán, 1967), p. 75.



planters were reported while in 1895 the number had increased to 2,630! Continued proliferation occurred during the 1900's. In 1926 cane farmers totaled 5,033 and by 1965 a phenomenal increase to 26,780 was reported.⁴ The growth rate varied with cycles in the industry, but two general conditions prevailed: (1) early separation of the agricultural and industrial stages, and (2) negative incentives offered the large owner of cane lands.

During the initial stages of the sugar industry each grower was also an industrialist, that is, he processed the cane into crude sugar. Large-scale processing became both possible and necessary when the railroad arrived in 1876, and the people with capital not only acquired the machinery for a modern mill but also extended their land holdings. A new class came into being along with the large industrialist: the monoculture cane farmer. Planting sugar cane was attractive to even a small landowner, since cane was easy to care for and afforded a better cash return than any other crop. The growers had little economic leverage, however, for at this stage the industrialist dictated the prices for the raw material. Yet, this did not deter thousands from entering the new profession.

⁴Adolfo Canitrot and Juan Sommer, Diagnóstico de la situación económica de la provincia de Tucumán, p. 21.



Sugar cane proved so profitable that the industrialists sought ways to extend cultivation to all suitable parts of their properties. To use all or most of their lands, the ingenio owners developed a system of colonias.⁵ This was a variant on share cropping where the mill owners awarded use of sections of their land in exchange for the care and harvesting of the crop. All the cane was sent to the mill and cash reimbursements were made to the colonistas. At first the parcels of land were passed to family members and friends, since they assured an income and could be subcontracted if so desired.⁶ The workers were normally agglomerated into housing groups, near the fields, which frequently developed their own town characteristics and functions. In this manner, the mills extended their cane area and assured additional supplies of cane. By 1895, some 240 colonias accounted for about 36 percent of the land planted to cane within the province.⁷ Each of the colonistas was considered a separate grower and thus added to the count of planters, somewhat falsely.

⁵Jorge A. Domínguez and Agustín Hervas, Cooperativas agropecuarias de trabajo: Una alternativa de solución para el problema Tucumano (Tucumán: INTA, 1970), p. 107.

⁶Ibid., p. 108.

⁷Emilio J. Schleh, La industria azucarera en su primer centenario: 1821-1921 (Buenos Aires: Ferrari Hnos., 1921), p. 81.



The development of worker demands in the late 1920's changed the land and planting strategies of most sugar mills. Each ingenio traditionally held large planted acreages and produced much of the cane it milled. This necessitated large numbers of workers to care for and harvest the crop, and demands for higher wages and benefits led many mills to sell or rent large portions of their lands. These actions multiplied the number of persons directly involved in growing cane. Additional cañeros resulted from: (1) expansion onto the marginal eastern lands of the province; (2) favorable pricing policies which rewarded the small, relatively inefficient producer; and (3) the natural break-up of holdings over time through inheritance.

Developments in the Norte did not parallel those of Tucumán. Here, large holdings associated with the sugar mills remained dominant throughout the years. Even today, only 20-25 percent of the cane in Salta and Jujuy is grown by independent planters. The explanation for the estate system lies with the isolated location of the cane lands in these provinces, the restricted area of land suited to cane, and the need for substantial capital to install irrigation systems. Wealthy families or individuals with large land-holdings started the modern sugar mills, and have remained in command of production, although many have developed corporate structures. Thus, historical development,

physical limitations and restrictively high capital needs have all mitigated against the development of small cane growers in both Salta and Jujuy (Table 20).

There are obvious industrial advantages to the land ownership structure that evolved in the Norte. Large cane fields associated with the mills favor efficient production and an easy coordination of the harvest period. In contrast, the large number and small size of holdings in Tucumán have complicated the industrial process. Among the associated problems of Tucumán are difficulties in coordinating the harvest, transport and milling phases; a lack of control over varieties and cultivation techniques (quality control); a lag in putting research results into practice; payment complications; and a generally inefficient size of holdings. Thus, from an industrial point of view the Norte appears to have a much more effective production system.

Land Ownership

A pronounced difference in land tenure patterns exists among the cane areas. Tucumán again exhibits the greatest variety and most serious "problems." The integrated sugar cane operations of Salta and Jujuy are almost uniformly factory operated, in contrast with those of Tucumán.

Tucumán has a very large number of cane growers and, surprisingly, the great majority own their own land. In



TABLE 20

SIZE AND NUMBER OF CANE HOLDINGS IN TUCUMAN,
SALTA AND JUJUY PROVINCES

Province	No. of Planters (1970)*	Range in Cane Area/Farm (Hectares)
Tucumán	4,725	2.5 - 7,000**
Salta-Jujuy	46	20 - 22,000

Source: Compiled by author.

* Includes Ingenio lands as single planters.

** Many minifundia remain in Tucumán province without quotas but with under one hectare in cane.

1960-61, for instance, owner-operated fields accounted for about 86 percent of the total cane acreage.⁸ Sample data in 1970 also indicated that over 80 percent of the individual cane fields (fundos), which vary greatly in size, were owner operated.⁹ Other relevant tenure conditions include tenant farming, rental, and squatters (Table 21).

Although the statistics presented are not directly comparable, due to varied information gathering techniques, it is clear that owner-operated cane farms are the rule.

⁸Censo de explotaciones cañeras, 1960-61 (Tucumán: Cámara Gremial de Productores de Azúcar, 1961).

⁹Censo de productores cañeros, Año 1970 (Tucumán: Cámara Gremial de Productores de Azúcar, 1970) and personal sampling in 1970.



TABLE 21

LAND TENURE PATTERNS IN CRUZ ALTA AND RIO
CHICO DEPARTMENTS, TUCUMAN, 1970

Department	Owners	Renters	Tenant Farmers	Squatters	Total
Cruz Alta	1,063	95	145	17	1,320
Río Chico	832	42	53	7	934

Source: Censo de Productores Cañeros, 1970
(Preliminary), Tucumán, 1970, and personal
sampling in 1970.

Many are included under other modes of tenure, however.

The land tenure system was greatly altered following the government actions of 1966. Many small landowners were forced out of cane production by the elimination of their sugar quotas. The government encouraged a positive approach to the minifundia problem, however, which led to a new form of land utilization, the cooperative. Three large cooperatives were organized in the late 1960's and probably exemplified the most important new development after 1966. Directly following government intervention, one mill, Bella Vista, made about 2,000 hectares available to dismissed workers, purportedly to help alleviate the immediate problem of severe unemployment. This co-op appeared to be well founded and is today a viable unit.¹⁰ Despite its success,

¹⁰Dominguez and Hervas, Cooperativas, 1970, offer a thorough analysis of this cooperative, Cooperativa "Trabajadores Unidos" Ltd., pp. 120-130.



there does not seem to be any great increase in the cooperative movement in the province of Tucumán.

Labor

Although a heavy demand for labor is common to the sugar industry as a whole, various means have been employed to supply the demand. This in turn has led to a number of problems.

The need for workers is especially critical during the harvest season (Table 22). The 1963 figures, while not representative of absolute numbers involved today, show graphically the seasonal movement of workers into and out of the province. An indication of the declining labor needs over time is given in Table 23. The effect of the 1966 actions, and the more gradual prior decline of employment due to increased efficiency and mechanization, is also clearly shown.

The workers can be classified in four categories according to where and when they are employed: permanent and transitory factory workers, and permanent and transitory field hands. Each category pertains to specific needs and each shows a different employment pattern. The importance of the groups numerically and the effect of mill closings between 1966 and 1968 are shown in Tables 24 and 25.

Differences in the origin of workers in each region have been alluded to earlier. Entrepreneurs of each region



TABLE 22
WORKERS OCCUPIED IN CULTIVATION AND HARVESTS IN TUCUMAN PROVINCE, 1963

Origin	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
From Tucumán	16,141	13,207	12,013	13,220	15,985	34,824	39,599	38,186	34,636	28,387	24,382	21,432
From Other Provinces	1,166	513	355	420	5,335	20,613	23,752	23,311	17,899	10,896	4,032	2,107
Total	17,307	13,720	12,368	13,640	21,320	55,437	63,351	61,497	52,535	39,283	28,414	23,539

Source: Dirección Provincial de Estadística, Encuesta agropecuaria 1964 (Tucumán: Dirección Provincial de Estadística, 1966).

TABLE 23
VARIATION IN SUGAR EMPLOYMENT DURING HARVEST MONTHS
IN TUCUMAN PROVINCE, SELECTED YEARS, 1955-1969

Year	Employees
1955	119,025
1960	97,807
1963	83,938
1965	96,307
1969	64,230

Source: La Industria Azucarera, 1955-1970.

TABLE 24

NUMBER AND COMPOSITION OF INGENIO PERSONNEL
IN TUCUMAN PROVINCE, 1966

Workers	Numbers
Permanent Factory	5,500
Transitory Factory	12,300
Permanent Field	3,300
Transitory Field	9,700

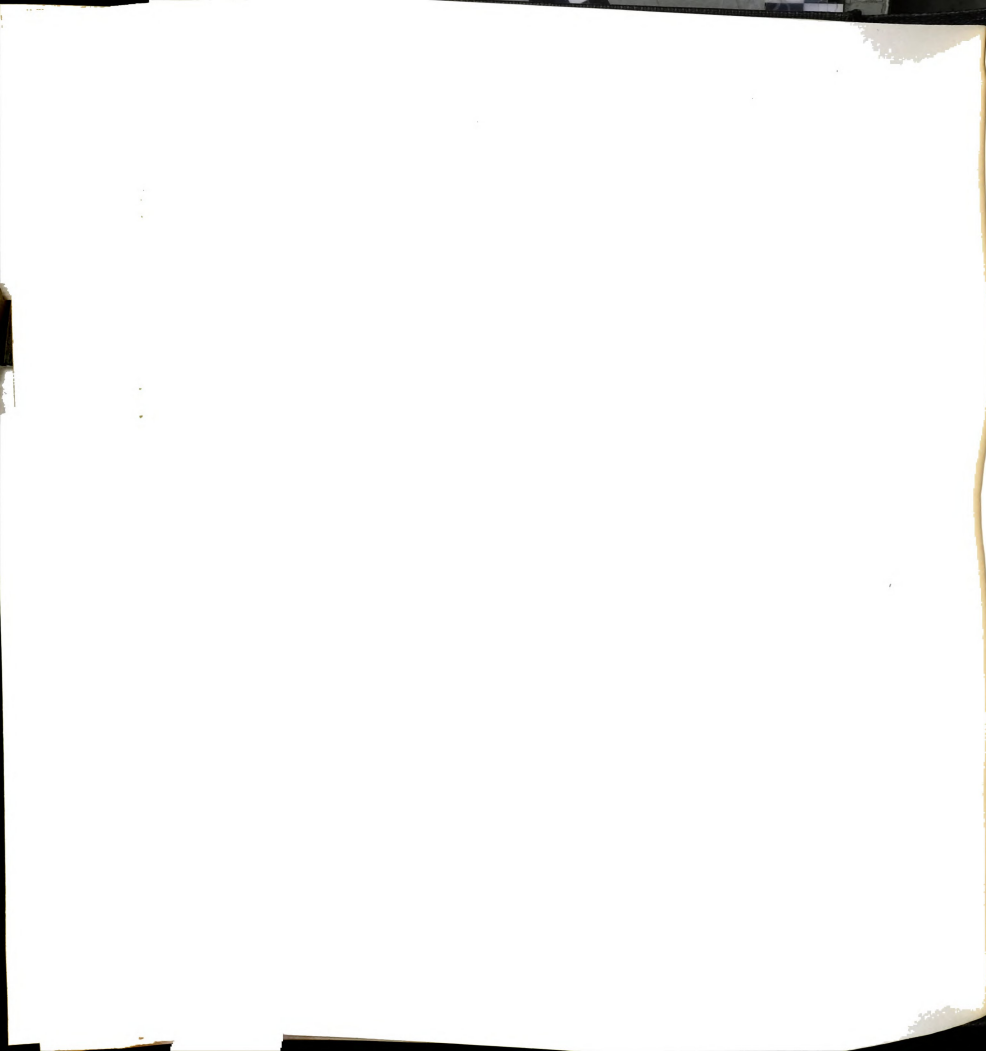
Source: Miguel Murmis and Carlos Waisman, "Monoproducción agro-industrial, crisis y clase obrera: La industria azucarera tucumana," Revista Latinoamericana de Sociología, Vol. 5, No. 2, 1969.

TABLE 25

PERSONNEL OF CLOSED MILLS IN TUCUMAN PROVINCE, 1966

Workers	Permanent Factory	Trans. Factory	Perm. Field	Trans. Field
Workers of Mills Closed in 1966	1,516	3,406	540	1,550
% total workers in 1966	30%	28%	17%	16%
Workers of Mills not Operating in 1968	2,080	4,050	1,130	2,067
% of total workers 1966	41%	33%	34%	21%

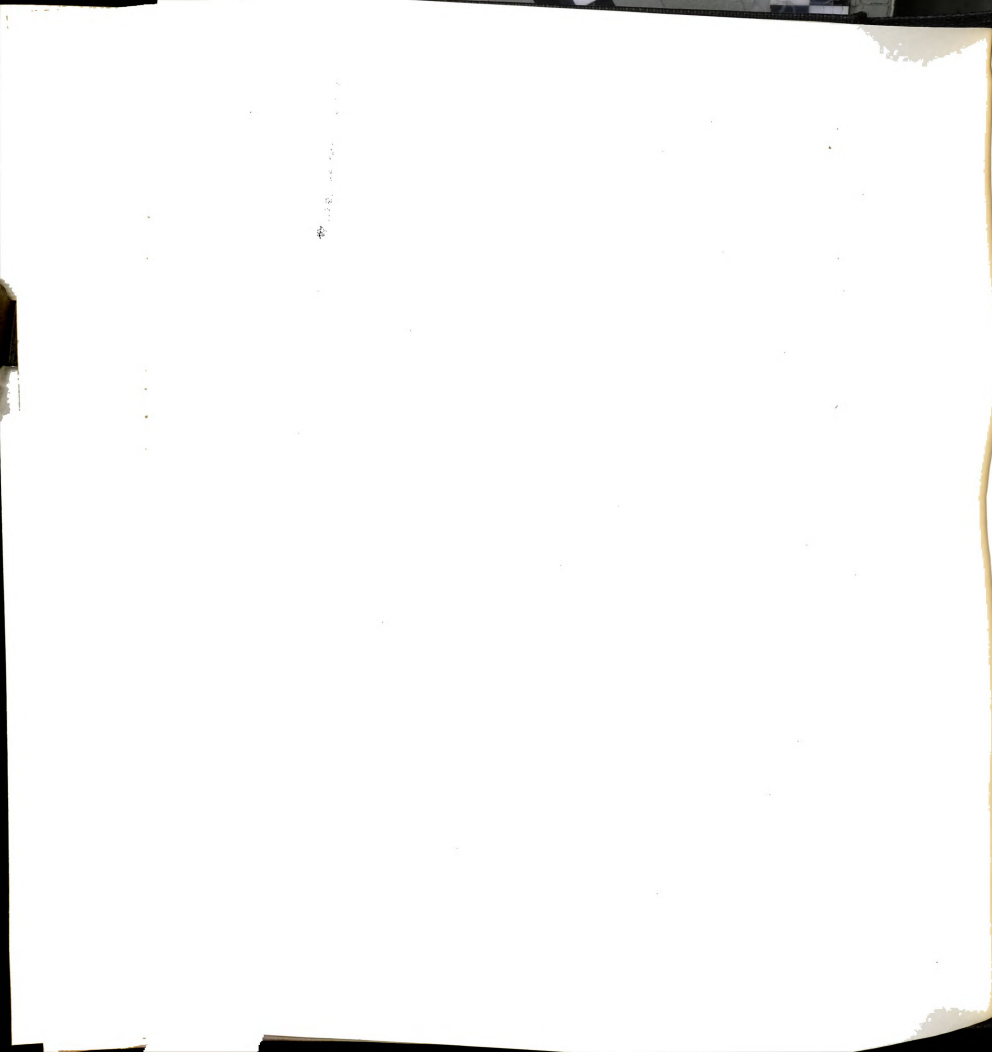
Source: Murmis and Waisman, "Monoproducción agro-industrial, crisis y clase obrera: La industria azucarera tucumana," Revista Latinoamericana de Sociología, Vol. 5, No. 2, 1969.



have actively recruited laborers from outside the respective provinces, but notable differences in techniques and results can be noted. In Tucumán, the workers are chiefly white and from within the province or the near-by provinces of Santiago del Estero and Catamarca. Active labor recruitment is needed only by the larger landowners and is normally handled on an individual basis.¹¹ At present, there is little need for even subtle coercion to attract workers. A completely different system is used in Salta and Jujuy. Bolivia was found to be the best source of cheap, seasonal labor. Contratistas are hired by the individual mills to contract Bolivian Indian laborers and are reimbursed for each laborer delivered. It is estimated that in 1970 Salta and Jujuy employed more than 26,000 men in the sugar harvest and that up to 80 percent were Bolivians.¹² Laws extant limit migrant workers to those with proper documentation, and these state that no more than 40 percent of the workers in any establishment may be from a foreign country. Despite such laws, large numbers of Bolivians still enter the country to work.

¹¹Interview with Dn. Mario Santamarina, former large cane grower, Tucumán, May 14, 1970.

¹²Scott Whiteford and Richard Adams, "Migration, Ethnicity and Adaptation: Bolivian Migrant Workers in Northwest Argentina," paper presented at a Symposium on Migration and Ethnicity, Chicago, 1973.



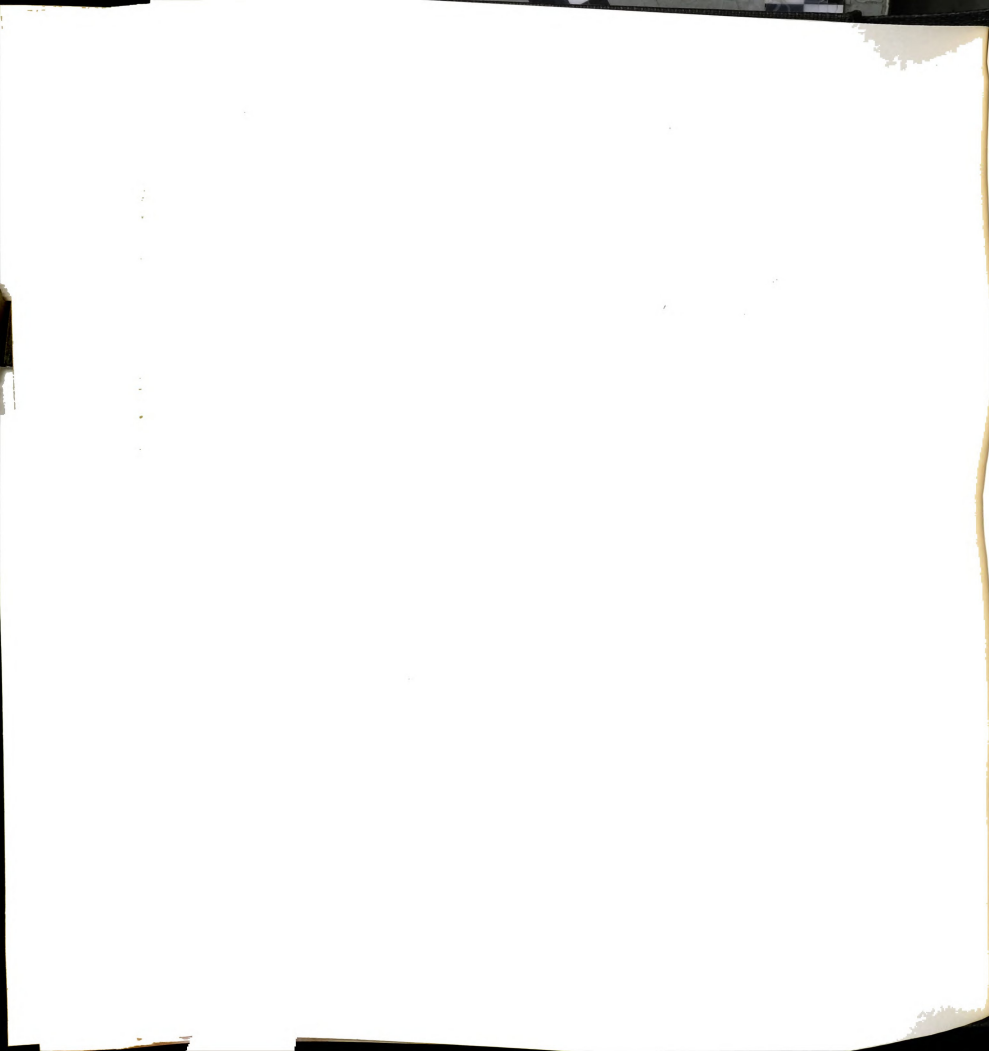
Another important laboral element that has influenced change has been the "organizational environment" of each region.

Organizational Factors

The three major protagonists of the sugar industry are the industrialists, cane planters and workers, to which might be added the government. Each group spawned organizations at different historical moments to represent its interests. These organizations, in turn, affected the direction of the industry and influenced the changes of the past several decades.

On the national level, the sugar industry is well regulated through the national sugar council (Dirección Nacional de Azúcar). Most of the formal actions effecting policy changes have been directed from this level. Local or regional decrees occasionally influence the industry but problems are generally directed to the highest levels. The government also serves as enforcer when local conditions are judged to be worthy of attention.

Formal organizations have exerted strong influence in both major producing areas of the Northwest. The interplay among the sectors, however, has been most striking in Tucumán. The industry in Salta and Jujuy has been dominated by the industrialists, since relatively few independent planters exist and the worker unions have not been very powerful or militant. Within each area the



organizations have worked to further their own ends and have acted as defenders of their respective sugar zones. A strong regional bias bordering on direct antagonism has frequently existed between the Norte and Tucumán.

In Tucumán, all sectors of the industry were represented by organizations by the 1940's. Mill numbers remained relatively constant from then until 1966, but the planters and workers gained in overall power and influence. An erosion of the industrialist's leverage, and internal adjustments to this situation, characterized the period.

During the 1960's another cycle of overproduction occurred, and this eventually led to severe structural problems. By 1965 the excess stocks of the previous year and another abundant harvest drove sugar prices down. This meant that some mills were unable to meet their financial obligations. Payments for cane were reduced and in many cases non-existent. A parallel lag in the payment of salaries occurred in both the industrial and planter sectors, with consequent demands and shows of force that culminated in the take-over of some mills by the workers.¹⁴ In August, 1965, a new labor agreement was reached that awarded a 30 percent wage increase for workers, and this further aggravated the situation. Industrialists pointed out that while prices for sugar were lower than in 1963,

¹⁴ La Industria Azucarera, Jan. 1966, Vol. 72, No. 872, p. 13.

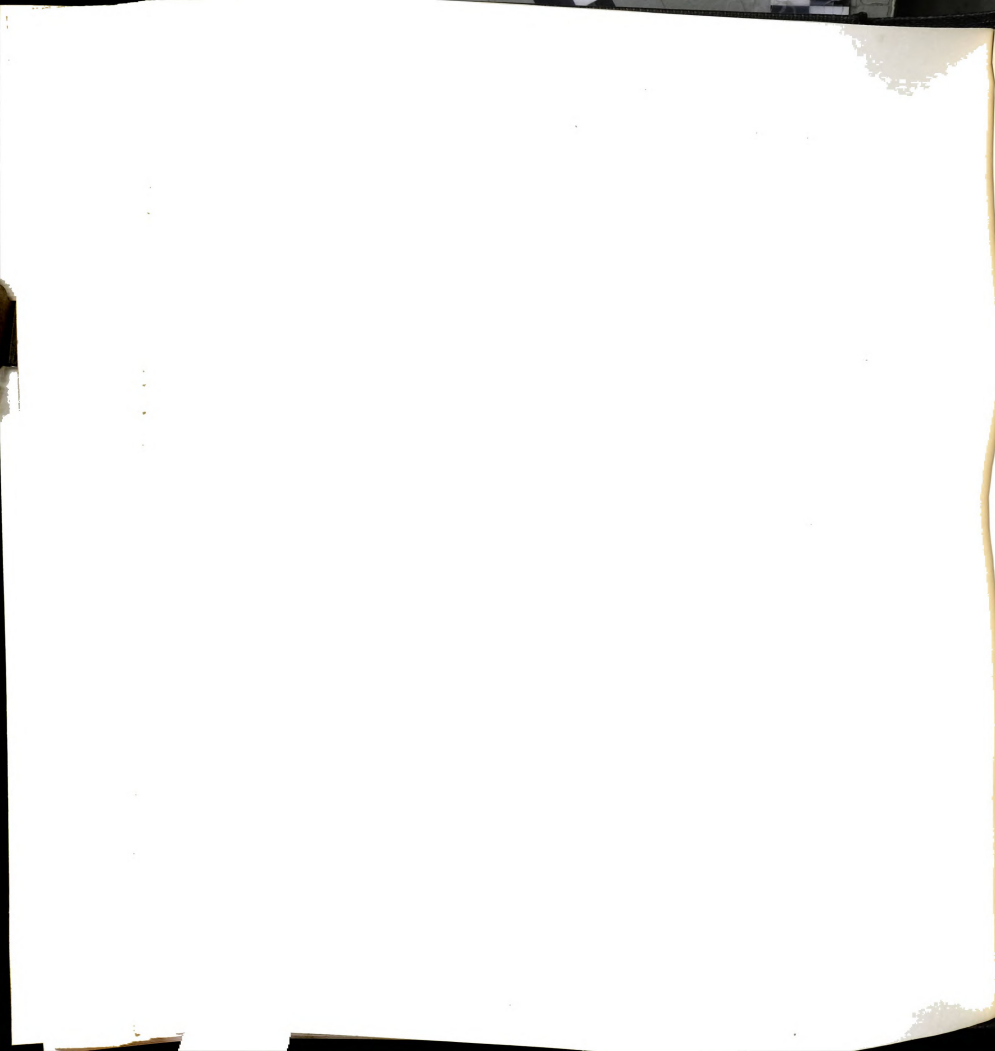


salary increments amounted to 37 percent in 1964 and an additional 30 percent in 1965. Thus, financial pressure on all mills was considerable and drastically affected the marginal ingenios.

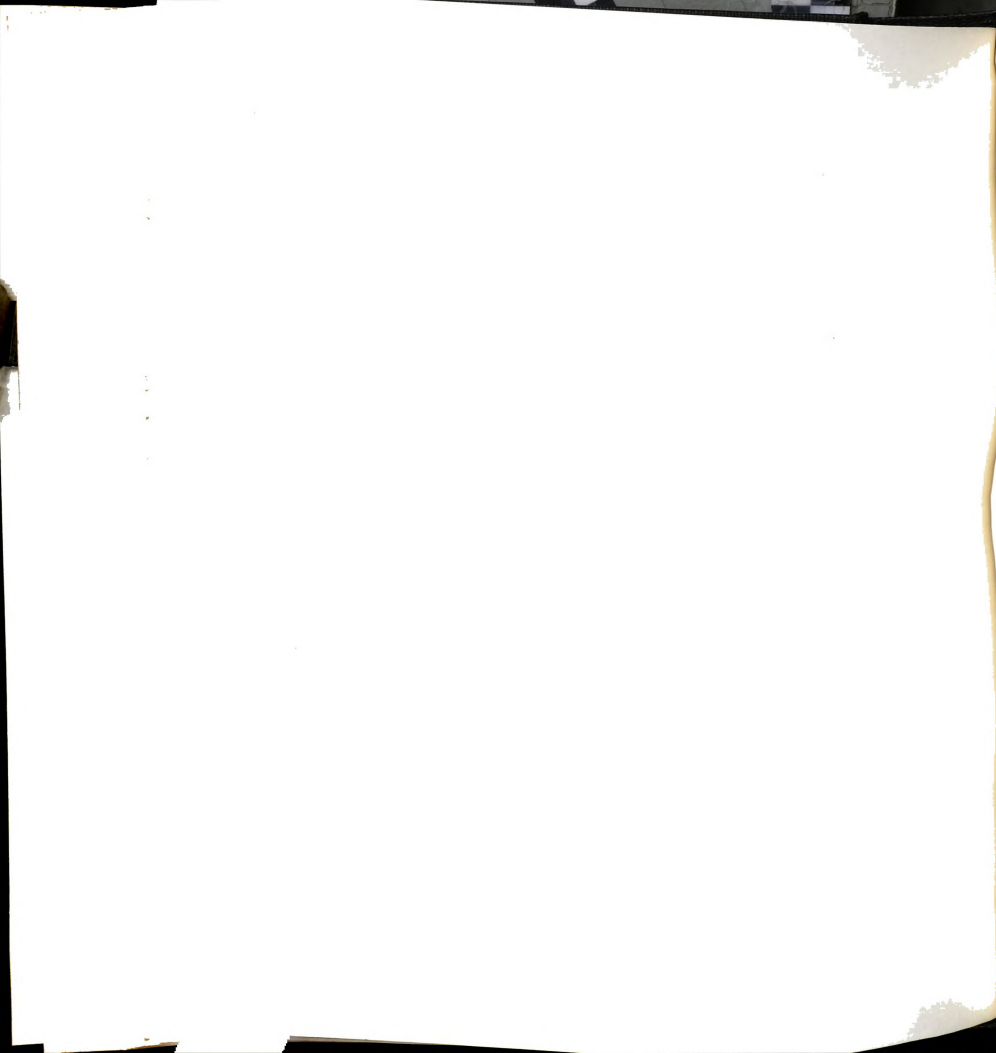
National attention was naturally directed toward the delinquent mills by both worker unions (FOTIA AND FEIA) and the small planter organization (UCIT) of Tucumán, which helped to force the government's hand. Intervention was demanded by these unions, but not at the price of shut-downs.¹⁵ Everyone deplored the eventual loss of jobs in the province, but many growers and workers were hopeful that the government would assume responsibility for the six to ten mills that were in serious trouble. Several ingenios, such as Bella Vista, were bailed out of difficulty but within several years ten mills were closed.

Following the government actions of 1966 it was the groups represented by more radical organizations (UCIT, FOTIA, and FEIA) that were most decimated. The workers of the factories that were closed and the small growers who lost their quotas were effectively disenfranchised. Most of the medium-sized and large planters, represented by CACTU, who supplied the intervened mills were hurt financially by non-payments, but they could find other markets for their cane.

¹⁵La Gaceta, Tucumán, July 19, 1965.



Actions taken by the unions of Tucumán demonstrated the need for restructuring the industry. The organizations pointed out major problems and inefficiencies which were later used as ammunition to shift production from Tucumán to the Norte.



CHAPTER VII

ECONOMIC FACTORS INFLUENCING CHANGE

The traditional factors of production (land, labor and capital) have all had an effect in shifting the sugar industry from Tucumán toward the Norte. Inputs affecting all phases of cane production, processing and marketing have changed in form or quantity within and between the regions over time. These economic elements offer important insights into the reasons behind shifting production patterns in the Northwest.

Historical Perspective

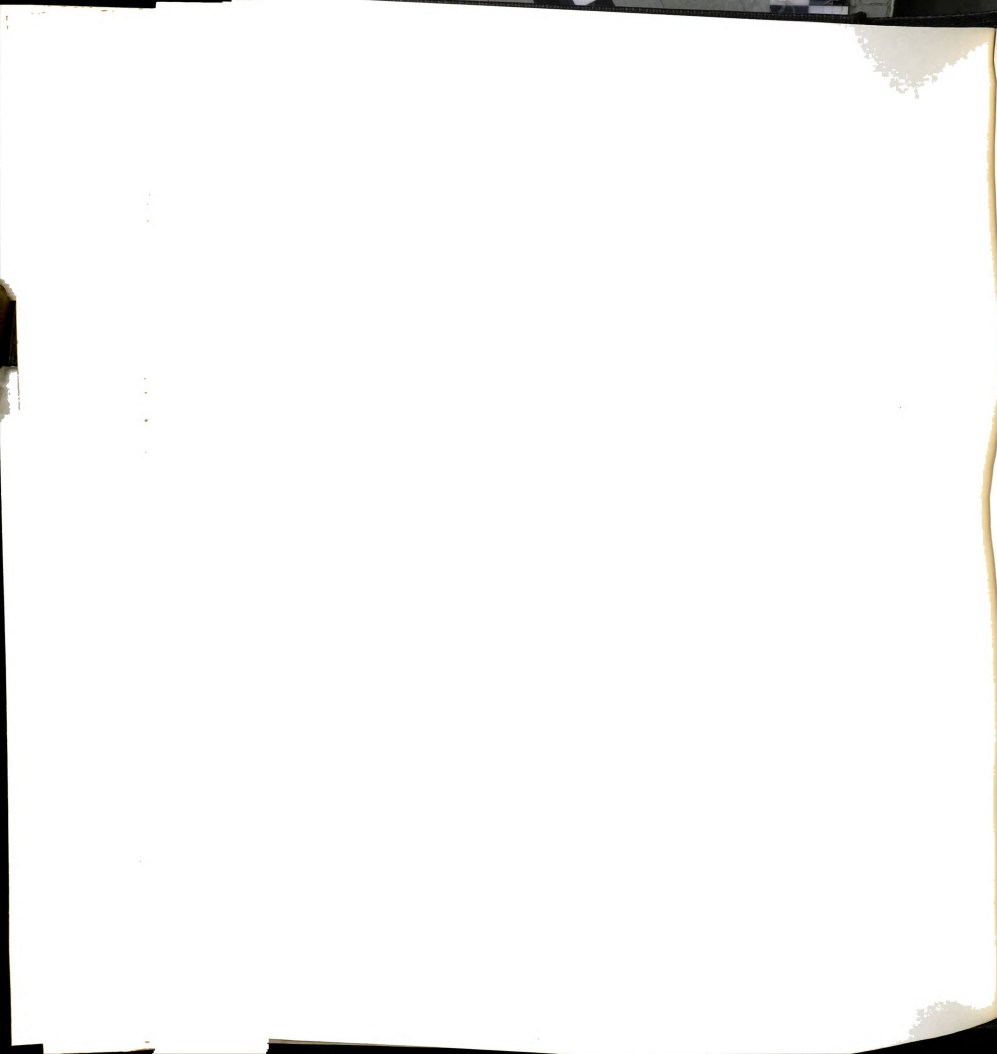
Commercial sugar production in Argentina never really operated under a free market situation. Early production was influenced greatly by price structures instituted by the national government. Thus, incentives to create efficiencies in the field and factory depended frequently on the policy in force. During the first Perón era, more recently, emphasis was on social welfare and immediate short-run goals were not strictly economic. Production elements have responded to changing prices at all levels, from the mill to world market prices, and factor costs (such as land and labor) linked to specific sites also have been important in causing production shifts.



Farming inputs have changed visibly over time. Growing and harvesting sugar cane have always required a large amount of energy, and heavy manpower needs have been tempered with greater utilization of animal and inanimate sources of energy. Through the early stages of the industry man's labor was aided by the use of animals, particularly oxen, mules and horses. Originally, due to their strength and docile natures, oxen were most used in the fields but were gradually replaced by the faster working mule. Replacing the four-legged creatures with mechanical horsepower began on the larger farms during the 1920's and 1930's, and tractors have now almost entirely replaced animals in the canefields of the Norte. In Tucumán, however, it is still common to see animals working the fields or hauling cut cane. In 1964, Tucumán supported over 42,000 horses, 57,000 mules, 6,900 donkeys and 10,000 oxen.¹ Numbers have undoubtedly declined since that date. A sample taken in 1966 found that only 5 percent of the provincial cane farmers owned oxen, 63 percent used mules, and about 40 percent had work horses.² A personal investigation indicated that of 100 farmers in 1970, eighty-eight

¹Dirección de Estadística, Encuesta agropecuaria 1964 (Tucumán, 1966), p. 13.

²Francisco J. Delich, Tierra y conciencia campesina en Tucumán (Buenos Aires: Ediciones Signos, 1970), p. 81.



owned either horses or mules and only nine utilized oxen. The remainder used no work animals in their cane operations.

Modernization of the typical cane farm came piece-meal. Originally, draft animals and a wooden cart (carreta) to transport the cut cane were the main necessities. Equipment improvements included replacement of the large-wheeled, heavy carreta with lighter metal carts, (carros), which rode on pneumatic tires instead of metal-rimmed wooden ones. Tractors replaced animals in the fields, and mechanical cane cutters have since the early 1960's eliminated some of the most difficult manual labor of the harvest. All of these changes are making the industry more capital intensive and tend to favor the large landowner. Thus, the ingenios of the Norte have moved faster and further in this process than the whole of Tucumán.

Refinements in the machinery of the sugar mills have been no less important than those of the canefield but are hidden behind the walls of the ingenio. Upon entering the large-scale phase of production in the 1880's most mills operated with the most modern and efficient equipment available. Over time, however, considerable differences emerged among mills in terms of age and efficiency of the machinery. For example, most mills are currently in the process of phasing out wood burning furnaces (calderas) with those burning oil and gas (Table 26). There have been many other technical advances in the



TABLE 26
FUEL CONSUMED IN SUGAR MILLS OF TUCUMAN, SALTA AND JUJUY PROVINCES, 1969-1972

Year	Province	Wood (kg.)	Oil (kg.)	Gas (mt. ³)	Bagasse (kg.)
1969	Tucumán	40,083,433	41,016,042	23,653,072	1,489,190,239
	Jujuy	21,345,143	12,543,170	44,583,945	599,093,470
	Salta	---	410,888	21,185,111	246,475,183
1970	Tucumán	40,812,733	37,041,182	28,943,669	1,561,762,441
	Jujuy	26,567,985	14,246,470	43,720,036	653,099,467
	Salta	---	431,750	26,568,146	304,191,584
1971	Tucumán	33,869,142	37,706,321	27,213,762	1,456,821,027
	Jujuy	7,102,690	15,851,000	66,119,802	556,138,014
	Salta	---	431,750	30,675,523	310,601,027
1972	Tucumán	38,138,008	59,563,638	40,363,630	1,948,269,754
	Jujuy	4,506,190	15,787,642	81,205,633	810,663,000
	Salta	8,129,000	3,629,935	29,863,593	383,090,907

Source: "El azúcar argentino en cifras," La Industria Azucarera, 1969-1972.

milling process but, for the uninitiated, changes in a vacuum pan, for instance, adds little to an understanding of the industry! Many of the larger mills typify modernity, but efficiency of operation cannot be related directly to size. In fact, one study has indicated that there may be diseconomies of scale in the sugar mills of Tucumán.³ In general, the Norte, with larger mills and larger capital investments, made greater gains in the industrial sector than did Tucumán. By the late 1960's, however, Tucumán factory yields did advance relative to those of the North. (See Table 11, pp. 107-108).

General marketing conditions influence all areas with near uniformity. Since most of the production is directed toward domestic consumption, levels of consumption are an important variable affecting quotas. Per capita consumption in Argentina has remained relatively constant over recent time, and the nation's population growth rate is one of the lowest in Latin America (Table 27).

Production Efficiencies

Production efficiencies, or inefficiencies, can be divided roughly into two categories: those affecting cane production in the field, and those related to sugar production in the factory. Other exogenous factors, such as government policies, may likewise affect productivity.

³Manual L. Cordomí, A Study of the Production of Sugar in Tucumán, Argentina, unpublished Ph.D. dissertation, University of Chicago, 1969.

TABLE 27

PER CAPITA CONSUMPTION OF SUGAR IN ARGENTINA,
1950-1972

Year	Kgs/Capita	Year	Kgs/Capita
1950	34.8	1961	34.5
1951	35.7	1962	36.2
1952	36.9	1963	33.6
1953	32.8	1964	35.1
1954	35.3	1965	37.9
1955	34.6	1966	31.1
1956	35.4	1967	35.7
1957	37.2	1968	34.5
1958	37.2	1969	33.7
1959	35.7	1970	35.2
1960	31.3	1971	38.8

Source: Centro Azucarero Argentino.

Field Efficiencies

The process of growing and harvesting the raw material is similar in all producing areas. The numerous inputs and machinery, however, differ considerably within and between Tucumán and Salta-Jujuy. Variables related to productivity in the cane fields include property size, technology and labor.

Property Size

As previously noted, small holdings developed extensively in Tucumán, while large cane lands characterize the Norte. The size of holding correlates directly with



crop yields, as can be seen in examples from Tucumán (Table 28).

About 50 percent of the cane farms in Tucumán in 1964 were less than three hectares in size! The minimum size of canefield that will support an average family has been variously estimated, but most authorities seem to agree that from sixteen to twenty hectares are needed.⁴ From Table 28 it can be seen that 93 percent of the farms, and about 40 percent of the area planted to cane, in 1964 fell below this figure. Yields do not correlate neatly with size of farm, but a reasonable consistency of higher yields can be seen on farms from twenty hectares upward. Conversely, the smallest holdings tend to show the lowest average yields. By 1969, 82 percent of the farms were still below the recommended minimum size, but the low end of the scale had been thinned out considerably. This reduction was attained through enforcement of a production quota system set high enough to eliminate the smaller growers (Tables 29 and 30). It was not only the number of small farmers that was affected, however, as shown in Table 30. After the drastic reduction in number of small

⁴Estación Experimental Agrícola de Tucumán, Bases para el desarrollo agrario de la provincia de Tucumán (Tucumán, 1968), p. 12, and Instituto Nacional de Tecnología Agropecuaria, El minifundio cañero en la provincia de Tucumán (Tucumán, 1969), p. 33. Delich, Tierra y conciencia, 1970, p. 81, uses sixteen hectares as the base.

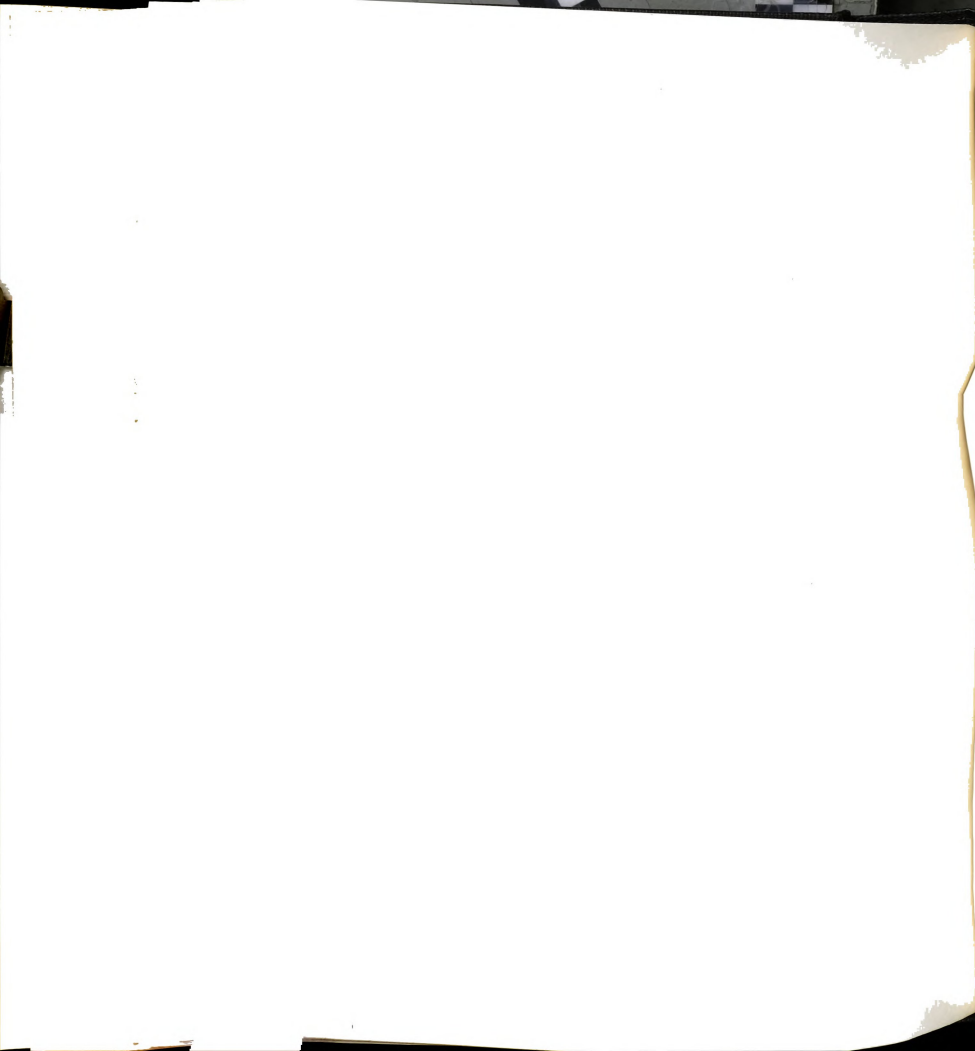


TABLE 28
SIZE, NUMBER, PRODUCTION AND YIELDS OF CANE FARMS IN TUCUMAN PROVINCE, 1964

Size (Has) ¹	Surcos ²	Number of Farms	Percent of Total	Total Has.	Percent of Total	Cane Harvested (tons)	Yield (tons/Has.)
0-1	0-50	2,009	10.7	1,945	1.2	12,821	37.4
1-2	50-100	4,792	25.6	8,523	5.1	289,669	33.9
2-3	100-150	2,780	14.9	7,328	4.4	293,223	40.0
3-4	150-200	2,571	13.8	9,202	5.5	340,408	36.9
4-5	200-250	1,152	6.2	5,168	3.1	206,267	39.9
5-6	250-300	1,028	5.5	5,938	3.5	240,810	40.6
6-7	300-350	460	2.5	2,977	1.8	107,355	36.1
7-8	350-400	515	2.8	3,950	2.4	161,950	41.0
8-9	400-450	359	1.9	3,100	1.9	134,850	43.5
9-10	450-500	497	2.7	4,120	2.5	170,240	41.3
10-11	500-550	687	3.7	7,220	4.3	292,500	40.5
11-12	550-600	323	1.7	3,484	2.1	146,550	42.1
12-13	600-650	79	0.4	980	0.6	44,100	45.0
13-14	650-700	60	0.3	815	0.5	30,562	37.5
14-15	700-800	40	0.2	615	0.4	25,215	41.0
16-20	800-1000	36	0.2	760	0.5	25,021	32.9
20-30	1000-1500	425	2.3	11,003	6.6	449,454	40.8
30-40	1500-2000	275	1.5	9,800	5.9	491,505	50.1
40-60	2000-3000	220	1.2	11,750	7.0	486,390	41.4
60-80	3000-4000	101	0.5	6,700	4.0	348,950	52.1
80-100	4000-5000	81	0.4	6,780	4.0	355,215	52.4
100-200	5000-10000	115	0.6	18,914	11.3	932,610	51.3
200-300	10000-15000	30	0.2	7,227	4.3	426,583	59.0
300-400	15000-20000	18	0.03	5,700	3.4	336,400	59.0
400-600	20000-30000	25	0.1	13,200	7.9	763,250	57.8

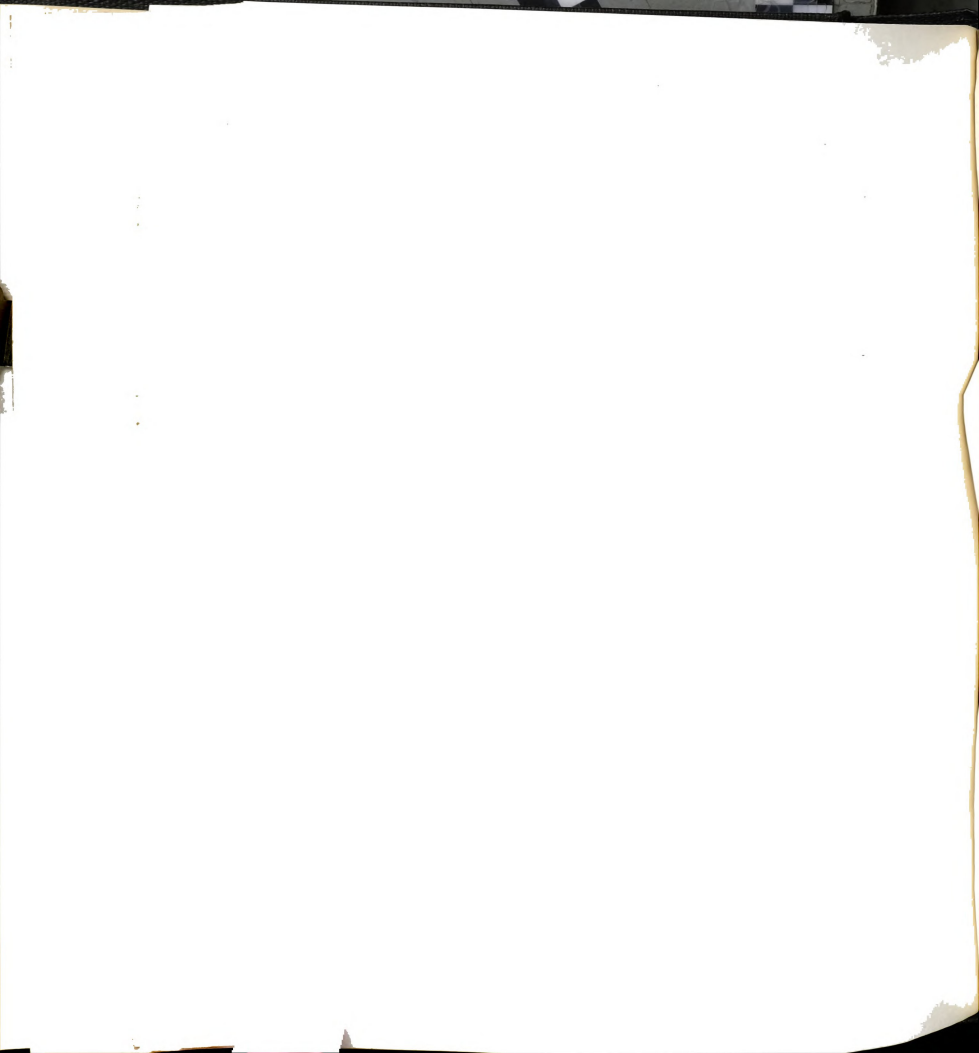


TABLE 28--Continued

Size (Has.) ¹	Surcos ²	Number of Farms	Percent of Total	Total Has.	Percent of Total	Cane Harvested (tons)	Yield (tons/Has.)
600-800	30000-40000	5	0.03	3,800	2.3	209,000	55.0
800-1000	40000-50000	1	0.01	700	0.3	36,750	52.5
over 1000	over 50000	6	0.03	5,568	3.2	291,480	70.0
		18,690	100.00	167,267	100.00	7,649,128	46.7
							Average

Source: Dirección de Estadística, Encuesta agropecuaria, 1964 (Tucumán, 1966).

¹Note that intervals are irregular.

²A surco is a row of cane 100 meters long. Normally, the conversion to area is at 50-55 surcos per hectare. In this table fifty surcos was used as the conversion figure for ease of computation.

TABLE 29

COMPARISON OF AREAS AND QUOTAS OF SMALL CANE GROWERS IN TUCUMAN PROVINCE,
1964 AND 1969

Probable Surcos	Area (Has.)	Production Quota (Kgs. Sugar)	% Farmers 1964	% Farmers 1969	% Production 1969
0-100	0-2	to 8,000	36.3	2.6	0.2
100-200	2-4	8,000-16,000	28.7	28.7	3.7
200-300	4-6	16,000-24,000	11.7	16.8	3.7
300-400	6-8	24,000-32,000	5.3	12.2	3.7
400-500	8-10	32,000-40,000	4.6	6.5	2.6
500-600	10-12	40,000-48,000	5.4	4.7	2.3
600-700	12-14	48,000-56,000	0.7	5.6	2.1
700-800	14-16	56,000-64,000	0.2	2.7	1.7
800-1000	16-20	64,000-80,000	0.2	4.2	1.7
Total			(93.1%)	(84%)	(21.7%)

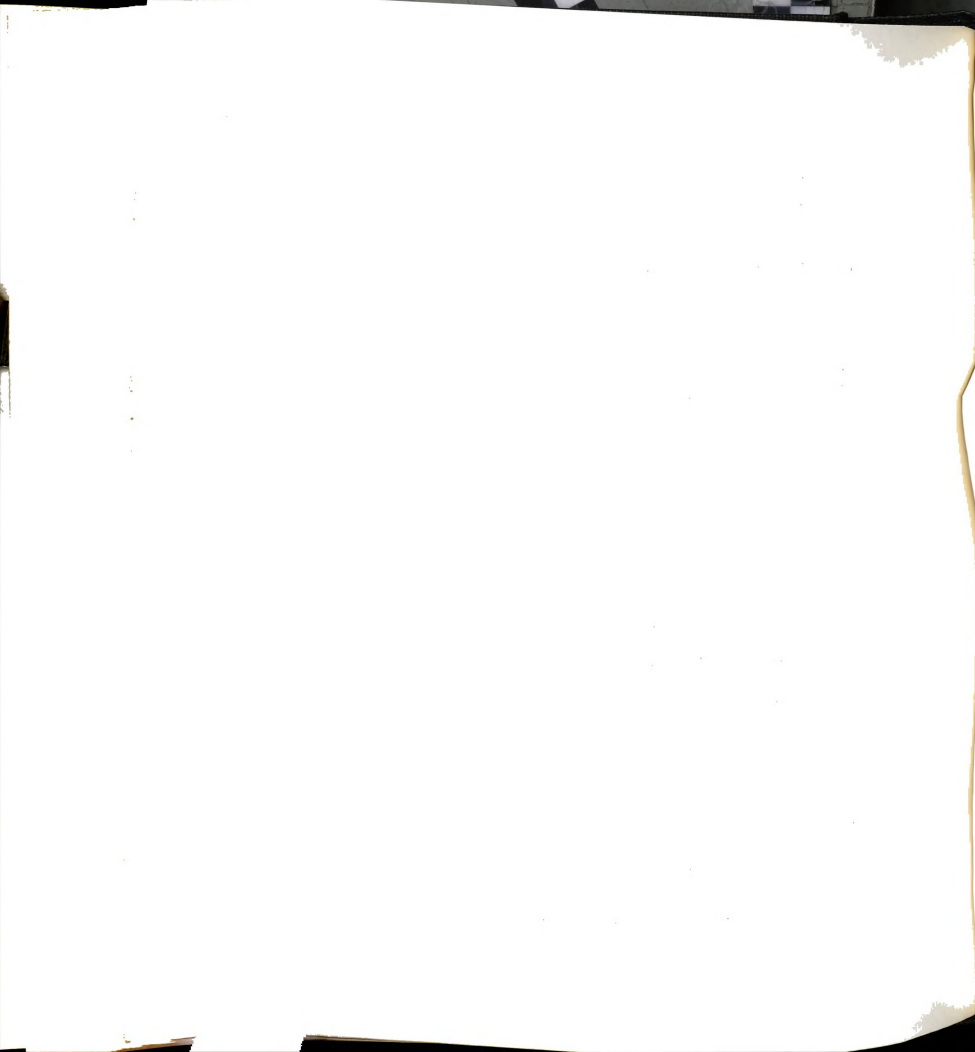
Source: Adolfo Canitrot and Juan Sommer, Diagnóstico de la situación económica de la provincia de Tucumán (Buenos Aires: Instituto Torcuato Di Tella, (1972), p. 71 and 75.

TABLE 30

DISTRIBUTION OF QUOTAS TO CANEROS OF TUCUMAN PROVINCE, 1967-1969

Quotas (Kgs.)	1967 Harvest		1968 Harvest		1969 Harvest	
	Growers	Kgs.	Growers	Kgs.	Growers	Kgs.
8,000-10,000	1,254	11,495,000	823	7,522,000	708	6,476,000
11,000-15,000	1,559	19,749,000	912	11,217,000	785	9,675,000
16,000-20,000	779	13,711,000	678	12,080,000	599	10,692,000
21,000-30,000	949	23,740,000	897	22,607,000	812	20,519,000
31,000-40,000	505	17,665,000	455	15,817,000	408	14,219,000
41,000-50,000	318	14,353,000	297	13,463,000	274	12,428,000
51,000-100,000	682	48,889,000	625	44,181,000	564	39,900,000
100,000-200,000	315	44,396,000	336	47,073,000	332	46,680,000
above 201,000	219	208,779,000	330	245,684,000	445	259,055,000
Total	6,580	402,777,000	5,353	419,644,000	4,927	419,644,000

Source: Adolfo Canitrot and Juan Sommer, Diagnóstico, 1972, p. 73.

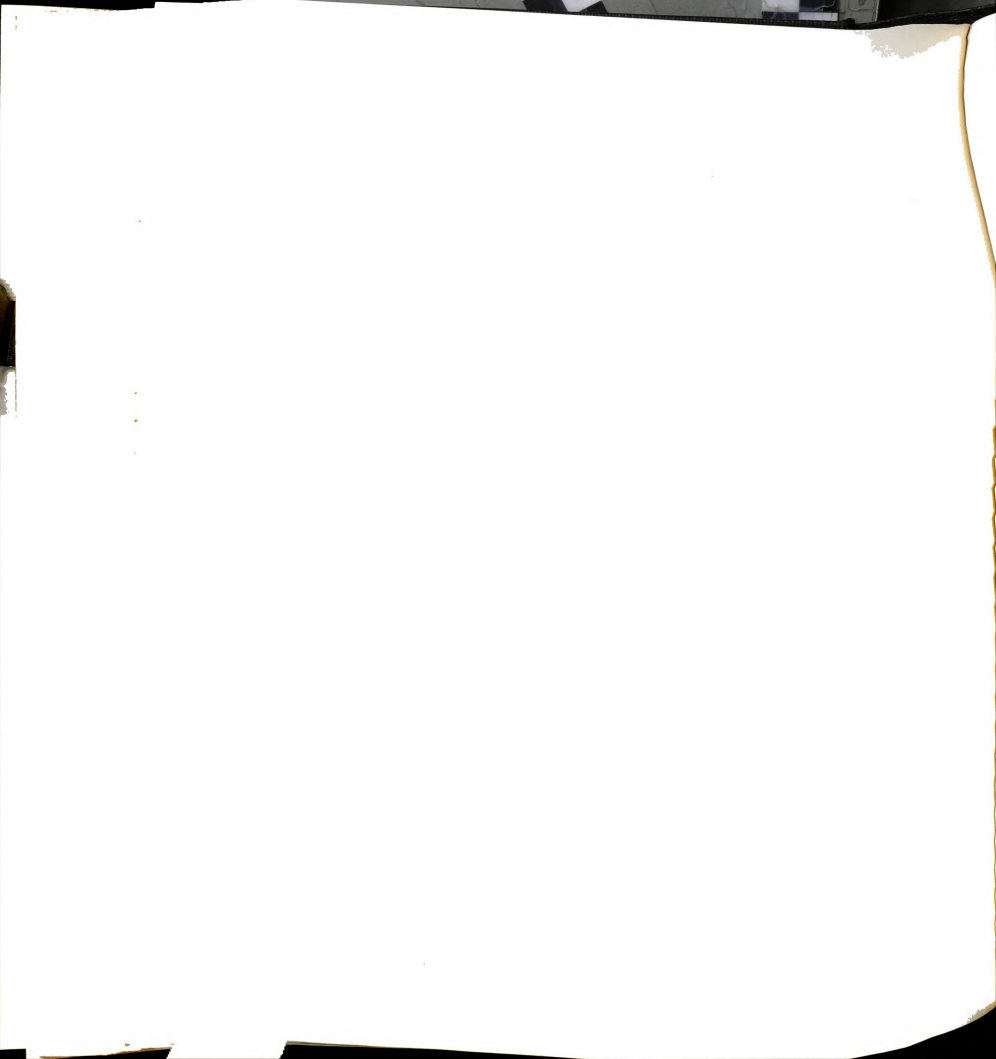


growers, a steady attrition also occurred in other categories except for the largest farmers.

Many elements associated with small size affect yields, but most are directly related to limited availability of capital. The small farms are less "efficient" because of poor physical sites, a lack of irrigation, limited cane varieties and little fertilizer or pesticide use, to name some of the more important considerations. Countering these restrictions is the tendency of the very small farmer to substitute increased labor for capital inputs. The small field usually is very well cultivated at the early growth stages, but without irrigation, fertilizer or pesticides, the final yield has strict limitations.

The Norte offers direct contrasts with Tucumán. In Jujuy, for example, there were only forty-one registered independent growers in 1970, and only ten of these had holdings of less than twenty hectares. Most independents held between twenty-one and forty hectares and were considered medium-sized cane farmers.⁵ About 80 percent of the cane in Salta and Jujuy is grown on large ingenio lands, and the advantages for production lie chiefly in the use of new and better farming technology.

⁵Information from Cañeros Independientes de Jujuy, Jujuy, 1970.



Technology

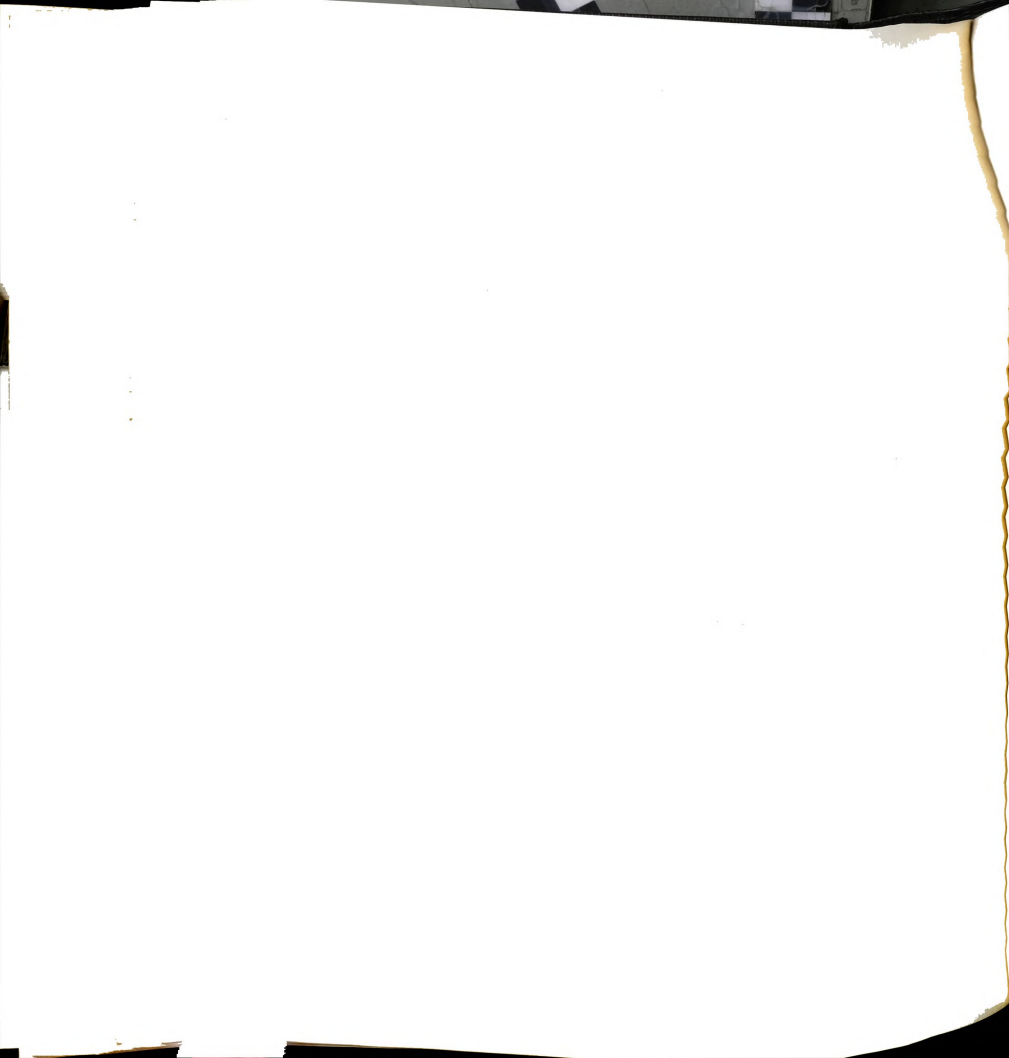
New and improved farm machinery appears frequently, and sugar cane production is not exempt from this process. Often the equipment has a level of operation which becomes efficient and economical at a given farm size. Considering the differences in land holdings between Tucumán and Salta-Jujuy, it is not surprising that field technologies differ.

There were an estimated 1,600 tractors in Tucumán during 1970, which worked more than 50 percent of the cultivated cane area.⁶ It has been estimated by the Agricultural Experiment Station of Tucumán that between forty and forty-five hectares are required for the economic use of a tractor for cultivation and general work in the cane fields.⁷ In 1969 about 65 percent of the cultivated cane area was included in farms of more than forty hectares (Table 28, p. 170). Thus, it may be assumed that additional tractors could still be introduced economically. On the other hand, numerous farms under the "minimum economic size" are tilled by tractors. Presumably these farms could be worked more economically with animal power.⁸

⁶Adolfo Canitrot and Juan Sommer, Diagnóstico de la situación económica de la Provincia de Tucumán (Buenos Aires: Instituto Torcuato Di Tella, 1972), p. 88.

⁷Estación Experimental Agrícola de Tucumán, La mecanización en el cultivo y la cosecha de la caña de azúcar, Publicación Miscelanea No. 24 (Tucuman, 1967), p. 11.

⁸Canitrot and Sommer, Diagnóstico, 1972, p. 90.



By adding attachments to the tractor its overall utility is increased and the effective area limitation can be altered. Thus, by adding a cane cutting attachment, the minimum economic size of farm for the use of a tractor is reduced to about thirty-five hectares.⁹ About 200 cortadoras operated in Tucumán during 1970 and, since their cost is not extreme, it is assumed that many more will soon be in use.¹⁰

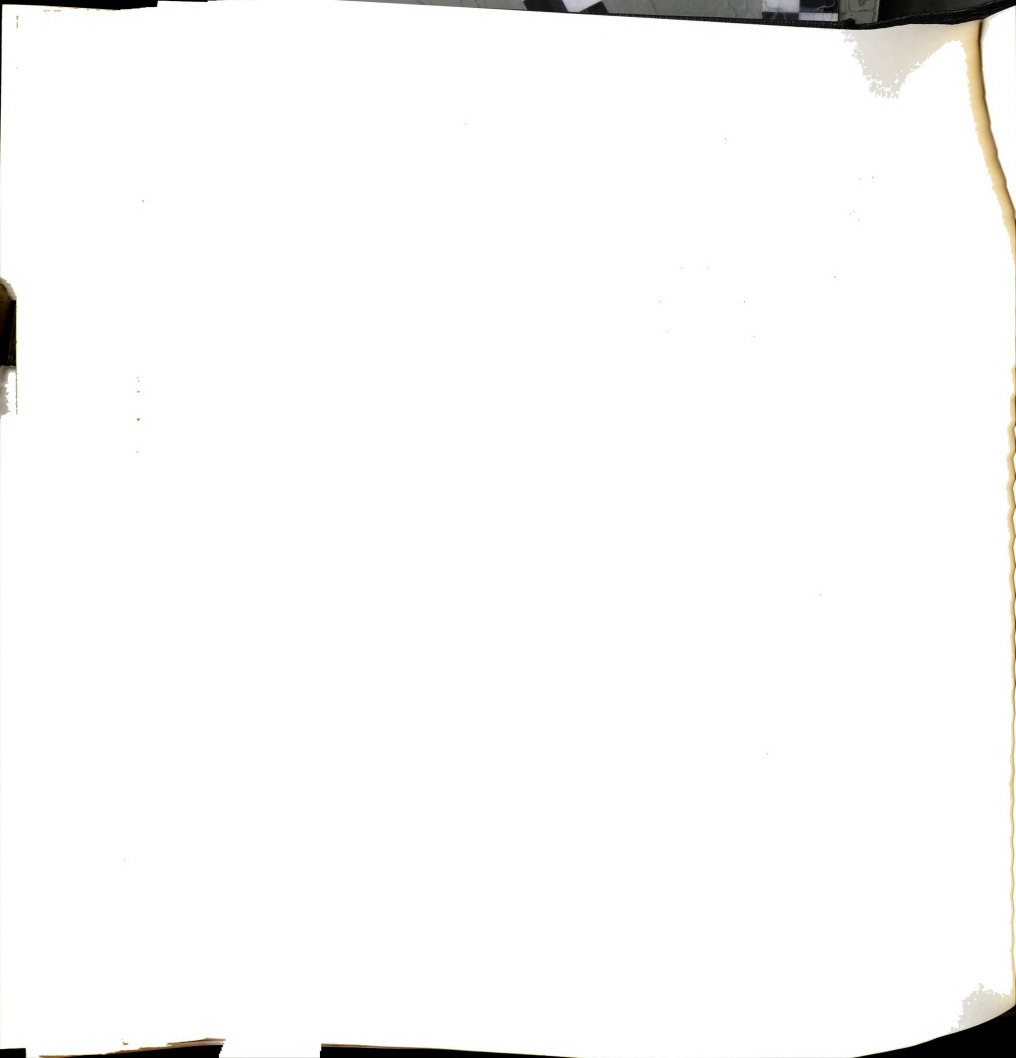
Salta and Jujuy are more "tractorized" per unit area of cane than is Tucumán but are not yet as involved in mechanical cutting. Data on total number of tractors in the sugar areas are unavailable, but Ledesma alone owns more than 200.¹¹ On the other hand, since labor problems are less common in these areas the pressure to use mechanical cutters is also less severe. Several mills, notably Esperanza, have experimented with a much more complicated cane harvester which not only chops the cane but also cuts it into pieces and loads it. However, little was being done in 1970 with the simple mechanical cutter.

At least 400 hectares of sugar cane are required for economical levels of operation with the mechanical cane

⁹Estación Experimental Agrícola de Tucumán, La mecanización, p. 12.

¹⁰Canitrot and Sommer, Diagnóstico, p. 90.

¹¹Personal interview, Victor Hugo Valdera, Secretary to Ledesma Director, March 13, 1970.



loader.¹² Fewer than forty farms in Tucumán qualify in this respect, yet the reported number extant in the province is about 100 and many more farmers seem to be considering this means of partially mechanizing their harvest.¹³ All of the Salta and Jujuy mills save one, Río Grande, were using these cargadoras in 1970, while just one of the independents in the Norte was large enough to make their use economically feasible.¹⁴

Labor

Since labor costs are large and increasing in sugar production, means are constantly being sought to reduce these expenditures. Mechanization is one obvious solution, while an often overlooked but extremely important possibility is increased production from less total area. In fact, it is estimated that the greatest labor savings could occur through improved yields.¹⁵

Factory Efficiencies

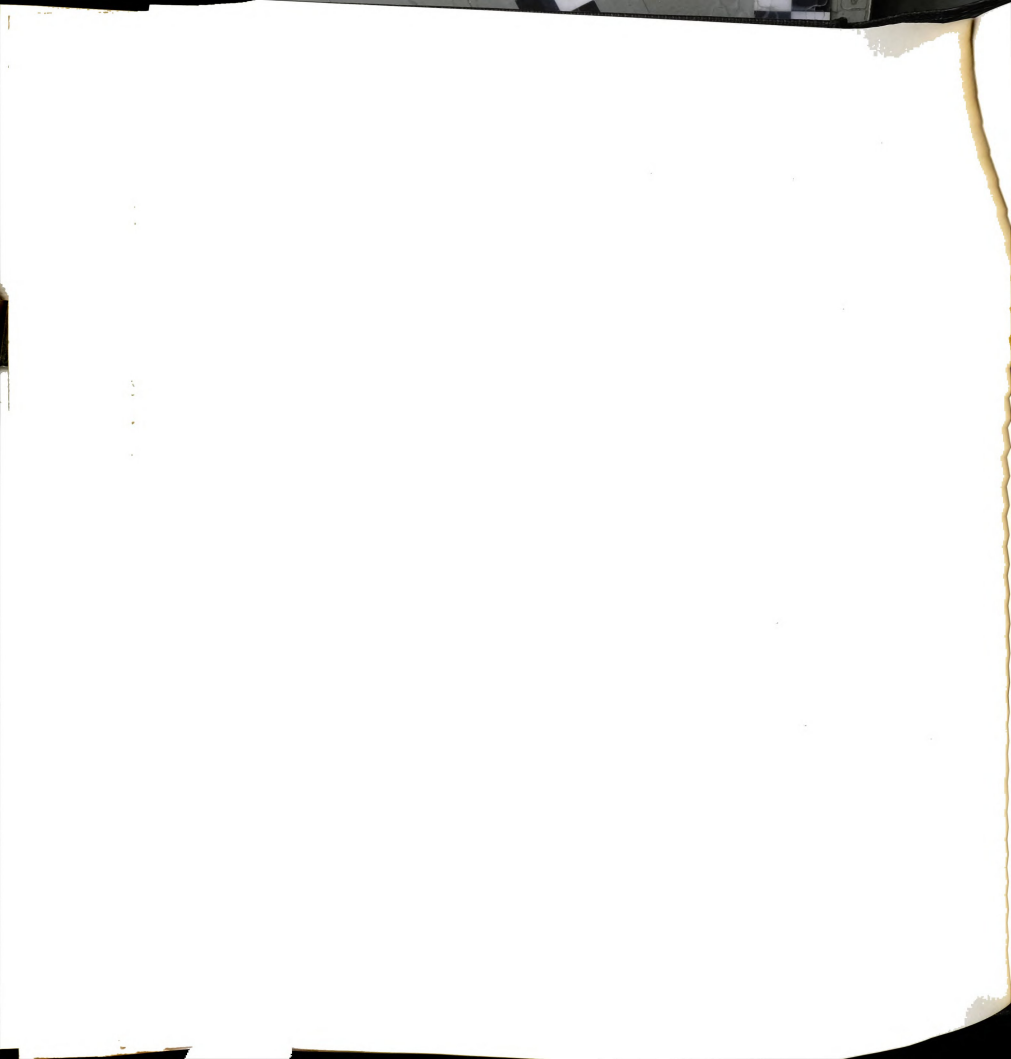
Individual ingenios differ in the amount of sugar extracted from a ton of cane. The extraction rate is

¹²Estación Experimental Agrícola de Tucumán, La mecanización, p. 17.

¹³Canitrot and Sommers, Diagnóstico, P. 92.

¹⁴Personal interview with cane grower Ricardo Leach, San Pedro de Jujuy, March 15, 1970.

¹⁵Canitrot and Sommer, Diagnóstico, P. 94.



dependent upon two major conditions: the quality of the cane received and the efficiency of the milling process.

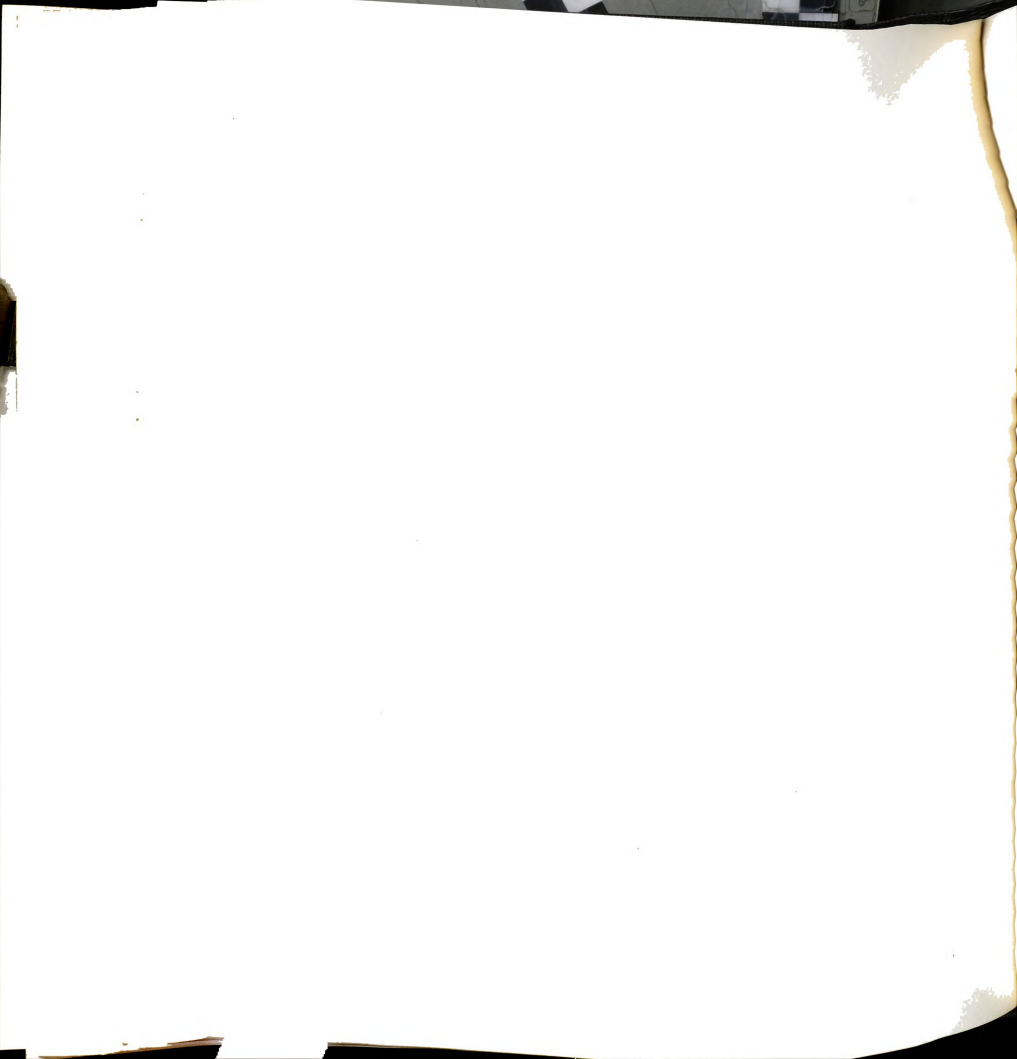
Sugar extraction from the raw material results in a complex series of steps, but the process is essentially the same at all mills. There are, however, some local conditions that affect the process:

1. Efficiency is in part related to modernity. Those mills in which old equipment is replaced with new are likely to extract more sugar from the cane. Constant technical advances, both large and small, are being made and it is advantageous to incorporate these periodically. The ingenios of the Norte, for instance, have uniformly newer trapiches and other equipment than do the mills of Tucumán.

2. While it is tempting to associate increasing extraction rates with increased size or capacity of the factories, according to one study of mills in Tucumán there is no evidence of economies of scale at the ingenio level.¹⁶ Nonetheless, it seems logical that the well-run larger mill would have more financial influence to obtain increased quotas and investment money for improvements.

Factory yields, or sugar obtained per ton of cane, are the only available measures of efficiency for the milling process itself. Aggregate figures of factory yields greatly favor the mills of Salta and Jujuy over those of Tucumán (see Chapter 5). Other measures of productivity can be obtained by considering output per worker. The clear superiority of Salta and Jujuy can be seen, but a slight revival of the Tucumán area occurred

¹⁶Cordomí, A Study of the Production of Sugar,



1968. This was due in part to the government actions
66 (Tables 31 and 32).

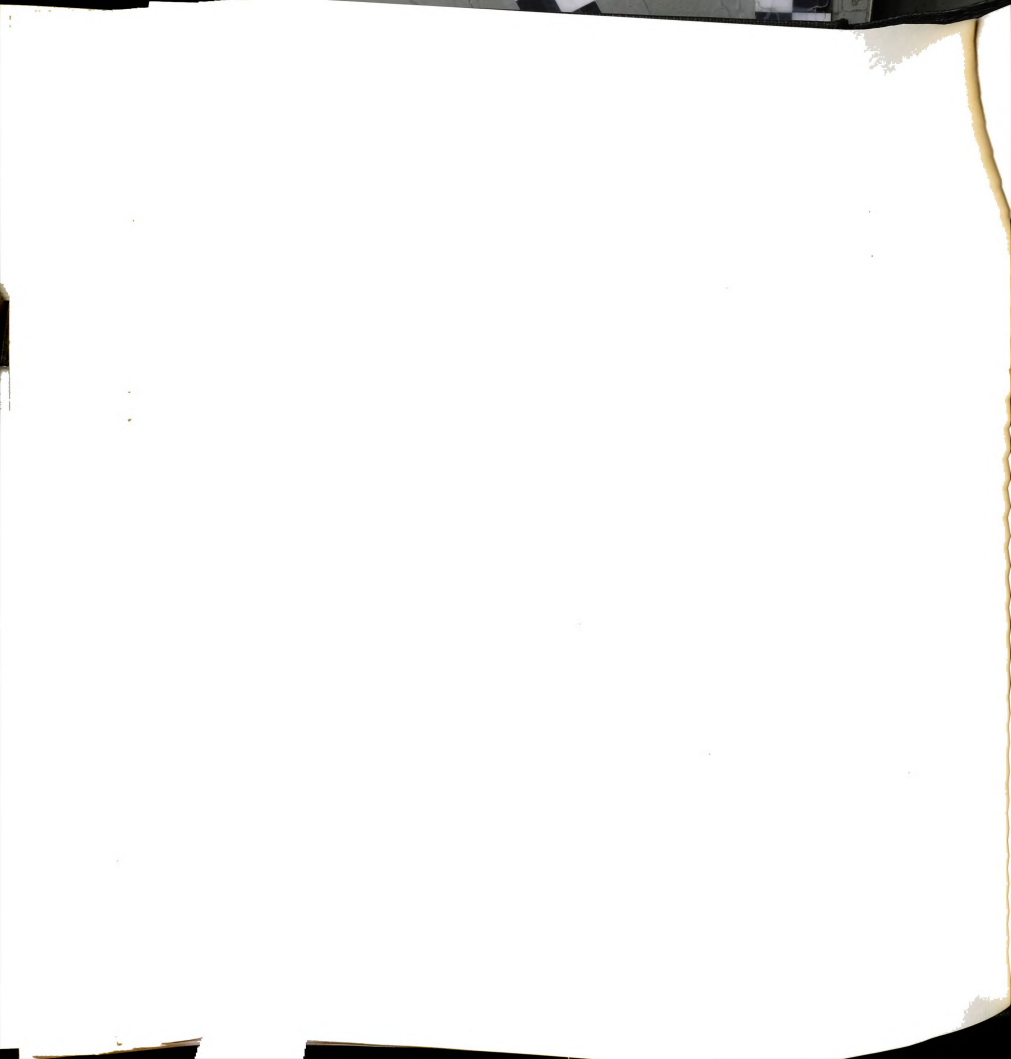
TABLE 31

PRODUCTIVITY AND YIELDS IN SUGAR MILLS OF
TUCUMAN AND SALTA-JUJUY PROVINCES,
1963 AND 1969

	Tucumán		Salta-Jujuy	
	1963	1969	1963	1969
of workers	17,625	10,196	3,610	3,915
Production (tons)	616,409	503,733	321,451	368,773
of Sugar per worker	35.0	49.4	69.7	94.2

Source: Data from La Industria Azucarera

Tables 33 and 34 show the situation in Tucumán, by
mills, in 1963 and 1969. Production and employment are
recorded, and it can be noted that productivity per worker
increased greatly after the closing of ten mills that were
the least efficient. The rationalization of the
industry was also reflected in a drastic reduction of
employment in nearly every mill. The mills with the
best worker productivity ratios, La Corona, Santa
Cruz and La Providencia, offer interesting contrasts
to the remainder. La Corona is notable in the province
for its very modern and efficient factory operations, while



Year	Production of Sugar (tons)		Man Hours		Production of Sugar (Kgs)		Relative Productivity Salta-Jujuy
	Tucumán	Salta-Jujuy	Tucumán	Salta-Jujuy	Tucumán	Salta-Jujuy	
1963	616,409	321,451	27,386,919	9,315,218	22.51	34.51	1.53
1964	541,680	337,884	26,212,361	9,690,904	20.66	34.87	1.69
1965	749,575	404,977	27,528,114	9,412,359	27.23	43.03	1.58
1966	541,104	365,307	22,476,684	7,772,145	24.07	47.00	1.95
1967	378,197	317,560	14,603,641	6,595,488	25.90	48.52	1.87
1966	472,947	377,718	12,643,990	6,751,105	37.05	55.96	1.51
1969	503,733	368,773	13,707,434	6,222,211	36.75	59.27	1.61

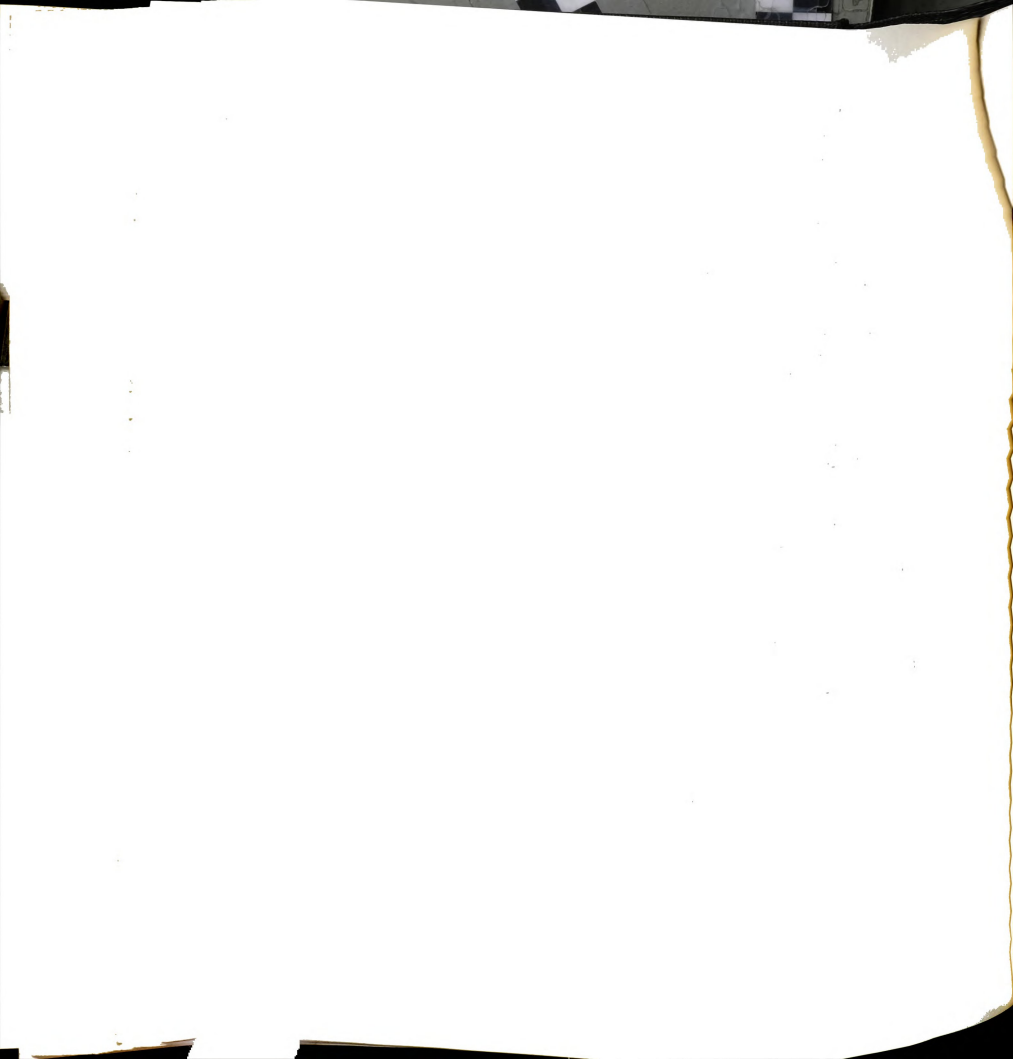
Source: Personal elaboration on the basis of data from Centro Azucarero Argentino.



Ingenio	Production (tons sugar)		Employment (No. workers)		Production		Worker	
	1963	1969	1963	1969	Change %	Change %	Change %	Change %
<u>Open Mills</u>								
Aguilares	17,660	21,681	436	465	+ 22.8	+ 6.7	+ 6.7	
Bella Vista	33,918	29,640	1,015	740	- 12.6	- 27.1	- 27.1	
Concepción	61,901	65,457	1,905	1,637	+ 5.7	- 14.1	- 14.1	
Cruz Alta	20,949	19,193	614	534	- 8.4	- 12.5	- 12.5	
La Corona	32,011	46,617	400	423	+ 45.6	+ 5.8	+ 5.8	
La Fronterita	31,152	40,826	1,803	639	+ 31.1	+ 64.5	+ 64.5	
La Providencia	33,254	38,636	449	396	+ 16.1	- 11.8	- 11.8	
La Florida	16,300	23,809	700	539	+ 46.1	- 23.0	- 23.0	
La Trinidad	26,441	30,677	854	556	+ 16.0	+ 34.9	+ 34.9	
Leales	20,651	22,407	584	598	+ 8.5	+ 2.4	+ 2.4	
Marapa	14,085	16,962	695	434	+ 20.4	+ 37.6	+ 37.6	
Nuñorco	24,471	25,224	606	382	+ 3.1	- 37.0	- 37.0	
San Juan	23,477	22,108	1,079	512	- 5.8	- 52.6	- 52.6	
San Pablo	39,333	46,878	1,235	715	+ 28.3	+ 27.3	+ 27.3	
Santa Bárbara	23,974	30,760	378	275	+ 28.3	- 27.3	- 27.3	
Santa Rosa	24,874	22,857	640	557	- 8.1	- 13.0	- 13.0	

Closed Mills

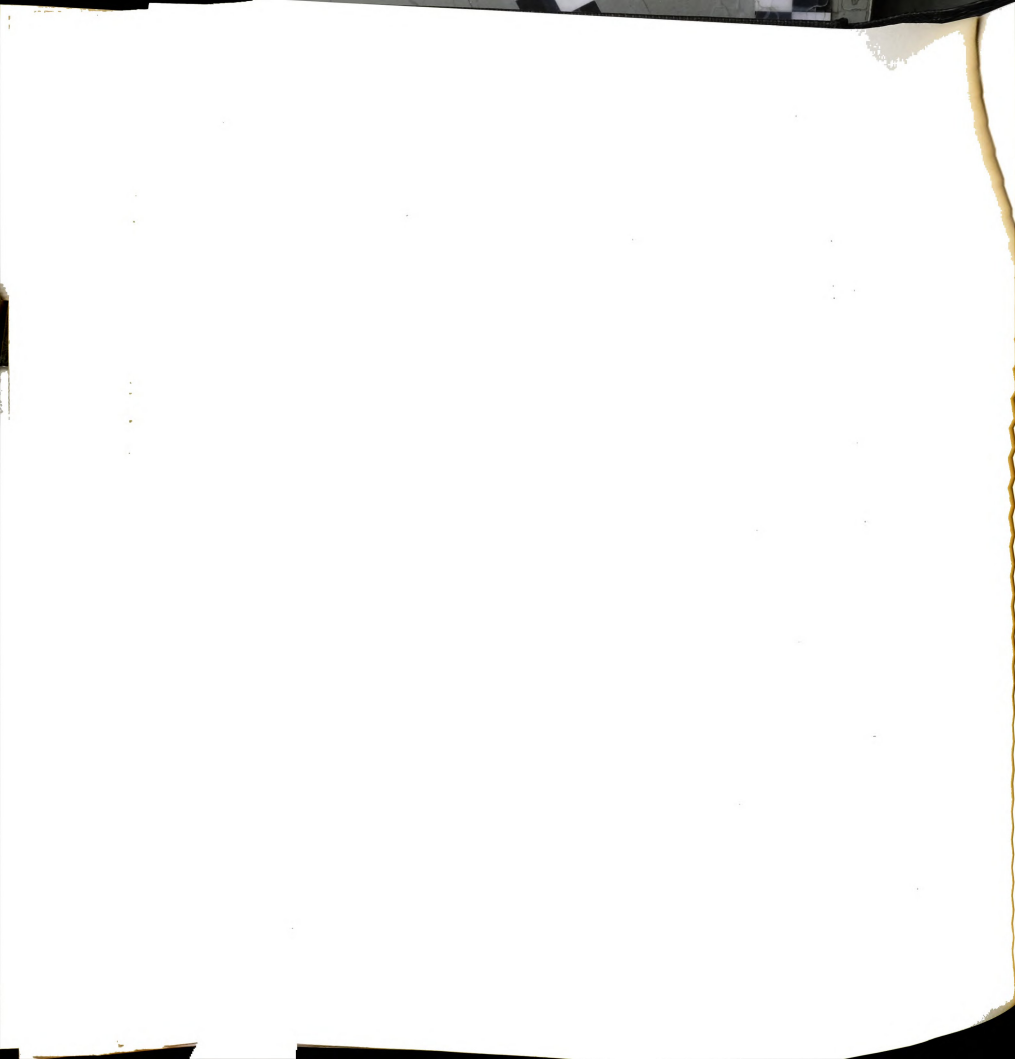
Amalia	21,116	-	616	-
Esperanza	10,162	-	716	-
Lastenia	12,598	-	536	-



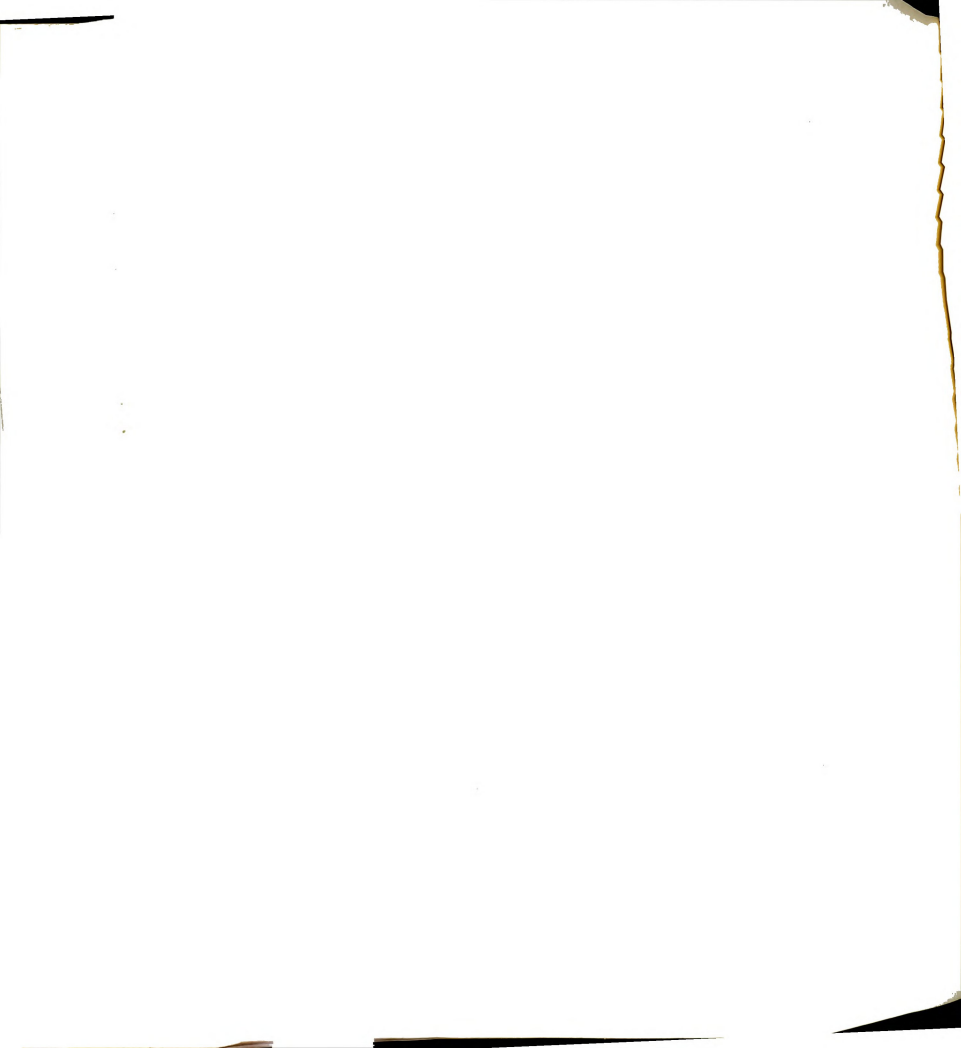
Ingenio	Production (tons sugar)		Employment (No. workers)		Production		Worker	
	1963	1969	1963	1969	Change %	Change %	Change %	Change %
Los Ralos	16,416	-	600	-	-	-	-	-
Mercedes	23,622	-	700	-	-	-	-	-
Nueva Baviera	15,515	-	436	-	-	-	-	-
San Antonio	23,733	-	731	-	-	-	-	-
San José	14,939	-	642	-	-	-	-	-
San Ramón	14,969	-	476	-	-	-	-	-
Santa Lucia	26,662	-	765	-	-	-	-	-
Totals	622,692	503,733	19,611	9,405	- 19.1	- 52.1	- 52.1	- 52.1

Source: Canitrot and Sommer, Diagnóstico ..., p. 115.

*Workers in month of July

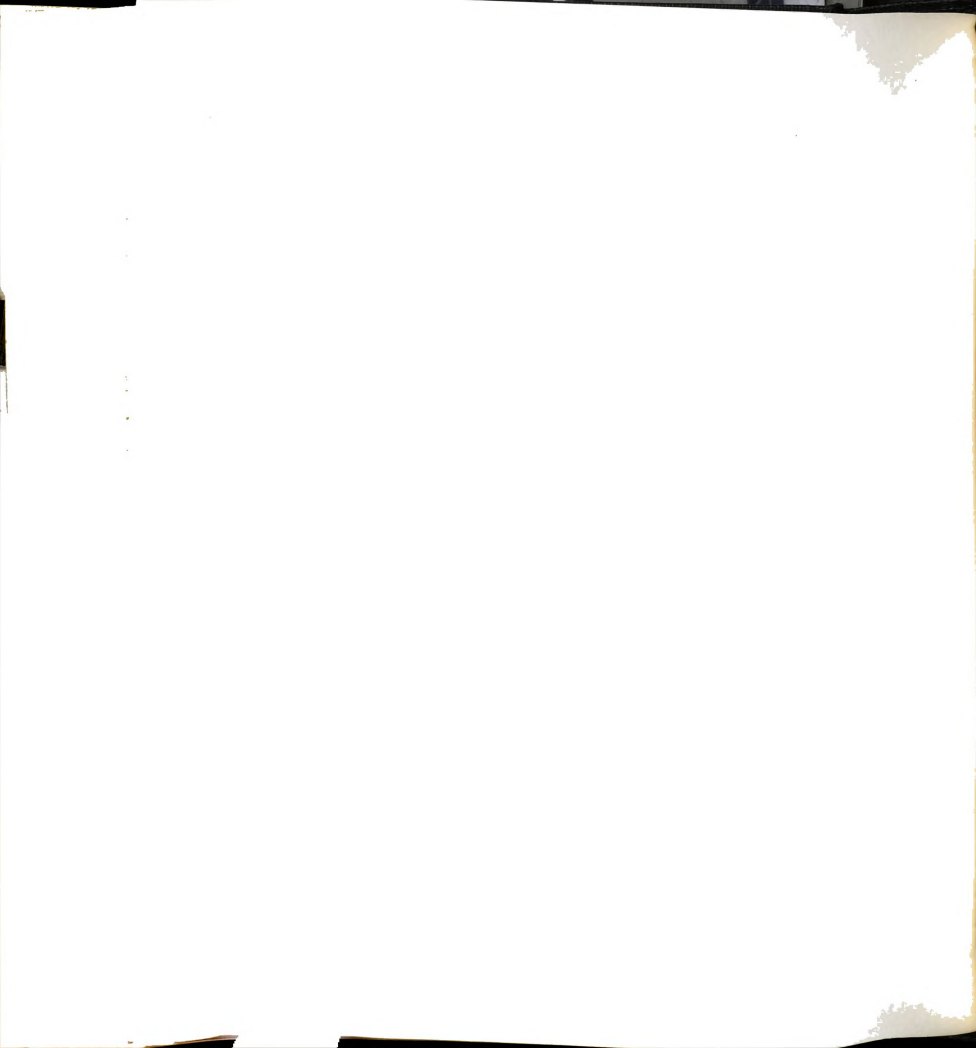


<u>Ingenios</u>	<u>Tons of Sugar</u> <u>per worker</u>		<u>Factory Yields</u> <u>tons of sugar</u> <u>tons of cane</u>	
	1963	1969	1963	1969
<u>Open Mills</u>				
Aguilares	40.5	46.6	9.10	9.60
Bella Vista	34.2	40.1	8.44	9.16
Concepción	32.4	40.0	8.16	9.57
Cruz Alta	34.1	35.7	9.82	10.20
La Corona	80.1	110.2	8.42	9.63
La Fronterita	17.3	63.9	8.82	10.27
La Providencia	74.1	97.6	9.19	10.14
La Florida	23.3	44.2	8.33	9.02
La Trinidad	31.0	55.2	8.57	9.13
Leales	35.3	37.5	7.67	9.00
Marapa	20.3	39.1	7.55	9.53
Nuñorco	40.3	66.0	9.39	9.88
San Juan	21.8	43.2	9.00	9.00
San Pablo	31.8	65.6	8.26	9.63
Santa Bárbara	63.4	111.9	9.40	9.88
Santa Rosa	38.9	41.0	8.98	9.19
<u>Closed Mills</u>				
Amalia	34.4	-	7.99	-
Esperanza	14.2	-	7.61	-
Lastenia	23.5	-	8.22	-



<u>Ingenios</u>	<u>Tons of Sugar per worker</u>		<u>Factory Yields tons of sugar tons of cane</u>	
	1963	1969	1963	1969
Los Ralos	27.4	-	7.32	-
Mercedes	33.7	-	8.93	-
Nueva Baviera	33.3	-	8.51	-
San Antonio	32.4	-	8.11	-
San José	23.3	-	8.17	-
San Ramón	31.4	-	8.78	-
Santa Lucia	34.9	-	8.49	-
Totals	31.8	53.6	8.51	9.58

Source: Canitrot and Sommer, Diagnóstico, p. 116.



a Bárbara is a smaller mill that quietly does its job pays everything on time.¹⁷ La Providencia also has of the more modern factory operations and a well coordinated field-to-factory transition. All have the reputation of good administration.

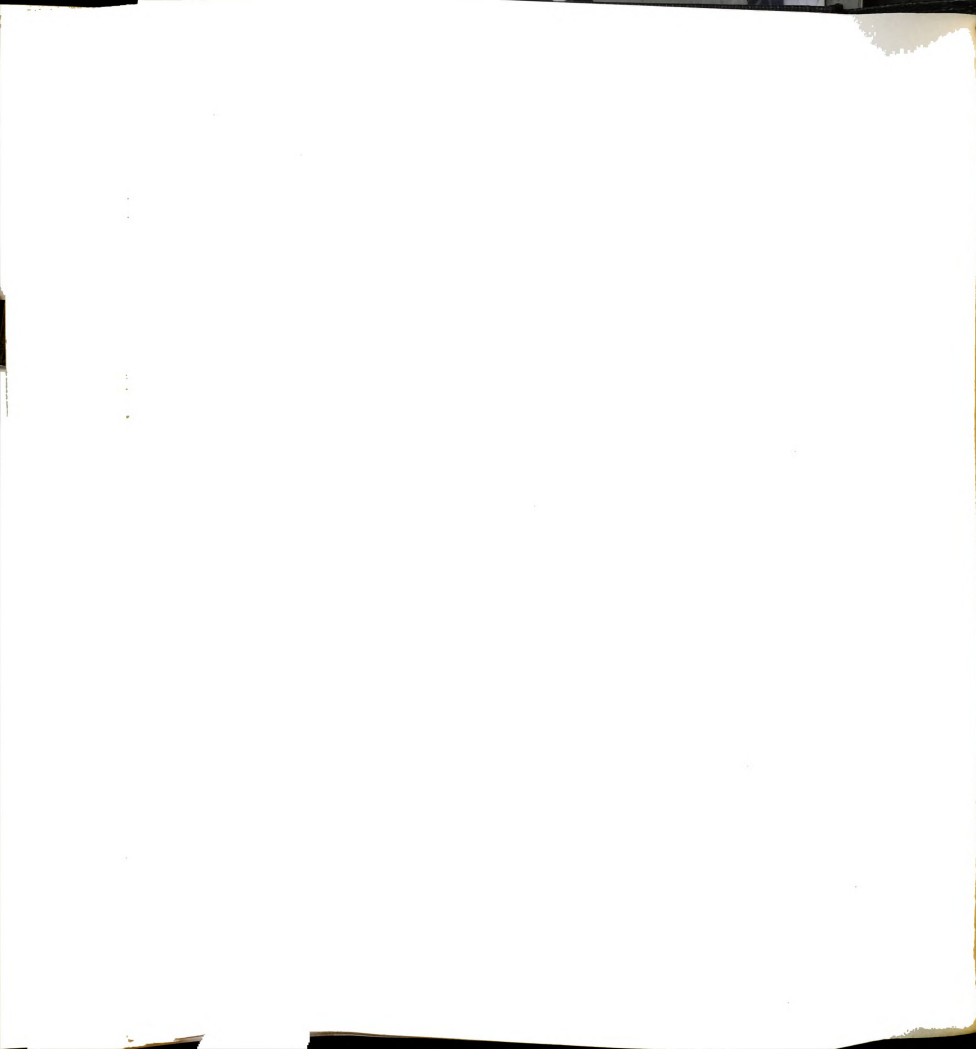
One additional measure of efficiency frequently mentioned in interviews was the length of the operating season. Management uniformly expressed the desire to mill at capacity on a daily basis. Given the production quotas for each mill, this translates into the need to condense the zafra into a minimum number of days. Being able to control their harvest period a bit more, due to ownership of most of the cane milled, the mills of Salta and Jujuy normally have much shorter seasons.

Administrative Factors

Since the sugar mill is a business enterprise of a certain size, administrative policies and actions are of great importance. In fact, administration has often been the critical element in making or breaking an enterprise.

The administrative structure varies considerably from mill to mill. The hierarchy can be quite complicated,

¹⁷Personal interview with Prof. Estela B. de Montemarina, Professor of Geography, Tucumán, April 2, 1970.

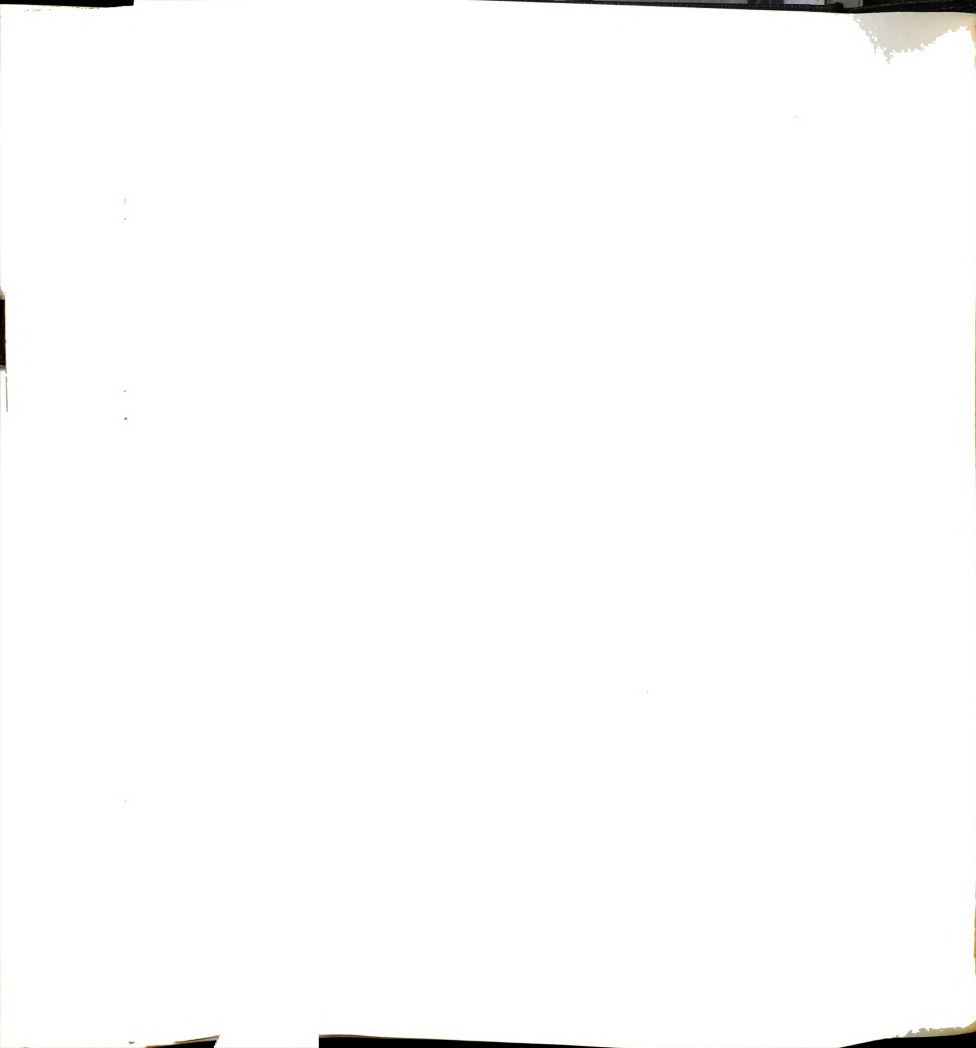


icularly in the large mills. In addition to the central administrator, there are heads of each division at a fine breakdown below that level. Coordinating all projects is a very challenging task.

Most of the sugar mills were founded as single family operations. This family structure still characterizes many of the mills in Tucumán and several in Salta and Jujuy. Numerous families have remained in control of the mills since the beginnings of the industry. Notable among these are representatives from each producing region: the Cornejo family of San Isidro, the Nogués clan of San Juan, and Prat Guy of San Martín de Tabacal. Their operations have considerable tradition and are well established in the sugar industry. In contrast, the larger mills of the Norte are under corporate ownership and frequently do not divulge the names of the major stockholders. This has opened up a more dispassionate profit motive, with management extremely aware of efficiency. This process is not unknown to other areas of the world!

The mills of Tucumán in particular have frequently been criticized for poor administration.¹⁸ Evidence is indicated by the desperate financial situation of numerous mills prior to 1966. This was obviously not a condition that occurred suddenly but developed over time. It is hypothesized by many that it was a lack of reinvestment.

¹⁸La Gaceta, 1969-1970.



aps seeing the handwriting on the wall, the owners not about to place money into a dying operation.

A new administrative entry to the sugar industry Tucumán appeared in 1970. The government agency, SA, is now responsible for five mills in the province. It will be interesting to see if the government does as much in the sugar industry as it has with the railroads!

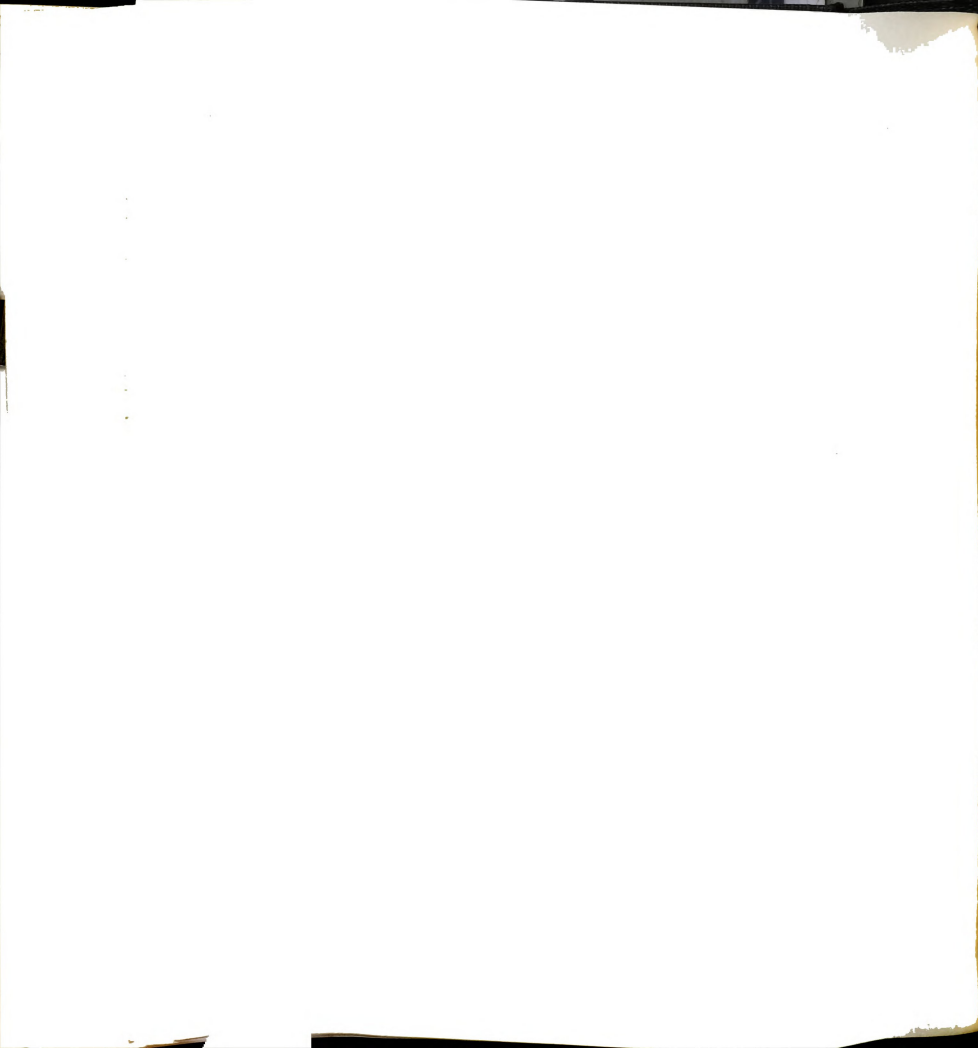
Foreign Influence

Initially the total investment capital in the sugar industry of the Northwest was derived from within the region and the nation. The only thing foreign was equipment, which was shipped principally from France and England.

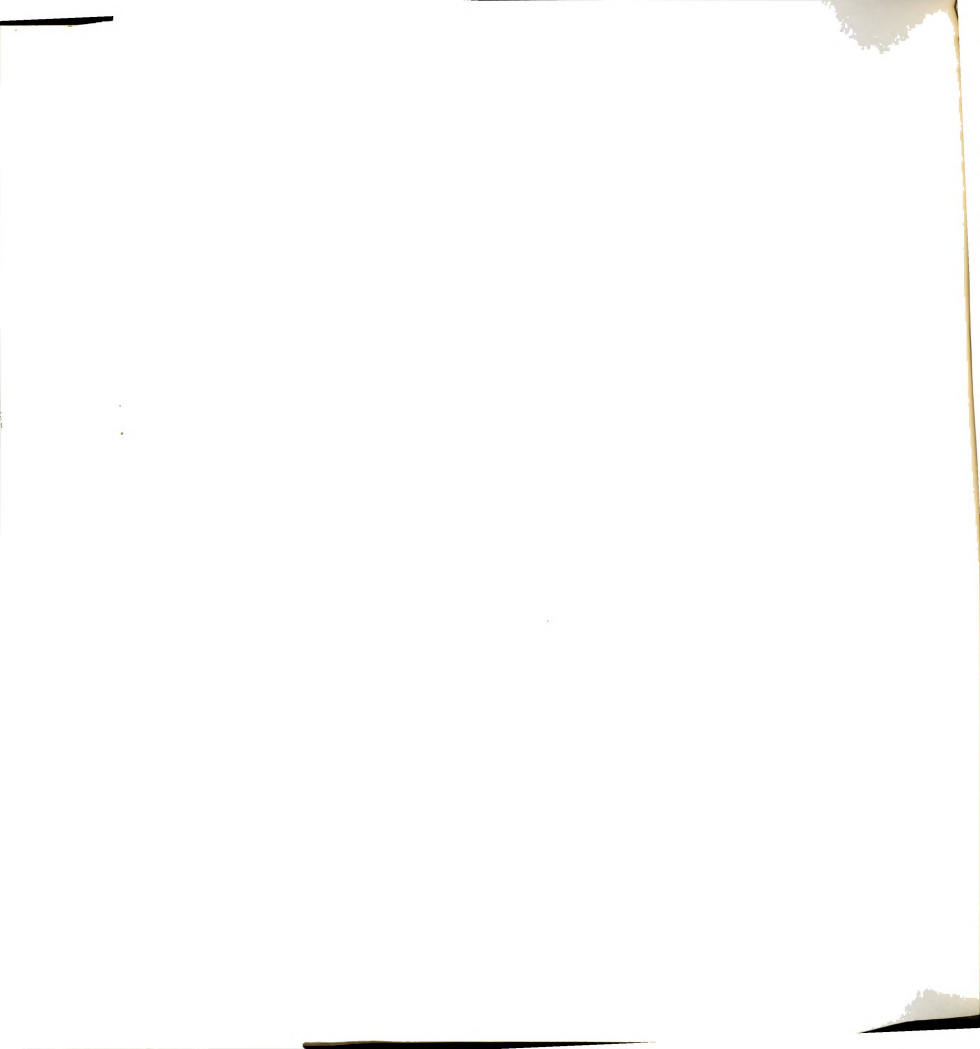
It is difficult to document foreign investment, but a general consensus indicates that it is influential in the sugar industry today. In 1970, there was a not-so-secretive British attempt to buy a number of mills.¹⁹ This seems to have come to naught, but the "smoke" indicated the possibility of further action.

Many of the technically trained people in the sugar industry have studied in other countries, e.g., the United States, Cuba and Europe. Thus, some cross-fertilization of ideas and methods has occurred.

¹⁹Personal interview with Prof. Estela de Antamarina, Professor Geography, Tucumán, July 20, 1970.



There is definitely an indirect foreign influence
production from the marketing viewpoint. A growing
dependence on the United States market as an outlet for
large amounts of sugar is one characteristic.



CHAPTER VIII

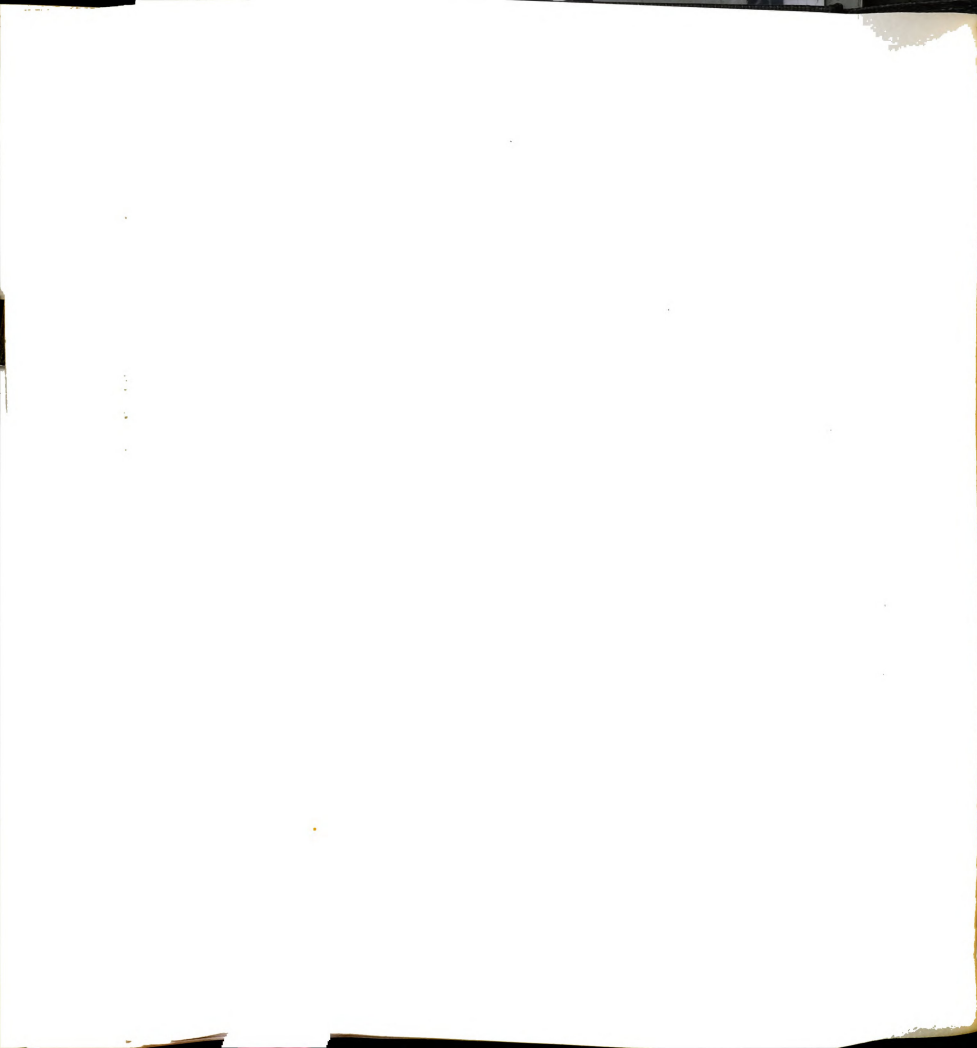
GOVERNMENTAL FACTORS INFLUENCING CHANGE

As an activity deemed essential to national interests, the sugar industry has been closely regulated by the Argentine government. Major goals are to assure self-sufficiency and to maintain the industry as a healthy and well balanced element of the economy. A long and continuous series of laws and decrees has been promulgated to attain such ends, and these have played a dominant role in structuring the industry.

Historical Perspective

The main areas of government intervention in the sugar industry have included (1) tariff protection, (2) control over the domestic price of sugar, (3) regulation of prices for raw sugar cane, and (4) controls over production and sales.¹ Readjustments in policy have occurred frequently as conditions within the sugar zones and the world market changed.

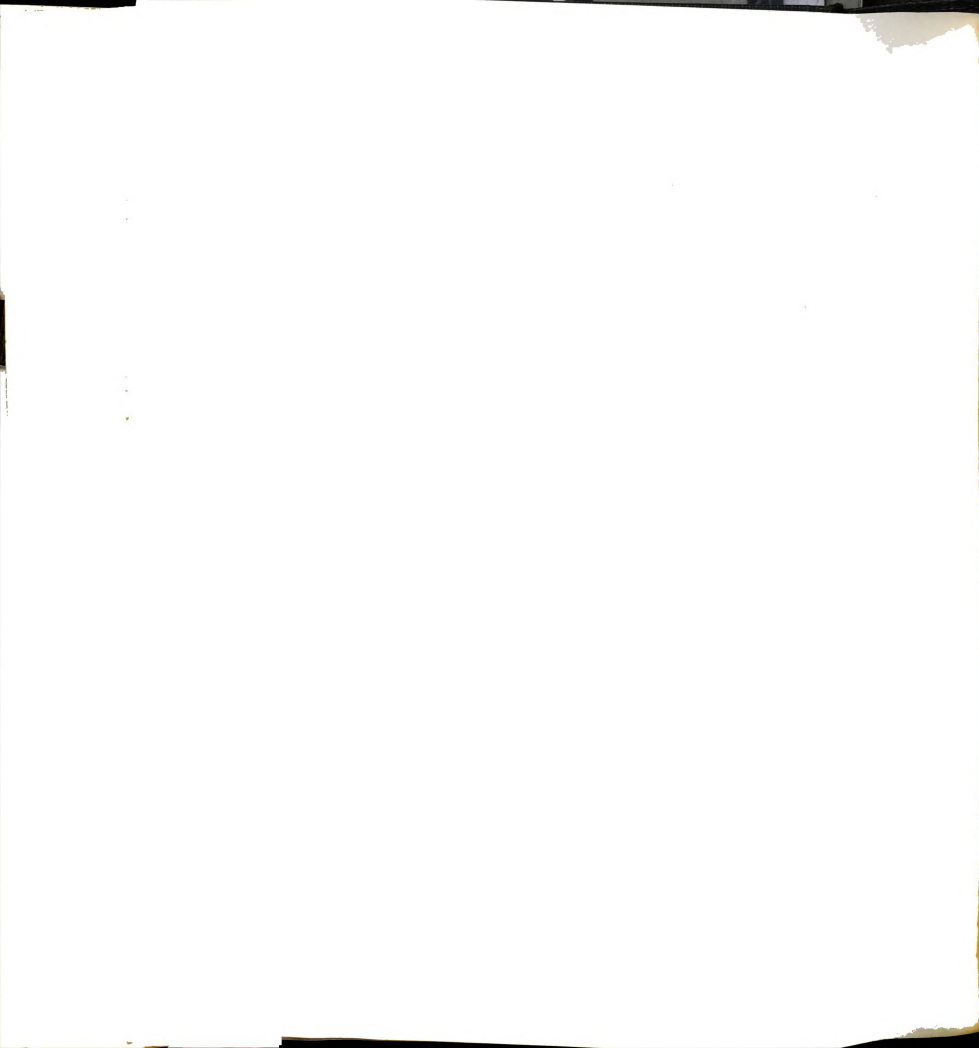
¹Manuel L. Cordomí, A Study of the Production of Sugar in Tucumán, Argentina. Ph.D. dissertation, University of Chicago, 1969, p. 3, and Roberto F. Ullivarri and Guillermo K. Voss, La producción azucarera Argentina: necesidad de su regulación, (INTA: Tucumán, 1966), p. 13.



In the early stages of industrial development, the late 1800's, the government placed tariff barriers on imported sugar so that the infant domestic industry could progress without "unfair competition." By the 1890's, the country was not only self-sufficient but was exporting its surplus. Argentina was, however, a high cost producer and its excess sugar was frequently difficult to sell on the world market. Due to this fact, and continued years of exceeding domestic demands in the first decade of the twentieth century, restrictions were placed on the industry. The first sugar law of Tucumán province, the "Ley del Machete," so limited production that much cane was destroyed in the fields.

Two major laws dictated sugar policy through the first half of the 1900's, the Ley Saavedra Lamas and the Laudo Alvear. The Saavedra Lamas Law of 1912 maintained a system of tariffs on imports and set a maximum price on sugar for domestic consumer protection. If prices exceeded this maximum per kilogram cost, the tariffs could be lowered to allow entry of low-cost imported sugar. This policy was effective until a prolonged period of overproduction occurred in the 1920's. Low market prices and resulting problems of payment to cane producers led to confrontation between growers and industrialists. This forced a new structure.

The new system, called the Laudo Alvear for the president who negotiated the agreement, was one of the

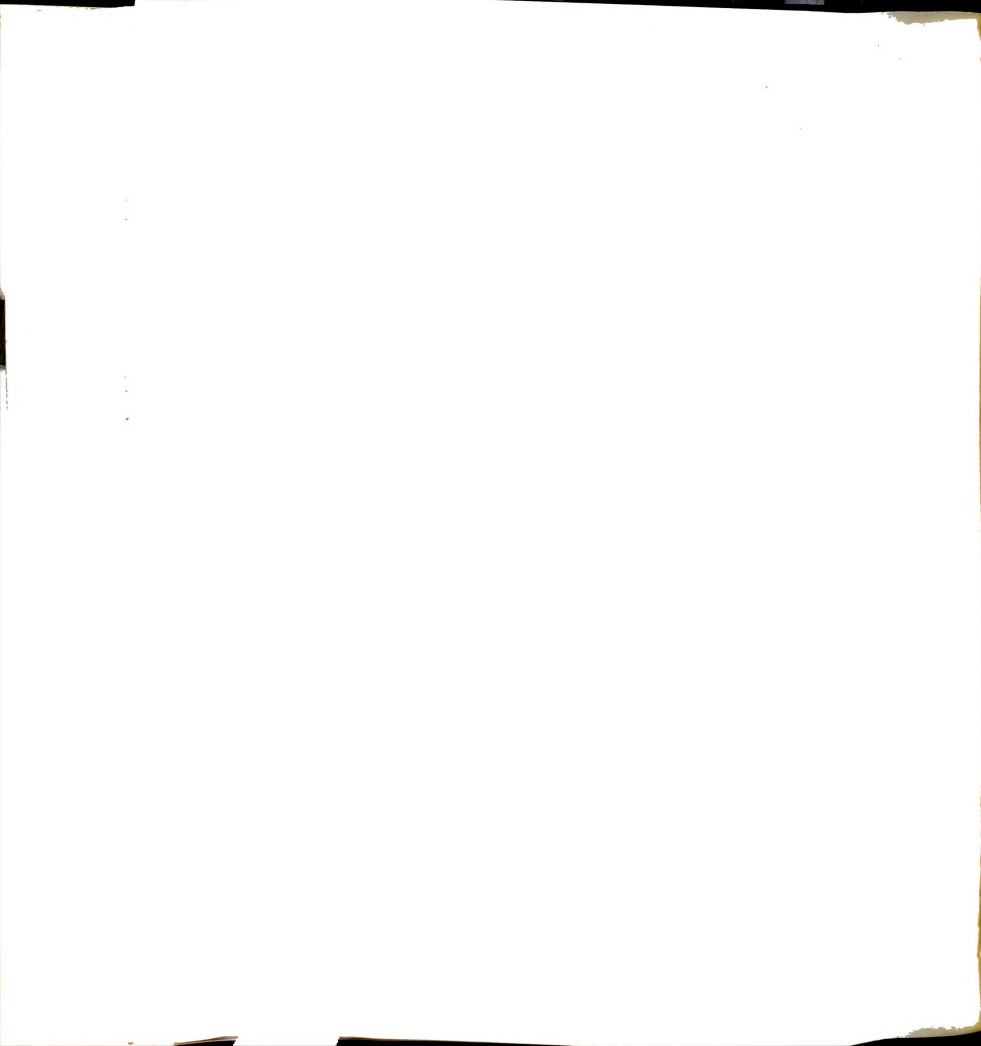


most important to be implemented in Argentina, since it provided the basic framework for the industry from 1927 to 1944. It set the price of cane and created a share system which divided the sale price of sugar equally between farmers and industrialists. It also established a quota system for each mill, based at first on 70 percent of the 1926 production. Analogous restrictive measures were applied to the agricultural sector.²

A different pattern of price regulation appeared in 1945, generated in part by a period of rapid inflation. Cane prices, based on weight of the raw material, favored the further establishment of inefficient cane farmers, but processed sugar prices remained low. Subsidies were needed to induce the producers to meet consumer demand at the artificially low price, which was still the ceiling price set in 1912! By 1949 the government subsidies had become too heavy a burden and the policy was changed. From 1950 to 1958 a Regulatory Fund operated with sporadic effectiveness and enforcement. This allowed sugar prices to rise to a new maximum which was calculated somewhat mysteriously using the average production costs of all existing mills, a difficult calculation at best.³ Each mill was allowed to retain from its sales an amount equal

²Ullivarri and Voss, La producción, p. 14.

³Cordomí, A Study of the Production of Sugar, p. 6.



to its average costs, while receipts over this amount were to be submitted to the Regulatory Fund to cover the losses of deficit mills. Many ingenios, particularly those in Norte, refused to make payments to the Fund and the government, unable to enforce the measure, had to pay for them. After 1955, with the departure of Perón, this system was maintained but not enforced and a short period of ambivalence followed. From then until the mid-1960's no special government program was evident, except for a basic price ceiling.

Current Government Regulations

In response to a great accumulation of sugar in 1965, a government program designed to restrict production was again instigated. At that time the country had a stored surplus equal to nearly eight months' consumption.⁴ A resolution of April, 1966, limited the output of sugar by placing production quotas on each mill.⁵ Restrictions were based on the amount necessary to meet total national consumption, plus a small safety margin, and this meant limiting production to a certain percentage of the 1965 harvest. Different criteria were applied to each sugar

⁴Jorge A. Dominguez and Agustín Hervas, Cooperativas agropecuarias de trabajo: Una alternativa de solución para el problema Tucumano (INTA: Tucumán, 1970), p. 61.

⁵Decreto 3407/66, published in La Industria Azucarera, April 1966, p. 101.



area. Thus, total production in Tucumán was reduced by 30 percent, while tonnages in Salta-Jujuy were cut "only" 17 percent.⁶

To attain reductions in processed sugar, restrictions obviously had to be placed on the individual grower, and several schemes for planter quotas were proposed. The first based production cuts on a sliding scale and allowed the smaller, more vulnerable producers to grow the highest percentage of their 1965 harvest. Finally, however, a flat 70 percent was applied to all growers in Tucumán and each farmer was to receive certification of the amount contracted. The farmer was also freed from supplying the nearest mill and could search out the highest price or most secure deal.

Following shortly after the new regulations, the government took the much discussed step of direct intervention in seven Tucumán mills in August, 1966. Four of these mills eventually were closed, either by law or through bankruptcy proceedings. The others reopened, but by 1969 a total of eleven ingenios in Tucumán were permanently out of business as a direct or indirect result of government action.

⁶Decreto 215/66, published in La Industria Zucarrera, June 1966, p. 176.



In early 1967 an "emergency law" regulating the industry over the next five years was enacted.⁷ Its primary goal was to facilitate the efficient functioning of the sugar industry. The country was divided administratively into three sugar zones designated as "A" (Tucumán), "B" (Salta and Jujuy), and "C" (Santa Fé, Chaco and Misiones). This law prohibited the installation of new sugar factories, or even an increase in capacity of the existing mills, and also established a production quota amounting to a 10 percent reduction from the 1966 harvest.⁸

The law established a total production of 750,000 tons and then provided for regional quotas. Zone "A" was assigned 400,000 tons of sugar, Zone "B" 304,000 tons, and Zone "C" 46,000 tons. The heaviest penalty was obviously borne by Tucumán, which had produced nearly 750,000 tons of sugar in 1965 and was reduced to 520,400 tons in 1966. This further reduction of more than 120,000 tons was a severe blow to an already shaky economy.

Combined planter quotas had to match the fixed regional total. Where the sum of the 1966 provisional

⁷Ley 17163/67 published in La Industria Azucarera, January, 1968, pp. 11-17.

⁸In 1974 a combined delegation of Salta and Mexican businessmen proposed a new mill to be located in the department of Orán, Salta. "Convenio para instalar un nuevo ingenio en Orán," La Gaceta, July 17, 1974.



ne allotments surpassed the regional quota, individual
 rm allocations were eliminated. The government asked
 r voluntary surrender of whole or partial quotas in
 turn for a "fair" price paid by the government. This
 licy hit hardest in Tucumán where the voluntary sale
 ll far short of that designated. The decision was then
 de to eliminate the smallest, and least efficient,
 ows and to proceed upward until the necessary reduction
 s reached. In this manner, quotas up to 8,000 kilograms
 re cancelled, i.e. those of farmers cultivating less
 an about 2.5 hectares of cane. Table 35 shows the
 urses of reduction. The two most notable changes were
 e closure of several functioning mills, including
 ssation of their crop production, and elimination of the
 allest cane farmers.

Even after such revisions, problems remained
 thin the industry. By 1970, many mills in Tucumán were
 ill in financial difficulty, and government expropriation
 f five mills was offered as a "solution." The idea was
 take bankrupt mills and operate them adequately while
 reserving major sources of employment for the province.⁹
 me minor modifications of the 1967 policy occurred in
 e early 1970's, and changing world and national condi-
 ons lead to the need for new policies.

⁹La Gaceta, May 20, 1970.



TABLE 35

REDUCTION IN SUGAR QUOTAS IN TUCUMAN PROVINCE,
1967

Event	Quotas (kilos)	Est. Area (Has.)*
Closing of several mills (laws 17,134 and 17,222)	27,997,000	10,000
Cancellation of <u>ingenio</u> land repay debts	17,059,486	5,686
Voluntary sales by dependents and mills	10,818,513	3,394
<u>Enfiteneas</u> cancelled	32,154,513	10,718
Totals	88,029,512 kilograms	29,798 hectares

Source: Jorge A. Dominguez and Agustín Hervas,
Cooperativos agropecuarias de trabajo:
Una alternativa de solución para el
problema Tucumano (INTA: Tucumán, 1970),
 p. 84.

*Using average figure of 3,000 kg. per hectare.

By 1972 a considerable reduction in the supply of
 sugar had been achieved within the country. The restric-
 tive policies had depleted the reserves of the nation,
 and world sugar prices were the highest they had been
 since 1963.¹⁰ This meant that much of the capacity of
 the industry was idle when it could have been making

¹⁰La Industria Azucarera, Vol. 79, No. 932,
 p. 18-19.



money for the nation and the provinces. Cautioned by previous boom cycles, however, the government formulated the 1972 Sugar Law to only moderately increase production. This measure took into account four main factors in determining production levels: (1) the level of domestic consumption, (2) a domestic reserve of 15 percent of the above figure, (3) contracted and expected exports, and (4) any stock remaining from the previous crop year.¹¹

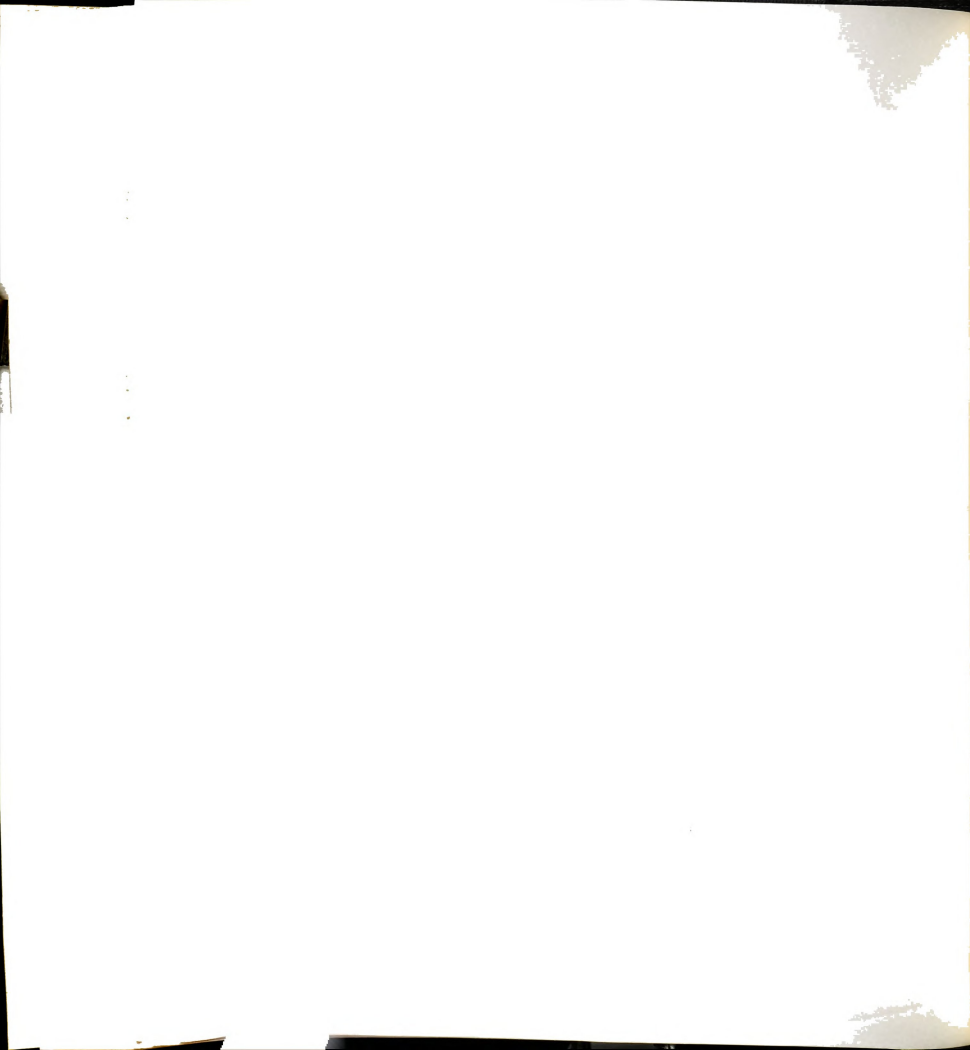
Current Government Programs

The government has wavered in its overall development plans for the Northwest, one time listing Salta as the growth pole for the region and then acceding to the cries from Tucumán. There is, however, no doubt of the need for new development investments in Tucumán following the events of 1966.¹²

After the intervention of 1966 and the forced closing of ten mills in Tucumán by the 1969 harvest season, it was realized that very serious consequences for the economic well-being of the province would follow. The negative effects of government actions were manifested in numerous ways in Tucumán, the more critical including

¹¹Ley 19,597/72 published in La Industria Azucarera, Vol. 78, No. 927, pp. 49-61.

¹²La Gaceta, May 6, 1971, reported that Tucumán was included as a growth pole in the National Development Plan of 1970-71.



(1) the aforementioned mill closing, actually eleven in number since 1966 as one mill filed bankruptcy just prior to the 1966 harvest; (2) a reduction in cultivated cane area of 60-80,000 hectares; (3) the emigration of an estimated 40,000 workers; and (4) the elimination of at least 7,000 small cane growers.¹³

To help alleviate the severe problems of Tucumán the government launched a three-pronged attack. The immediate goals were to reduce dependency on the sugar industry by (1) emphasizing a program of agricultural diversification; (2) creating temporary jobs in the public sector for the unemployed workers of the cane industry, whose numbers would be reduced as other sectors could absorb them; and (3) offering financial and tax incentives to attract new industries to the province.¹⁴

The Comité Operativo Tucumán was created to formulate programs of agricultural diversification and to coordinate new industrial development. Active dissemination of propaganda about the proposed agro-industrial transformation of the province was also part of the charge.

¹³Sources disagree on the total impact, and the stated figures are conservative.

¹⁴Adolfo Canitrot and Juan Sommer, Diagnóstico de la situación económica de la provincia de Tucumán (Buenos Aires: Instituto Torcuato Di Tella, 1972), p. 127.



Industrial Transformation

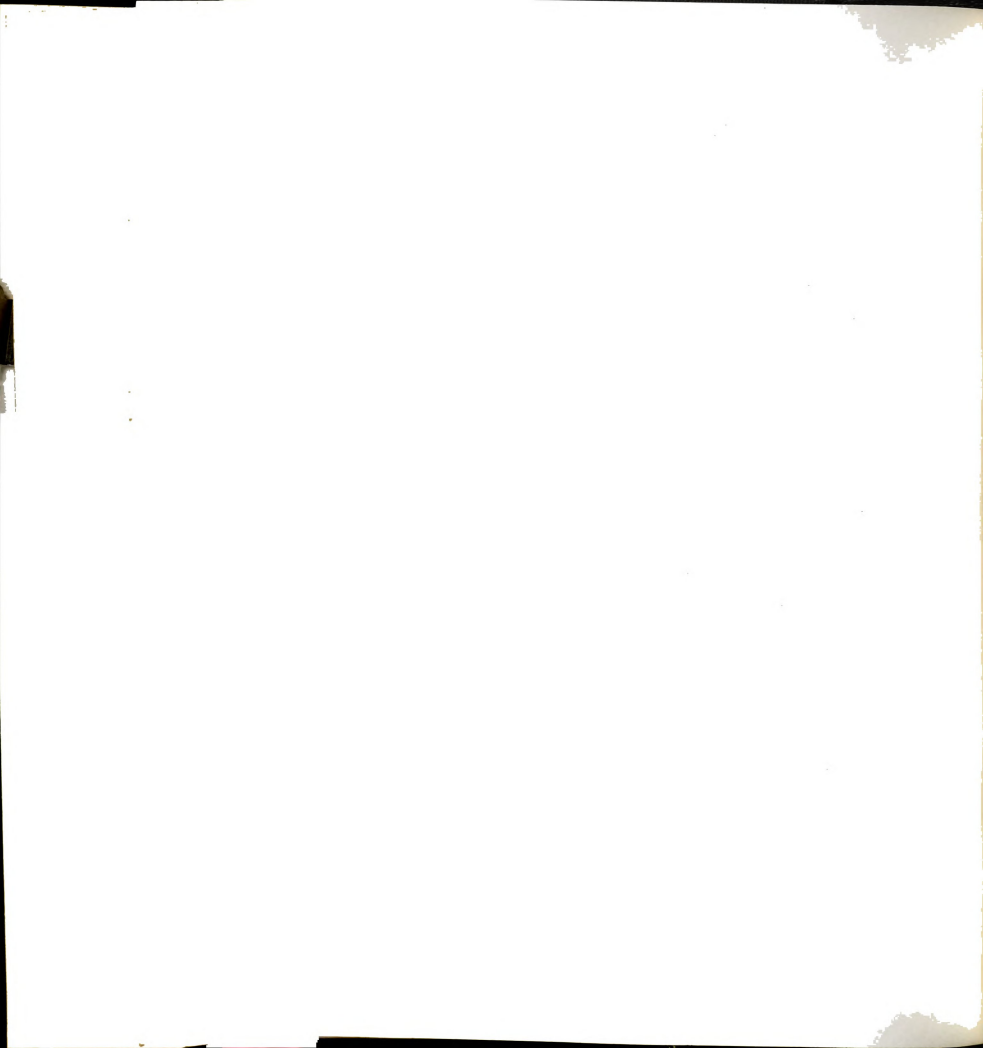
The primary factor in the re-invigoration of Tucumán was to be a new, more diversified industrial structure. This sector was slated to absorb a large percentage of the people unemployed by the closing of the sugar mills. A stated objective of the program was to regain the economic product of 1965 by the year 1972.¹⁵

The Comité Operativo Tucumán received and evaluated inquiries of firms wishing to locate in the province and submitted recommendations to the national and provincial governments. Incentives offered both for new firms and for expansion of established industries included credit, tax concessions, aid in finding industrial sites and some assistance in developing markets.

The industrialization program started slowly, and only fifteen small factories had entered the province by 1968. As incentives were increased more letters were received by the committee and a greater number of firms formalized location plans. By the end of 1970, under the auspices of "Operativo Tucumán," more than ninety firms had either begun construction or had permission to do so.¹⁶

¹⁵La Gaceta, April 12, 1971.

¹⁶Information from the office of the Comité Operativo Tucumán, June 1970.



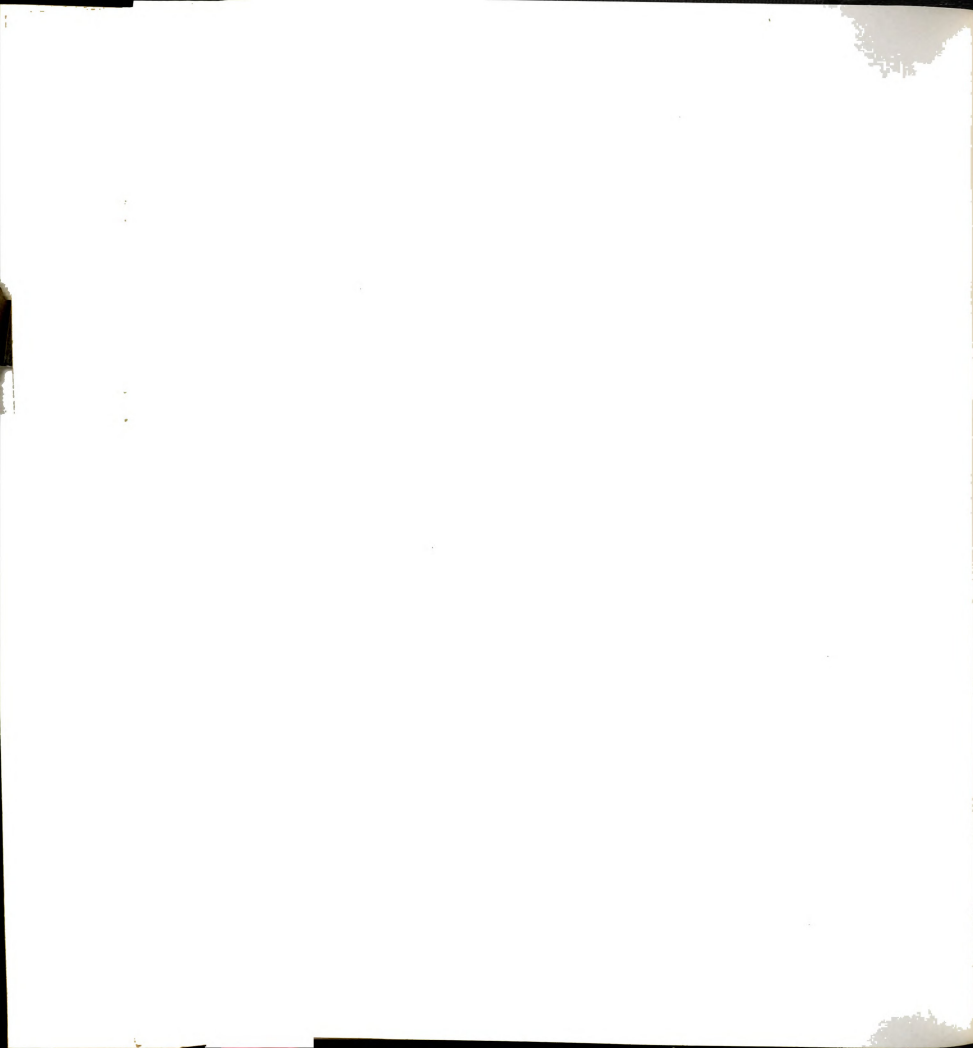
A specific goal of the industrial transformation was to attract new factories so as to strengthen the economy of areas where sugar mills had been closed. These areas are shown in Map 19, where they are compared with actual or planned factory locations through 1970. A system of secondary growth poles within the province was suggested to reflect the industrialization goal, but little official recognition was given to this plan.¹⁷ Although some dispersal throughout the province has occurred, most of the new firms have located near the capital city.

Numerous criticisms were leveled at the program. The major arguments were that (1) the businesses attracted were mostly very small, (2) most could be expected to have slow actual and potential rates of growth, and (3) there was a paucity of industries with any substantial national market.¹⁸

Of particular importance relative to the problems of Tucumán is the number of jobs provided by each industry, since at least 25,000 unemployed sugar industry workers remained in the province after the mill closings. If all industries scheduled to locate by 1970 were to

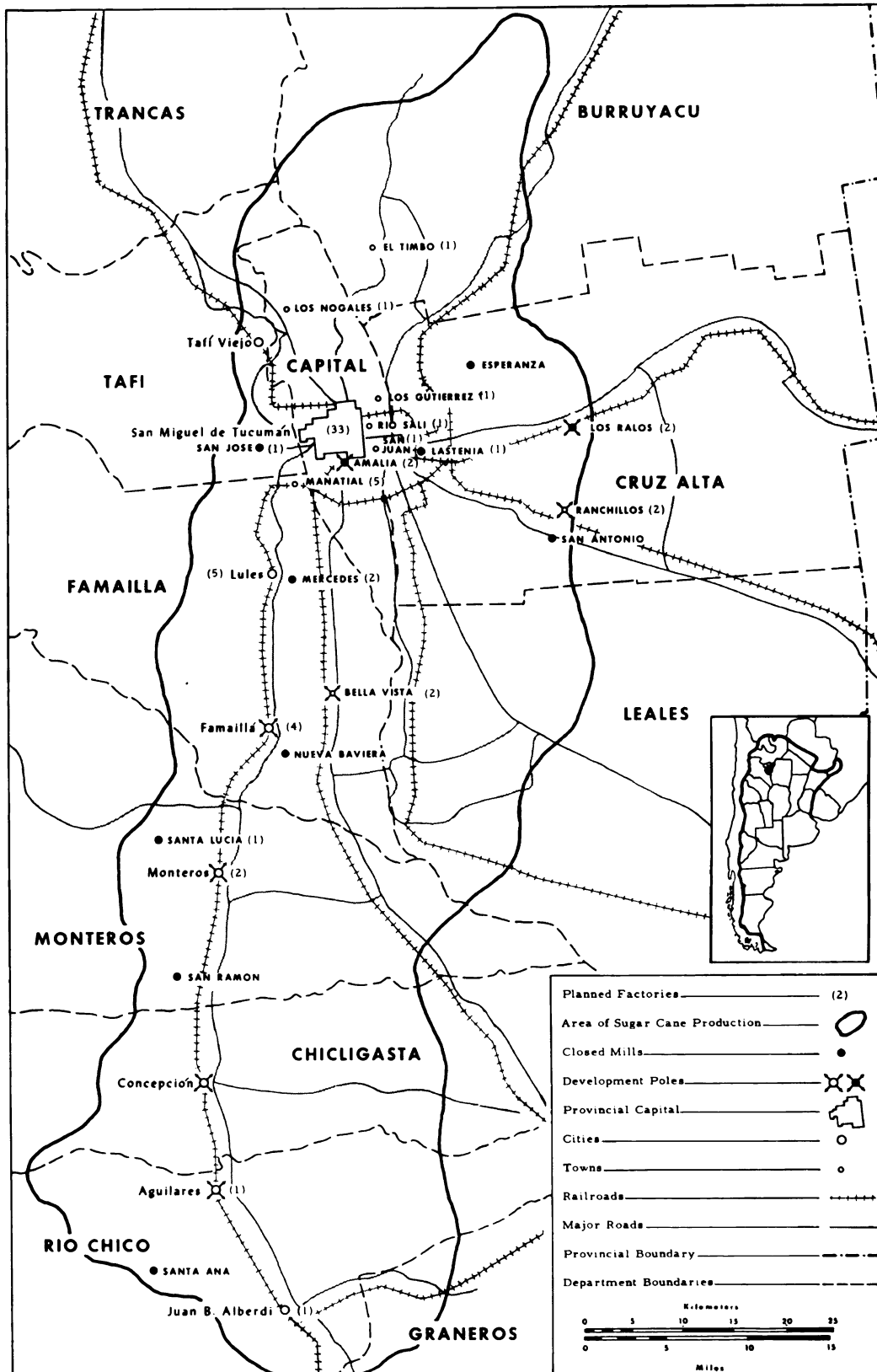
¹⁷Noticias, November 20, 1969. The eight chosen sites were Ranchillos, Los Ralos, Amalia, Bella Vista, Famaillá, Monteros, Concepción, and Aguilares.

¹⁸Canitrot and Sommer, Diagnóstico, p. 128.



MAP 19

PLANNED FACTORY LOCATIONS IN TUCUMAN PROVINCE: 1970



SOURCE: Compiled by author



employ their stated numbers, slightly more than 9,000 people would be involved.¹⁹ By September, 1970, thirty-one businesses were operating with nearly 3,300 employees, thirteen were under construction with a planned labor force of 2,200 and the eighteen establishments authorized planned to employ slightly more than 3,000 persons.²⁰

The new industries exhibit great variation in levels of employment, from ten workers in a plant for dehydrating vegetables to nearly 1,700 in a shoe factory. The average size of work force in the firms for which information was available, however, was about 110. By eliminating the largest individual company, the average would fall to only ninety persons.²¹ Thus, most firms appear to be capital intensive and certainly do not solve the unemployment crisis of the province. Aggravating the condition is the fact that many firms are employing primarily women. This leaves unemployment figures relatively unchanged, since many of the women are being drawn into the labor force for the first time. On the positive side, all firms are offering steady, year-round employment.

The new industries are predominantly of two types, textiles and clothing or foods and beverages, as

¹⁹Information from the office of the Comité Operativo Tucumán.

²⁰La Gaceta, Tucumán, September 22, 1970.

²¹Personal interview with Roberto Alvarez, coordinator, Comité Operativo Tucumán, July 8, 1970.



illustrated in Table 36. Demand for these products is normally quite inelastic. That is, consumption is relatively unaffected by price changes. As a rule these industries are characterized by gradual and slow growth rates and are dependent primarily on population increases for expansion. The need for local raw material assures linkages with the agricultural sector but the products do not lead to additional factories. Thus, these types of industry are not the ideal generators of continuing industrial development.

The market area for most of the goods produced by the new industries is limited to the province of Tucumán, or at best the Northwest. Businesses with greater outreach have not been attracted or, in some cases, have preferred sites in other regions of the country. A prime example of the latter condition concerns the planned location of two automotive parts factories, Saab-Scania and Volvo. Pressures from Córdoba, the main automobile manufacturing center, appeared to be the major reason for cancellation of these plans.

With information covering just four years of operation it is far too early to judge the long-term success or failure of the Operación Tucumán in its industrial phase. It is clear that some gains have been made, but the goal of regaining the 1965 provincial product



level was not attained until 1973/74.²²

TABLE 36
INDUSTRIES SCHEDULED TO LOCATE IN
TUCUMAN PROVINCE, 1970

Industries	Number
Foods and beverages	23
Textiles, clothing and shoes	21
Chemicals	9
Construction materials	6
Electrical machinery	5
Non-electrical machinery	4
Wood working, paper and cellulose	5
Furniture	1
Tobacco	1
Rubber	1
Printing	1
Miscellaneous agriculture oriented	<u>2</u>
	79

Source: Comité Operativo Tucumán and Canitrot and Sommer, Diagnóstico de la situación económica de la Provincia de Tucumán, 1972.

²²Correspondence with Prof. Teodoro Ricci, February 12, 1974.



Agricultural Diversification

Attempts to diversify the agricultural sector were coordinated by the Comité Operativo Tucumán, the provincial Secretary of Agriculture and the Secretary of Transformation (Secretaría de Transformación de la Provincia de Tucumán). With the great decline in cane area since 1965, and with farmers deprived of sugar quotas, the task was to continue a deemphasis of that dominant crop and to promote viable alternatives.

There has always been a great variety of things grown in Tucumán province, since it is a favored agricultural area with a diversity of ecological niches.²³ However, sugar cane has occupied as much as 80 percent of the cultivated land (Table 37). Certainly during the peak periods, monoculture would have been an appropriate descriptive term. Since 1956 sugar cane has decreased in relative importance but it certainly has continued to be the dominant crop. Such dominance by a labor intensive and seasonal crop has always been problematic, yet attempts at diversification have never had a lasting effect.²⁴

²³The possibilities for more than fifty different crops were explored and mapped by the Estación Experimental Agrícola de Tucumán in Cultivos posibles en Tucumán: Orientaciones para diversificar la producción agrícola (Tucumán, 1961).

²⁴According to La Industria Azucarera, December, 1973, the area planted to cane in Tucumán in 1973 was the highest it had been in the past decade.



TABLE 37

PERCENTAGE OF CULTIVATED AREA IN TUCUMAN PROVINCE
DEVOTED TO SUGAR CANE, SELECTED YEARS,
1937-1970

Years	Percent of Total Cultivated Area
1937-38	80.4
1947-48	77.7
1955-56	80.2
1960-61	68.2
1965-66	63.9
1966-67	53.5
1969-70	48.0

Source: La Industria Azucarera, various years.

The evolution of the most important crops in Tucumán province is shown in Table 38. The predominance of sugar cane is obvious, but nearly every crop listed has maintained some areal growth since 1965. The number of crops is considerable, but of particular note is the rise in importance of sorghum, soybeans, cotton, wheat and tobacco. On the basis of these data, diversification efforts appear to be at least partially successful.

Diversification schemes depend very much on the incentives offered to the agricultural sector. Some considerations essential for the development or expansion



TABLE 38

AREA UNDER CROPS IN TUCUMAN, SELECTED YEARS, 1937/38 TO 1969/70

Crop	1937-1938	1947-1948	1955-1956	1960-1961	1965-1966	1966-1967	1969-1970
Sugar Cane	194,016 (80.4%)	158,948 (77.7%)	248,700 (80.2%)	192,400 (68.2%)	190,700 (63.9%)	130,000 (53.5%)	135,000 (48.0%)
Corn	13,091	23,300	19,500	34,400	47,500	50,000	45,000
Sorghum		205	2,400	5,000	8,000	9,500	26,000
Vegetables	11,276	17,866	13,070	24,300	22,590	19,000	24,400
Alfalfa	-	-	5,000	8,500	10,500	12,000	14,000
Citrus	2,958	-	20,000	12,636	8,000	9,000	11,000
Wheat	2,200	700	-	1,000	2,500	3,500	8,000
Soybeans	-	-	-	500	2,000	3,000	6,500
Tobacco	200	400	250	300	600	700	3,000
Cotton	500	-	-	-	-	100	2,700
Peanuts	2,000	500	-	800	2,000	2,500	1,500
Miscellaneous Fruits	-	-	-	300	700	800	1,500

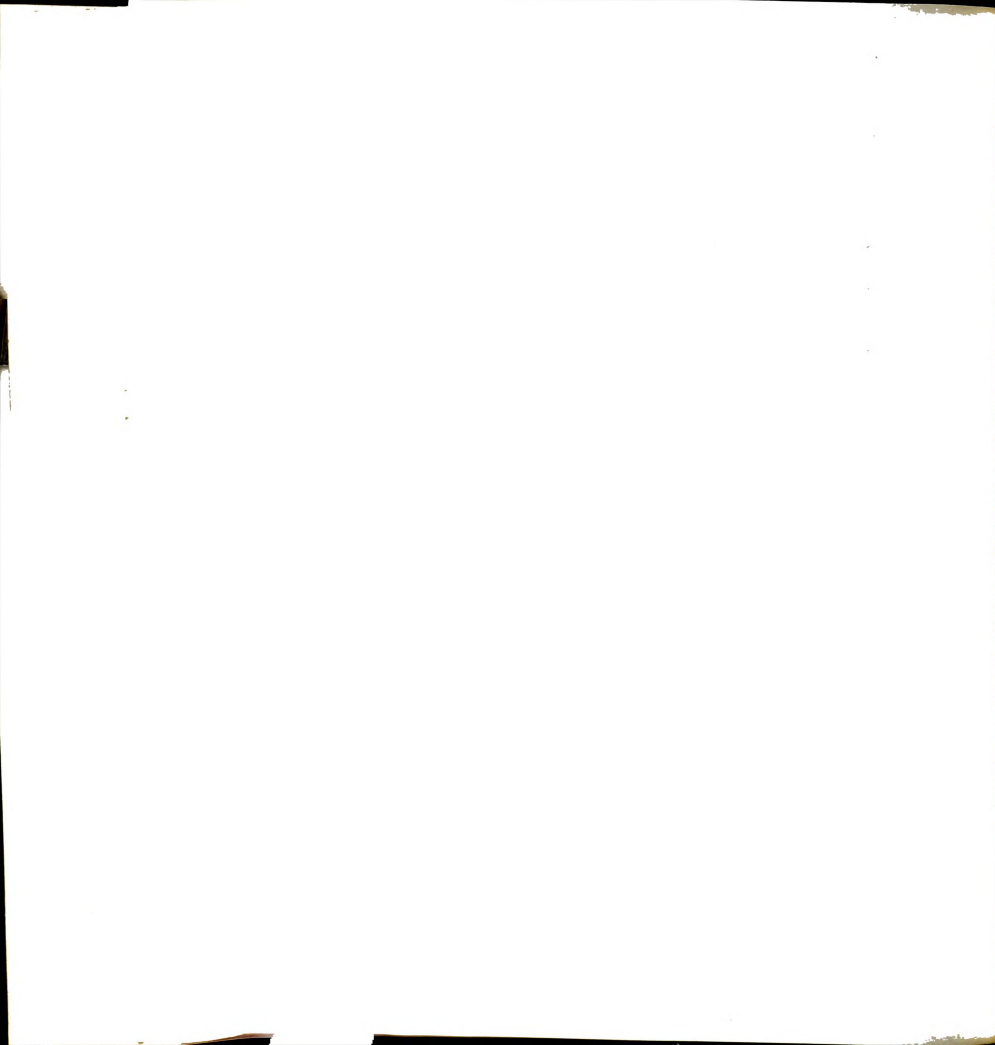


TABLE 38--Continued

Crop	1937-1938	1947-1948	1955-1956	1960-1961	1965-1966	1966-1967	1969-1970
Forestry	-	-	-	500	700	300	700
Sunflowers	100	200	-	-	700	1,500	?
Other Crops	1,500	2,500	1,200	1,500	2,000	1,000	2,000
Total Cultivated Hectares	227,841	204,619	310,120	282,136	298,490	242,900	281,300

Sources: Estación Experimental Agrícola de Tucumán: Bases para el desarrollo agrario de la Provincia de Tucumán (Tucumán: 1968) and Secretaría de Agricultura de Tucumán, mimeographed report of 1970.



of any crop include the physical requirements of the crop, labor and capital demands, market conditions and size constraints.

Although the area planted to cane decreased between 1966 and 1970, not all the expansion of other crops was at the expense of sugar cane. Some crops do not compete for the same land and, thus, diversification need not mean replacement of cane. The oil crops, cotton, and sorghum, for example, grow quite well under the drier and most frost-prone conditions of the eastern part of the province where cane cannot be cultivated profitably. Since sugar cane is grown in the most favored agricultural zones, however, some competitiveness among most crops is inevitable.

Labor requirements differ with each crop, both in absolute numbers and in period of need. As to the amount of labor necessary for cultivation and harvest, all crops listed in Table 38 require less labor per unit area than does sugar cane, with the exception of tobacco.²⁵

Restraints on tobacco cultivation include little suitable growing area and marketing difficulties.²⁶ If this crop is excepted, diversification will not greatly aid the unoccupied workers. It could, however, mitigate the

²⁵Canitrot and Sommer, Diagnóstico, p. 145.

²⁶Personal interview with Ing. Ploper, Secretaría de Agricultura de la Provincia, Tucumán, August 7, 1970.



drastic seasonal unemployment associated with sugar. Figure 18 shows the months of peak labor demand for a variety of crops, and it is noteworthy that many compete for labor during the same period as sugar cane. The major exceptions are wheat, corn, the oil crops and sorghum. Thus, it is not surprising that all agencies involved have stressed the latter crops.

With regard to economic return, "it is probable that of the diverse crops, only citrus and some other fruits and vegetables result in greater returns than cane..."²⁷ These crops, in turn, present problems to the average farmer of Tucumán because citrus requires at least five years to achieve profitable bearing, and most vegetables are viable only with the secure source of water that irrigation alone can provide.

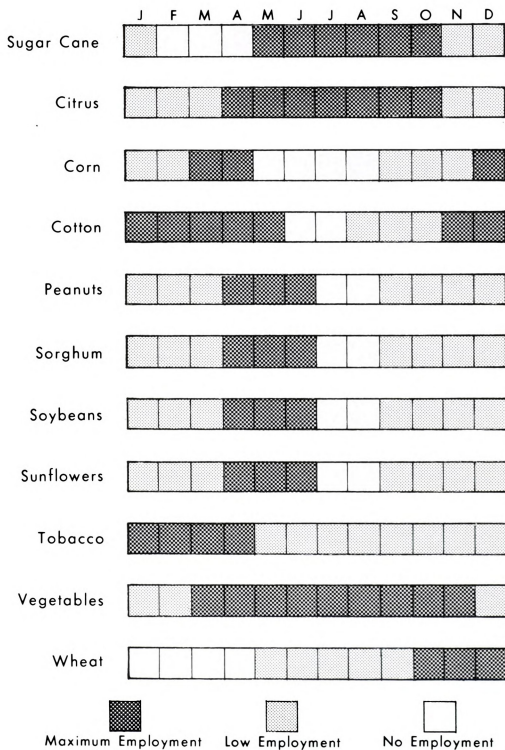
Finally, diversification is probably not compatible with minifundia. Because of the peculiarities of sugar cane, there does not seem to be a viable alternative to that crop for the extremely small landholder.²⁸ This can be checked empirically by noting that most minifundistas continue to grow cane despite legal prohibitions. It is

²⁷Canitrot and Sommer, Diagnóstico, p. 149.

²⁸Estación Experimental Agrícola de Tucumán, Bases, p. 28. Numerous other studies referred to the same situation.

FIGURE 18

PEAK LABOR DEMANDS FOR SELECTED CROPS IN TUCUMAN PROVINCE



Source: Tucumán, Secretaría de Agricultura.

argued that diversification can occur effectively and economically only on medium to large-scale farms. Not only is there a greater investment capability, but greater flexibility to allow reactions to prices. A recommendation based on these thoughts was made in 1965 by the Agricultural Experiment Station of Tucumán. It was suggested that cane production be assigned chiefly to the minifundistas, while the large owners should diversify.²⁹ It has been shown that the government did not exactly agree!

Some real changes have been effected in the economic structure of Tucumán province since 1966. Most authorities would agree that movement away from a near complete dependence on one industry is "good." Results to 1970 have been inconclusive at best, and indications are that high world market prices for sugar could undo the achievements attained to date.

²⁸La Industria Azucarera, December 1965, p. 274.



CHAPTER IX

EFFECTS PRODUCED BY CHANGE

The government intervention of 1966 and succeeding legislation directly affected all Argentine sugar producing regions. As a result of the new policies numerous changes occurred which were mirrored on the landscape and in the economic activities of each area. The effects were most strongly manifested in the Northwest, and specifically in Tucumán. The resultant changes in land use, agricultural productivity, industrial activities, and the size and composition of the regional labor force were particularly important.

Land Use

Patterns of agricultural land use were altered considerably within the Northwest after 1966. Change was abrupt and extensive in Tucumán, while the northern agricultural regions of Salta and Jujuy underwent relatively little modification. Since a principal government objective was to rationalize the sugar industry, the greatest effects were felt in the areas devoted to sugar cane cultivation. A reduction in cane area had to be forced by legislation, since farmers left cane production with extreme reluctance.



Sugar Cane

The dominance of sugar cane in Tucumán decreased rapidly after 1966 (see Table 7, p. 91). Reductions in regional quotas were attained either through voluntary individual action with monetary compensation, or by legislative fiat. In this manner lands planted to cane were withdrawn from production as quotas were eliminated. The climatically marginal zones for cane were most affected. These were frequently areas where larger farmers had "over-extended" their plantings or where small farmers had been able to maintain only minimal levels of production. Thus, the cane region of Tucumán retreated on three fronts, the north, east and south, and became slightly more concentrated west of the Río Salí (see Map 11, p. 99).

Surveys along major highways and around selected towns in Tucumán province reveal contraction in sugar areas at the eastern margins of the cultivated zone and even isolated changes within the prime growing areas west of the Río Salí. Cane holdings of the intervened mills, for instance, were sold without the accompanying sugar quotas and thus the land was effectively taken out of production. (About one-third of the sale price of their lands was needed by the closed ingenios to repay back debts).¹

¹Jorge A. Dominquez and Agustín Hervas, Cooperativas agropecuarias de trabajo: Una alternativa solución para el problema Tucumano (Tucumán: Instituto Nacional de Tecnología Agropecuaria, 1970), p. 84.



Minifundia were, and are, present within prime growing zones, as well as in the marginal areas. Some of these were also forced to relinquish sugar production quotas. Many minifundistas left land in cane, however, as no economically viable alternative was available to them. Along with the official elimination of the smallest cane farms, large numbers of loading stations (cargaderos) were left idle. These relics were particularly noticeable in areas of minifundia since transshipment points were usually needed to facilitate cane delivery to the mills. Slow individual transport by oxcart was then replaced by the faster collective movement by truck or tractor.

The actual change on the Tucumán landscape was often less a disappearance of canefields than a selective decline in quality due to the semi-abandonment of fields. Much land was gradually taken out of production as numerous canefields were simply left to merge into weeds or pasture. The area withdrawn from production remained out of cane cultivation for at least five years, until high world sugar prices started another cycle of planting.²

No great land use change resulted in the Norte. In Salta and Jujuy the effects of the policy changes were

²By the harvest seasons of 1971/72 and 1972/73 planted area in Tucumán expanded greatly, in the latter year exceeding any previous planting of the prior decade: "El azúcar Argentino en cifras: Zafra 1973," La Industria Azucarera, Vol. 80, No. 937, 1973.

mildly positive. Some reduction in cane occurred immediately after 1966, but by the late 1960's the ingenios were again expanding their planted area. As restrictions were gradually lifted a more pronounced expansion took place. By 1970 growth was mostly in newly cleared fields that had never before been devoted to steady cropping.

In summary, little change occurred in sugar cane cultivation in Salta and Jujuy, while Tucumán experienced considerable disruption. The pattern of change indicated a shift in production emphasis from Tucumán to Salta-Jujuy.

Other Crops

In Tucumán much of the land taken out of cane production was planted to a variety of crops as the provincial government stressed agricultural diversification. In Salta and Jujuy most of the cultivated area remained in cane, although some diversification into citrus, for example, did take place.

Crops appeared in Tucumán that were most suited to the drier arable margins where cane had been eliminated. Specialized horticulture also expanded around urban centers in the prime cane growing areas of the province. The growth of numerous individual crops can be noted in Table 38, p. 207. Most of this growth did not reflect increasing total acreage planted in the province, but a replacement of cane by other crops. Such substitution did not indicate a loss of esteem for sugar cane as a crop.

The farmers of the province almost without exception would have been growing more cane if permitted to do so.³

Psychologically there was an attachment developed to cane over time. This feeling was not without a firm economic foundation as cane appears to yield a higher monetary return on a steadier basis than almost any other crop. Uneasiness existed with regard to new crops, particularly in marketing the harvest. This prejudice was corroborated by experience with some of the vegetable crops, such as potatoes and tomatoes, during the 1970 and 1971 harvest seasons, when a very weak market existed and many farmers left their crops in the field.⁴ Thus, it was not surprising to find many small farmers still cultivating sugar cane even though they were officially prohibited from selling the crop. Allegiance remained to a crop that was easy to care for and that assured a good monetary return.

Diversification efforts in Salta and Jujuy were limited. There the attempts to diversify occurred chiefly on the extensive sugar mill lands. Ledesma and Tabacal both have profitable citrus plantings, while other ingenio lands feature tree and cattle farming, plus experimental

³Interviews with 104 cane farmers indicated that ninety-eight would prefer to have all possible land in sugar cane.

⁴La Gaceta, Tucumán, February 1, 1970, and January 12, 1971.

fields of crops such as soybeans, sorghum and cotton.⁵

Some diversification occurred in both sugar zones of the Northwest, but the greatest change in cropping patterns appeared in Tucumán. The greater emphasis upon new crops in Tucumán appeared because farmers were forced out of sugar cane. In the Norte diversified cropping took place because management of the large ingenios wanted to vary the holdings. This difference in motivation is important in understanding differences between the two areas.

Productivity

Available measurements of productivity in the sugar industry of the Northwest include yields per unit area and output per worker. Data for yields are normally available and reliable, while measures of labor output are difficult to find and more suspect in reliability. Such figures have been collected for sugar cane but for few other crops in the cane regions. Nevertheless, some comparisons and analyses can be made from the new relationships between crops following 1966.

Sugar Cane

Many factors affect the yields of sugar cane, including variety, soils, climatic conditions, and field

⁵Personal interview with Ing. Agrónomo Gerez, Ingenio La Esperanza, San Pedro de Jujuy, March 15, 1970.



and factory practices. Although a trend toward higher cane yields began with policy changes after 1955, the actions of 1966 had effects of their own.

The increasing areal concentration of production in Tucumán resulted in improved average yields, since many marginal fields were regulated out of production.⁶ Likewise, with the elimination of some of the less efficient mills, refined sugar yields were improved. Thus, the effect in Tucumán were to reinforce regional trends in yields and to make the province slightly more competitive. It was found that cane production on a unit of land could approach that obtained in the Norte.⁷

Despite individual improvements in Tucumán, Salta and Jujuy retained leadership in overall yields. There, the 1966 policies did not seem to exert any significant pressure on yields. Nearly all the cane in the Norte is grown on relatively high quality irrigated land and little was actually taken out of production. Thus, continuing improvements in yield must be attributed to such things as improved varieties, increased irrigation and better field practices. Only indirect effects due to the increased emphasis on overall efficiency after 1966 might have resulted in higher yields in the North.

⁶"El azúcar Argentino en cifras: Zafra 1973," La Industria Azucarera, Vol. 80, No. 937, 1973.

⁷Ibid.

Comparisons of worker productivity in Salta-Jujuy and Tucumán are made in Tables 31 and 32, pages 179-180, and it is clear that the Norte held a substantial lead over Tucumán. These data relate to factory labor only, since estimates pertaining to field workers are less reliable. Improvements occurred in Tucumán due in part to the closure of less efficient mills. The statistics for Salta and Jujuy also indicate continued increases in productivity per worker, but this is chiefly due to improved capital-intensive measures.

Other Crops

Reductions in cane area in the late 1960's decidedly affected the competitive position of other crops. In Tucumán, crops such as soybeans and sunflowers appeared for the first time on a large scale. Others, such as sorghum, were planted in semi-arid areas unsuited to most other crops without irrigation. A better correlation of crops to specific ecological conditions appeared. Thus, improved overall agricultural productivity could be attained by better matching natural conditions with crop requirements. More intensive crops, such as vegetables, were planted in some areas, increasing the total value of agricultural products. The reduced dependence on one crop in Tucumán was a step toward better utilization of all cropland in the province.

In the sugar cane areas of Salta and Jujuy crops other than cane have usually been grown for subsistence or as minor sidelines to the chief cash crop of the zone. The fact that much of the area requires irrigation naturally limits the viable alternatives. Despite this, some land rationalization has occurred with citrus, for example, as the trees occupy rolling land less suited for sugar cane. However diversification certainly does not currently characterize the sugar valleys (the Ramal) of the Norte.

Yields and productivity have been rising steadily in both producing areas, but improvements are still possible. Improved methods of cultivation and the increased use and better application of inputs such as fertilizer and irrigation water could greatly increase agricultural yields. Mechanization to replace manual labor will assure greater productivity per man hour.

Industrial Activities

Both study areas have been dominated by the sugar cane industry for 100 to 150 years. The effects of the 1966 policy were to lessen this dependency in Tucumán and to strengthen the industry in Salta and Jujuy.

Sugar Industry

Between 1965 and 1968 twelve Argentine sugar mills ceased operation, reducing the total number from thirty-seven to twenty-five. Eleven were located in Tucumán and

one in the Litoral production zone.⁸ Thus, the industrial capacity of Tucumán was sharply diminished. Even increased output by the remaining mills was not assured since total production was strictly limited, keeping each mill at near its customary level of production.

In Salta and Jujuy little change occurred within the sugar industry as the number of mills remained the same. In fact, the ingenios of the Norte gained relative to Tucumán since some of their competition had been eliminated. The northern industry emerged from the crisis of the mid-1960's stronger than ever. This allowed the mills to modify and improve their physical plants and total operations.

Other Industries

Some industrial diversification occurred in Tucumán following the abrupt 1966 closing of the sugar mills. The efforts of the Comité Operativo Tucumán attracted a relatively large number, but small range, of new industries. The goal was to broaden the industrial base of the province and to reduce dependency on the sugar industry. Thus, one effect of the campaign was a "forced" influx of new industries into the province. This did not increase the total number of employees in the manufacturing sector,

⁸Tacuarendí sugar mill in Santa Fé Province was closed in 1968.



however, since the losses from the sugar industry were so severe. A high rate of unemployment continued in Tucumán as the new firms were unable to absorb the workforce of the closed ingenios.

Those industries locating in Tucumán province after 1966, with few exceptions, were small and had little economic outreach to the rest of the country. The new firms tended to increase spatial concentration of industrial power, since most of the new factories were constructed on sites in or near the capital city. Efforts to place firms in areas of former sugar mill influence had little success (Map 19, p. 201).

The industrial diversification was viewed by nearly all Tucumanos as a useful but limited endeavor. The major objection was that the firms attracted were too few and too small. Intensive industrialization could rejuvenate the province, and as the historical location of the first real industry in the country (sugar milling) Tucumán was anxious to regain some economic momentum.

In the cane areas of Salta and Jujuy specialization in sugar production was maintained with little diversification. Greater utilization of cane by-products was stressed within the sugar industry itself. Ledesma, for instance, expanded paper production from bagasse and planned to double its Kraft output by 1974.⁹ The other four mills

⁹Interview with Victor Hugo Valdera, Secretary to the Administrator, Ingenio Ledesma, Jujuy, July 17, 1970.



of the Norte had investigated diversification possibilities, but only the management of San Martín de Tabacal admitted to expansion plans for by-products such as paper and furfural.¹⁰

Labor

Labor was one of the most critical elements of the Northwest economy affected by the intervention in the sugar industry. A labor intensive operation such as sugar manufacture had a far reaching influence, and the closure of eleven mills put a great number of people out of work.

Sugar Cane

It is estimated that up to 40,000 field and factory workers were affected directly by the mill closings.¹¹ Since the province of Tucumán could absorb only a small percentage of these laborers within the existing economic structure, many were forced to emigrate to other parts of the country. Some make-work projects helped temporarily, but the long range solution was to create permanent job opportunities. This was to be accomplished through a plan

¹⁰Interview with Ing. Jim Lord, Administrator, Ingenio San Martín de Tabacal, March 17, 1970. Furfural is a product used in the synthetic fiber process.

¹¹Estación Experimental Agrícola de Tucumán, Bases para el desarrollo agrario de la provincia de Tucumán, Publicación Miscelanea No. 29, Tucumán, 1968, p. 17.

to diversify agriculture and industry within the province. The accomplishments of the committee in charge have been spotty at best. Large numbers of workers in Tucumán have remained outside the active labor force, and unemployment rates in excess of 10 percent have been common.¹²

The labor organizations of the sugar industry were affected severely.¹³ The small growers union (UCIT) was especially decimated as a result of its drastic decrease in membership. The medium-sized and large cane farmers, represented by CACTU, gained some additional power after 1966. All labor unions deplored the mill closings, however.

In Salta and Jujuy labor did not suffer much from the events of 1966. Indirect effects were felt due to new policies stressing efficiency of operation and increased utilization of Argentine labor. There, reduction in labor needs have been associated with increasing mechanization rather than a decrease in number of mills. No effective labor opposition to these methods has surfaced, in part because many of the laborers of the Norte are not residents of the region or even the country. Labor has continued to decrease in number and appears to be dominated by management.

¹²Bank of London & South America Review, Vol. 8, No. 2/74(86), 1974, p. 89.

¹³Management also suffered to a degree because of the poor administration of many sugar mills.



Other Crops

With diversification efforts in Tucumán a greater number of workers became involved in crops other than sugar cane. Relative to cane, however, most crops are not as labor intensive. Many of the new crops, particularly those grown in the drier sectors of the province, were highly mechanized and did not require large labor inputs. Specialized garden crops, such as strawberries and potatoes, provided small seasonal labor demands but the market was often "soft." In such situations few opportunities for labor were generated. These conditions meant that most of the newly unemployed could not expect to find work within the agricultural sector.

Evidence from field interviews indicates that a number of manual labor tasks associated with vegetable and other crop harvests were carried on by migrant workers.¹⁴ These laborers are generally Argentine citizens who follow harvest cycles in various parts of the country. This does not characterize the sugar cane harvest, since most of the zafreros come from either Tucumán or adjacent provinces. A less consistent regional commitment could be attributed to the migrants, along with a minimum of organization. These conditions resulted in little direct involvement by these workers in affairs of the province.

¹⁴At least four individuals indicated that they followed the speciality crop harvests from north to south during the season.



Reactions from former cane workers indicate that much of the stoop labor required by the non-traditional crops appears as a less attractive alternative to working in the cane fields.¹⁵ This view does not seem logical to the author since, from limited personal experience, the work in a cane harvest is difficult and unattractive! Since many of the cane workers are owners or renters of their own small farms, another explanation for their work preferences is possible. The sugar zafra arrives late in the season when most personal crops have been cared for, thus freeing individuals for other work.

Industrial Opportunities

Maximum planned industrial employment of the new firms scheduled for completion in the early 1970's totaled 9,000 to 10,000 workers. This could be considered a small but significant percentage of the more than 40,000 sugar employees put out of work. Further analysis of the work force attracted by the new factories indicates that the employees were not entirely or even primarily those of the "former" sugar industry.¹⁶ Indeed, a large percentage of the new industrial workers were women, first-time wage

¹⁵Personal interview with Sr. Bulacio, Juan B. Alberdi, Tucumán, April 6, 1970.

¹⁶Adolfo Canitrot and Juan Sommer, Diagnóstico de la situación económica de la provincia de Tucumán (Buenos Aires: Instituto Torcuato Di Tella, 1972), p. 138.

earners for the most part. Thus, the employment base of the province was apparently broadened but unemployment was not much reduced.

Semi-skilled or skilled jobs characterized many of the new opportunities. Since most of the sugar workers had few marketable skills, they did not fit existing requirements. In addition, most of the new firms were highly mechanized and therefore employed rather small numbers. As efforts toward industrial diversification continue, employment outside of the sugar industry must increase and should eventually reduce the high unemployment rate.

The new industrial employment, in addition to including fewer sugar workers than desirable, was characterized by little unionization. This was attractive to the manufacturers but could be exploitive of the workers, according to the sugar industry!¹⁷

Synthesis of Changing Landscapes

The effects of change following 1966 were felt strongly in Tucumán and were only slightly evident in Salta-Jujuy. In Tucumán large areas were withdrawn from cane production and planted to a variety of other crops. The cane industry remained dominant but decreased in importance and this was evident on the landscape. Abandoned

¹⁷La Gaceta, August 14, 1971.

fields of cane were juxtaposed with new sorghum and wheat fields and citrus groves. These changes characterized areas of Tucumán up to 1973, when increased sugar acreages again occurred.¹⁸

In general, the recent period has featured a weaker sugar industry in Tucumán and improved well-being for the industry in the Norte. The sugar areas of Salta and Jujuy expanded slightly while cane lands in Tucumán contracted.

¹⁸"El azucar Argentino en cifras: Zafra 1973," La Industria Azucarera, Vol. 80, No. 937, 1973.

CHAPTER X

CONCLUSIONS AND RECOMMENDATIONS

This study has interpreted and synthesized the evolution of sugar production in Northwest Argentina. The changing relationships within and between the chief producing regions of the country, Tucumán and Salta-Jujuy, provided the general theme for investigation, and spatial differences through time have been delimited and explained. The study has focused upon the geographical aspects of cultivation, harvesting, processing and marketing and has stressed particularly the changes since 1966 when a major restructuring of the industry occurred. Interpretation and explanation of change necessitated investigation of physical, socio-historical, economic and political conditions.

The field investigation was conducted during a period of about one year, from October, 1969 through August, 1970. During this time it was possible for the author to become familiar with all major phases of the sugar cane industry and to formulate some conclusions and recommendations that should merit consideration by appropriate planning agencies of the Northwest.



Summary

Sugar cane production in Argentina developed slowly and sporadically during the colonial period. Early cultivation was undertaken by the Jesuits and by individual landowners in suitable areas of the country, chiefly in the Northwest. Production levels were so small, however, that considerable volumes of sugar were imported at high costs even into the producing zones. After expulsion of the Jesuit order in 1767 a near eclipse occurred in cane cultivation, and a period of more than fifty years followed without notable production. It was not until 1820 that cane was reestablished on a commercial scale in Tucumán by Bishop Colombres, the "Father of the Argentine Sugar Industry." This event coincided with the post-Independence period and signaled a new era for the war-ravaged Northwest. The sugar industry offered a focus for the re-development of Tucumán, and from this "beginning" cane cultivation expanded slowly in areal extent and overall importance.

A quantum advance in industrial modernization and agricultural production followed completion of a rail connection between Buenos Aires and Tucumán in 1876. This linkage allowed the transfer of heavy machinery inland and permitted a much greater market for sugar. Improved transportation stimulated a modern system of sugar mills, which in turn generated a great expansion in plantings to meet the increased mill capacity. In the twentieth



century growth continued but in an uneven fashion. A cyclical pattern of recurring surpluses was particularly problematic, and each period featured piecemeal legislation to deal with the production crises.

Tucumán province early became the undisputed leader in production and was never seriously challenged by the secondary zone of Salta-Jujuy. Each period of surplus production in the industry was largely the result of overplanting in that primary region and tended to deepen the natural rivalry between the provinces. An extensive surplus occurred again in the 1960's when record world sugar prices stimulated a great expansion in sugar plantings and government reactions affected primarily Tucumán.

The closure of seven mills in Tucumán in 1966 by the national government greatly changed the industry and seemed to be a tardy reaction to the regional differences that had evolved between Tucumán and Salta-Jujuy. Following 1966 undeniable shifts in production from Tucumán to the Norte occurred. Figures on yields and industrial efficiency heavily favored the northern production areas, and these data seemed to convince many influential people that Tucumán could no longer be "pampered." Factors leading to this situation were manifold and longstanding, as the investigation readily revealed. The original hypotheses, relating the production shift to technological differences and varying land ownership patterns, were only part of the answer.



Physical factors comparing Tucumán unfavorably with the Norte have often been used to denigrate Tucumán as a viable production zone for sugar cane. There is no disputing differences between the regions, but many factors have been over-stated. Tucumán is located at or near the southern margin of viable commercial sugar cane production, but many elements favor the cultivation of cane. Total precipitation is greater in Tucumán than in the Norte, although the distribution is frequently unsatisfactory. Rainfall in Tucumán often extends into the harvest period, which tends to promote additional plant growth rather than sugar accumulation. Salta and Jujuy, on the other hand, receive most precipitation prior to the critical stage of maturation. However, low total rainfall has made irrigation mandatory. This regulated water supply has resulted in higher yields and earlier planting than is characteristic of Tucumán. Although irrigation systems are expensive to install and maintain, their benefits appear to exceed the costs.

Other physical elements also seem to favor the Norte. Average monthly temperatures are slightly higher in Salta-Jujuy than in Tucumán, but both areas are susceptible to frosts. Frost damage to crops is more likely in Tucumán, due to lower absolute temperatures and longer periods below freezing, and these differences may be critical. Although difficult to document, it appears



that the North also benefits from a greater average number of sun hours.

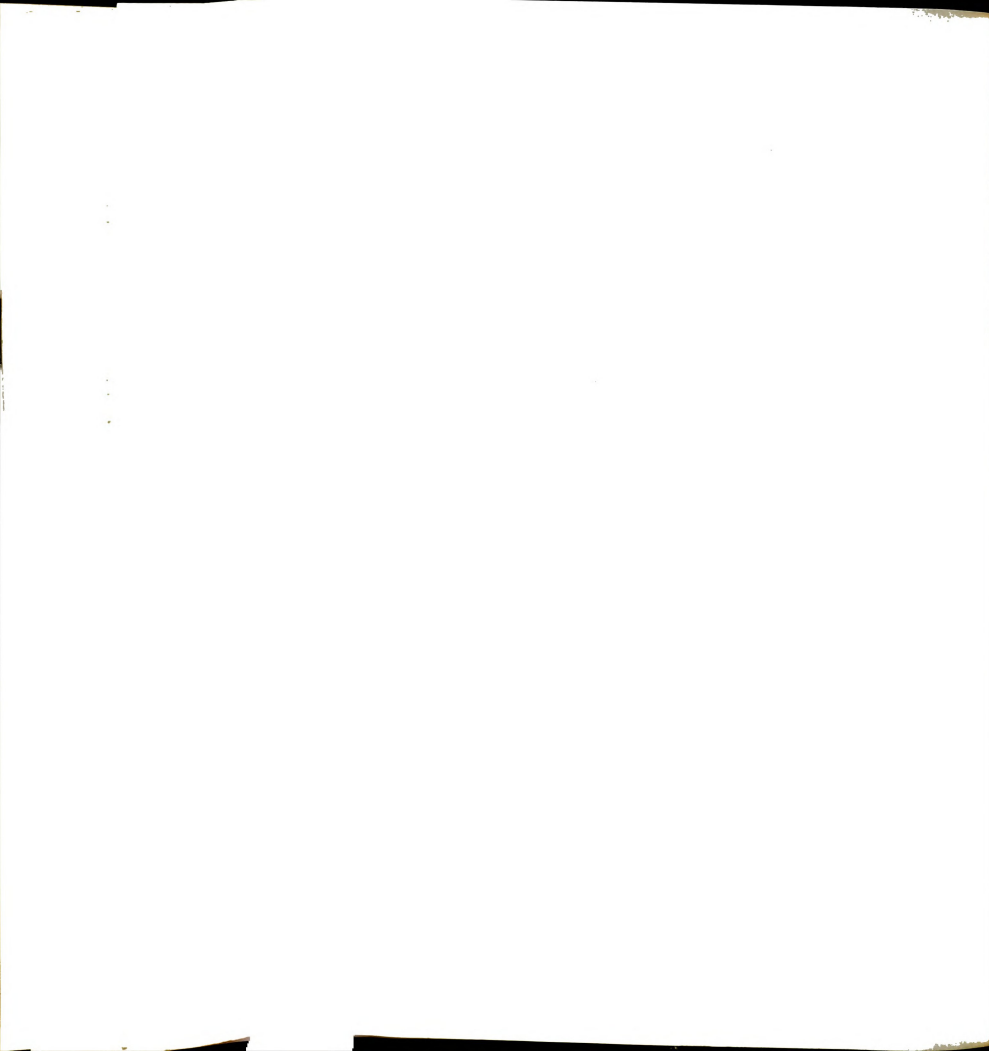
Soils in the two areas are similar in type and origin, but those of Tucumán have been longer under cultivation. Whereas less is known about the soils of the Norte, sectors of the cane areas there have been recently cleared and therefore are likely to be "fresher" than those under cultivation in Tucumán.

Socio-historical factors have naturally influenced the development of the industry. Population growth differed markedly among the Northwestern provinces, and Tucumán early featured the most dense pattern of settlement. Population was attracted to Tucumán in the colonial period by the city's location on the transport route to Bolivian mines. The fertile alluvial soils and fine timber resources of the province were subsequently major attractions. The land was not completely occupied by large estates and many small holdings became characteristic of the province. The Tucumán cane area by the mid-1900's included more than 20,000 individual farms and most were owner operated. In Salta and Jujuy, on the other hand, the river valleys suitable for cane were occupied by a few large holdings. There the sugar zones are still held by grower-industrialists, whereas in Tucumán only vestiges of that system remain, as agricultural lands associated with mills were broken up in the 1930's and 1940's.

The ownership and operation of large estates by the northern mills is an important distinction between producing regions. Consolidated mill and cane ownership tends to assure an efficient harvest operation and smooth movement of cane to the mill. The harvest, collection and transport of cane from the many small farms of Tucumán has many inherent inefficiencies. Data correlating farm size and yields also indicate higher yields on fields over thirty hectares (Table 28, p. 170), which gives another advantage to the Norte.

Labor force composition and labor costs are variables between regions that can best be understood through historical perspective. The Norte had few people to draw upon and needed to recruit laborers from Bolivia to satisfy demands in the industry. This practice has continued to the present and has numerous advantages to the mills, since wages can be kept lower and threats of unionization are minimized.¹ The labor force for the sugar industry in Tucumán was locally developed and drew upon neighboring provinces during the peak period of the harvest. The workers were and are mostly white and were organized into strong unions during the 1930's. Management in both areas had to search outside provincial boundaries

¹Wage levels are now regulated by law and adjusted only by cost of living differences between regions. Advantages still accrue to the northern mills, however, since migrant workers make fewer demands on the establishment.



for steady labor, and the resulting solutions led to lower labor costs and fewer initial problems for Salta and Jujuy.

The organizational aspects of the industry have also changed over time and have tended to favor the more centralized operations of the North. In Tucumán the industrialists are no longer all powerful as the worker unions have garnered considerable influence. In the Norte nominal unionization exists, but the owner class is still very much in control. A new element with great potential for leadership is the government agency (CONASA), which controls five mills in Tucumán.

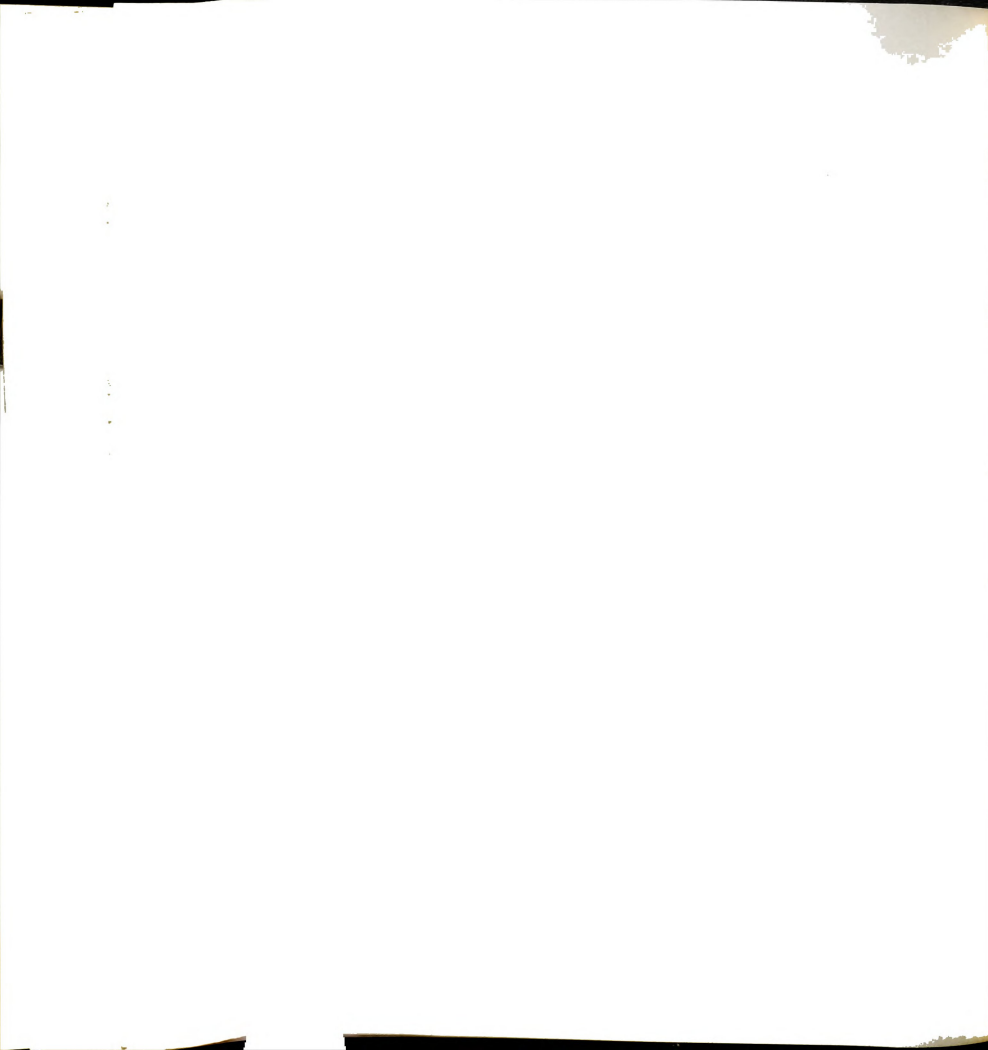
Economic-agrotechnical changes occurred throughout the evolution of the industry, and each change was implemented differently among the producing regions of the Northwest. Mechanization in the cane fields has proceeded sporadically, and nearly the full historical range can still be seen in Tucumán. Animal power remains important on the small farms, and on most large operations a full pen of mules is also common. Juxtaposed, however, are fields being worked by tractors where the cane is scarcely touched by human hands! The Norte is hardly more uniform in its field operations, although mechanical cane loaders are used on all the mill lands to some degree. Both areas are dependent mainly on the machete for cutting cane.



Modernization within the sugar mills has necessarily taken place in both production regions, but with a greater number of small and old mills in Tucumán, the "average mill" there lacks the degree of modernization seen in the Norte. The new, more efficient machinery has generally resulted in increased factory yields wherever it is employed.

Production efficiency obviously depends in part upon other than technical aspects in the field and factory. Property size and labor conditions in Salta and Jujuy seem advantageous, while the small size of many cane farms in Tucumán has mitigated against the diffusion of proven productive inputs, such as fertilizers, new cane varieties, and irrigation. The minifundia in Tucumán are handicapped by a lack of available capital, and even if it were available new technology and mechanization would have a limited effect. Labor efficiency is difficult to measure, but the control exerted over total operations by the northern mills assures less duplication of effort than in Tucumán. Also, the measures of output per worker are considerably higher in Salta and Jujuy.

Faulty administration of individual mills is not a monopoly of either region, but Tucumán offers the most negative examples. The family mill, as opposed to corporate mills, is present in both regions but is most characteristic of Tucumán. It is here that most "errors" have



occurred. The situation was epitomized when numerous mill owners neglected reinvestment and eventually were unable to pay their workers and cane suppliers. This coincided with the surplus production of 1965 and provided the immediate reason for government action.

The national government of Argentina very early passed legislation concerning the sugar industry. Varied national policies had been drafted to regulate and control production, but all sooner or later were found wanting. In 1966 drastic government action was taken to deal with the latest crisis.

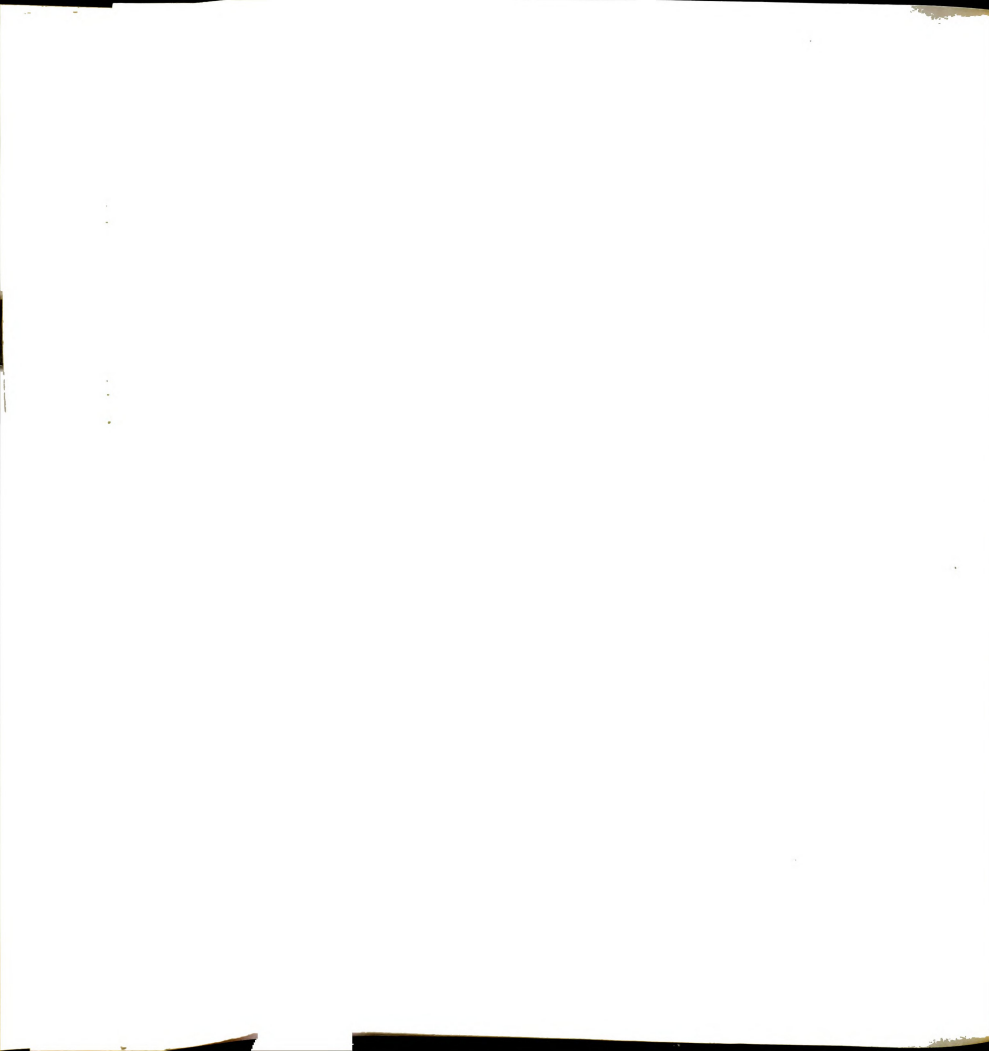
In August, 1966, seven mills were intervened with federal troops and were forced to cease production for the remainder of that season. Later several of these were reopened, yet a total of eleven mills closed in Tucumán between 1965 and 1969. Other restrictions on production were also instigated, but the most drastic step was the sudden mill closings. Closure of these mills was justified officially as providing an improved social and economic climate in Tucumán. The selected ingenios were the weaker ones of the province, and most were considerably behind schedule in payments to workers and suppliers. Thus, the government action was considered necessary to avoid collapse of the milling operations and a total lack of confidence in the industry.

Results of the 1966 government legislation and mill closure in Tucumán included: a great reduction in land devoted to cane, the elimination of the sugar quotas of 7,000 small cane growers, the creation of a pool of nearly 40,000 unemployed field and factory workers, and a drastic reduction in tax revenue for the province. On the other hand, the position of the northern zones was greatly strengthened, which seemed compatible with government interests. The prevailing notion was that there had been too much "subsidizing" of the Tucumán sugar industry and that Salta and Jujuy deserved larger roles in national production.

Conclusions

W. E. Cross predicted in 1923 that in the distant future Tucumán would have sugar competition from two areas: (1) from Jujuy, where expansion with low production costs would be based on cheap land, low-cost labor, and high yields; and 2) from the Litoral where beet sugar was expected to be competitive.² The second threat never materialized but the Norte did gradually fulfill the predictions of Cross. The area of Jujuy, along with Salta, gained increased importance and by 1966 was challenging

²William E. Cross, "Experimentos con la remolacha azucarera en Tucumán," Revista Industrial y Agrícola de Tucumán, Vol. 13, No. 7-8, 1923, p. 131.

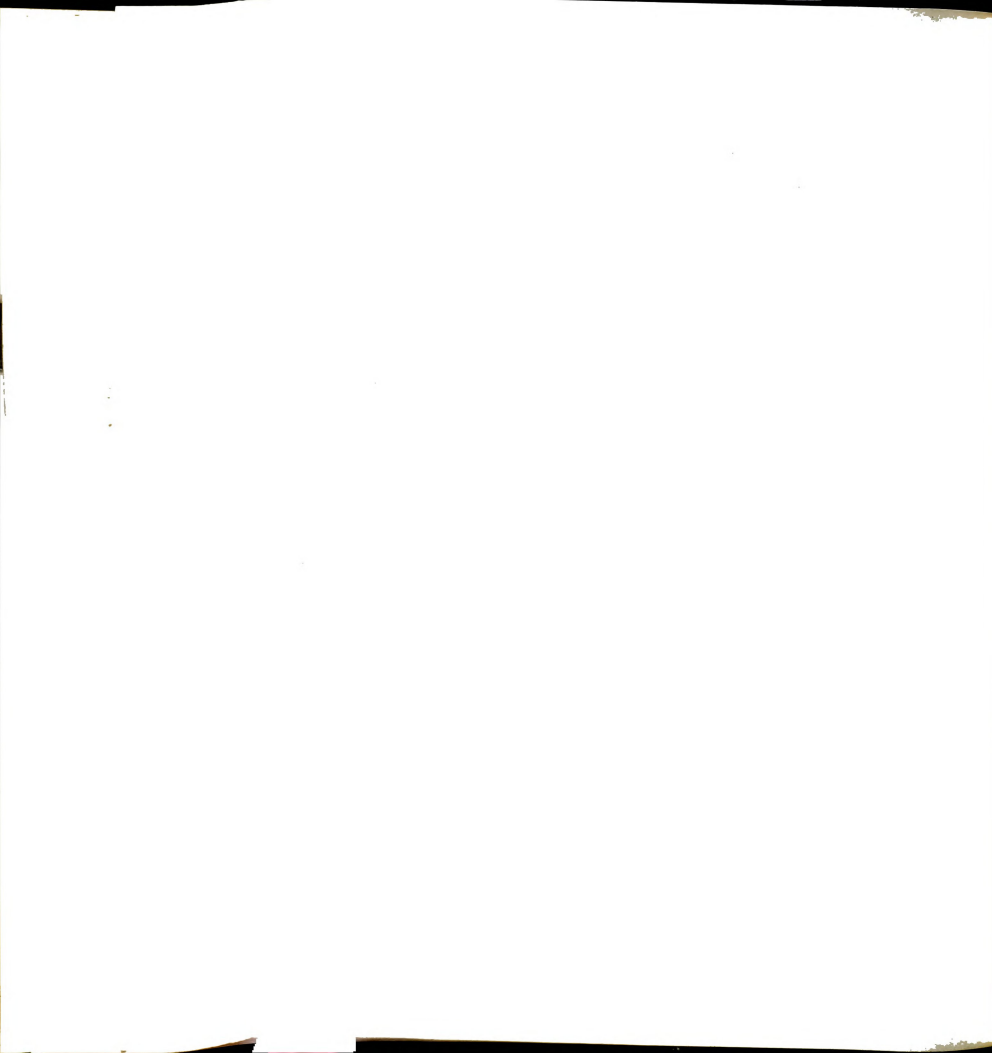


the sugar supremacy of Tucumán. Even the predicted reasons for northern competition were quite accurate, although more complex than indicated.

A pronounced change in the sugar industry was readily evident in 1967. In Tucumán an immediate and substantial reduction of cane land and production occurred, and most of the decrease was offset by increases in the Norte. Production in Tucumán was reduced to barely 50 percent of the national total, while that of Salta and Jujuy rose to about 43 percent in 1967 and 1968.³ It is estimated that the reduction in Tucumán was 120,000 hectares, which involved principally the marginal cane lands toward the east, north, and south. Some reduction occurred even in the prime sugar areas, particularly where minifundia were present. The planted area in Salta and Jujuy was reduced in accordance with the restrictions of 1966, but by 1968 began to expand again. Without exception the mills of the Norte were clearing land for new cane fields during the time of this field investigation, while the plantings in Tucumán were essentially stable.

Good reasons existed for the attempted rationalization of sugar production in the Northwest, although the

³"El azúcar Argentino en cifras: Zafra 1972," La Industria Azucarera, Vol. 79, No. 931, 1972.



methods used to accomplish this goal were questionable. The importance of government legislation and direct action was of the utmost importance in understanding the production shifts. This was an element not given much consideration by the author prior to arrival in the cane areas.

The evidence presented in this report indicated that Salta and Jujuy are indeed superior to Tucumán for producing cane sugar. Major factors include:

1) The physical advantages of the Norte over Tucumán are not overwhelming but are significant. Particularly, the difference in normal sun hours during the maturation period appears to give the northern zones an advantage. The corresponding lack of cloudiness, however, emphasizes the need for irrigation. Irrigation helps to attain high yields and, since the cane in the Norte is almost entirely irrigated, this is another advantage of that area. Available water remains a major constraint to expansion although it is not clear whether the mills of the Norte are fully utilizing their water supply.

2) The large, coterminous cane fields in the Norte are more easily managed than the scattered parcels of Tucumán. Of particular note is the ease of mechanization, which is becoming increasingly important in the industry. (Ledesma, for instance, has been testing a field system used in Australia by which a single machine cuts, gathers, and loads the cane. This assures that the cane arrives at the mill in optimal condition with little trash included.)⁴ Large holdings where mechanization of this type can easily be achieved are limited in Tucumán, although sharing equipment could eventually lead to more capital intensive methods on the smaller fields. Mill ownership of cane lands also favors the Norte. With this type of operation the planning and organization of all phases of the industry can be effected more easily. The modern corporate structure of the large northern mills, where profit is the major guideline, assures that

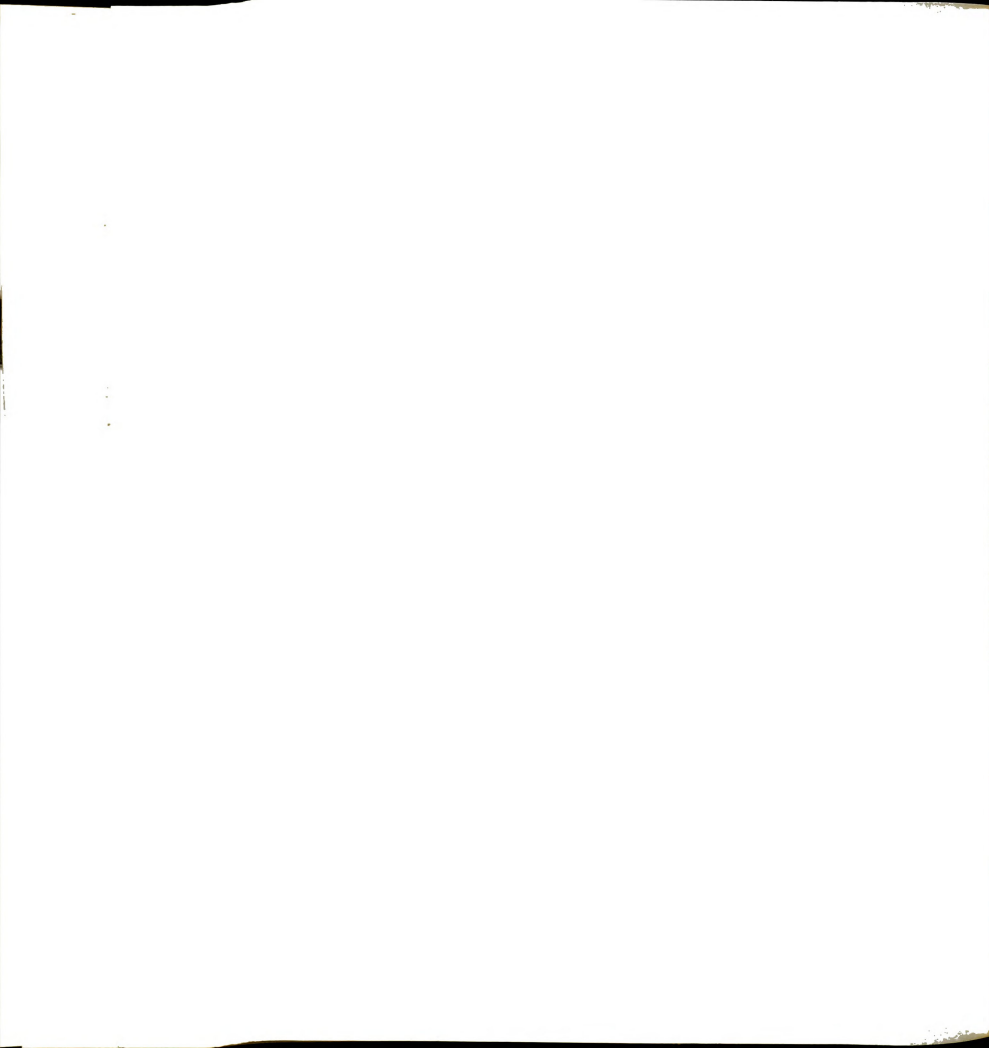
⁴La Gaceta, Tucumán, January 28, 1971.

efficiency of operation will be stressed.

3) Capital availability and a varied product line are most characteristic of the mills of the Norte. The large paper operation at Ledesma, producing an item in scarce supply within Argentina, aids this firm's position in government circles. This position of favor with the government and in the mental image of the Argentine people is by no means insignificant.

The relative positions of Tucumán and the Norte were altered in the late 1960's. Indications are, however, that by the early 1970's Tucumán regained much of its former dominance. Spokesmen for the Norte maintain that they can supply about 75 percent of the national sugar requirements.⁵ This assertion has not yet been tested, and raises an interesting question: If conditions are much more favorable in the Norte, why has production in Tucumán continued so tenaciously? With more extensive arable land and adequate natural precipitation Tucumán does have a major advantage of areal flexibility. Land there can be used or withdrawn from cultivation according to prevailing market conditions, whereas in Salta and Jujuy the land base for growing sugar is more narrowly fixed. Industrial inertia is a greater problem in Tucumán, since the province includes a large number of mills which represent a sunk investment of capital. This suggests that Tucumán will

⁵La Gaceta, Tucumán, July 17, 1970. Quoting Ing. Martín Blaquier, Manager of Ledesma.

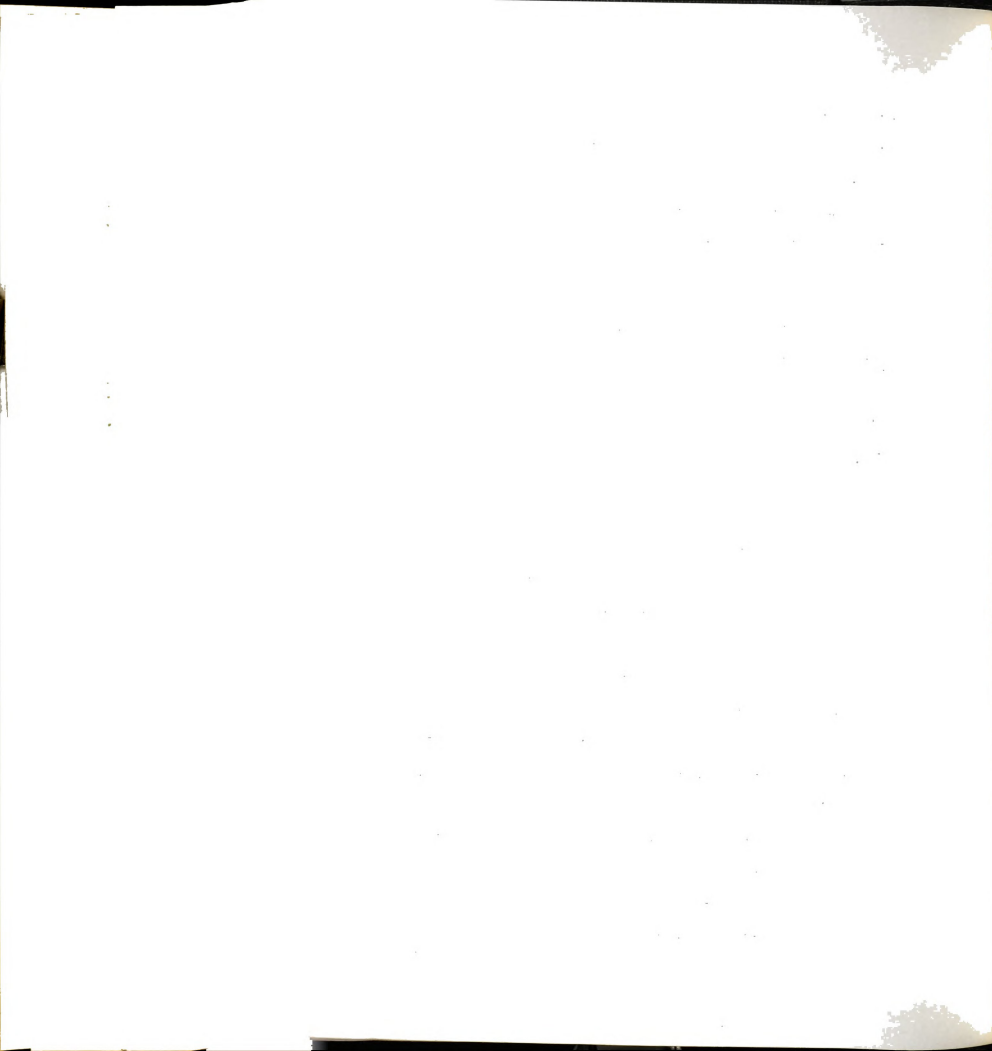


remain an important sugar zone. The process of agricultural and industrial diversification will surely continue, and the province's dependence on sugar production as the main economic activity may decline, but sugar will remain a vital part of the local economy.

Recommendations

There is need for a careful restructuring of the Argentine sugar industry. A better balance between the major producing regions would be of benefit to the nation, since improved production and less variation thereof would result. In addition, bickering and petty jealousies between regions could be reduced. Specific measures adopted depend to a degree upon government policy regarding exports. If the aim is to place considerable quantities on the world market, production can be essentially unrestricted and Tucumán growers can plant without limitation. Since Argentina is a high cost producer, however, it is probable that subsidized production would be required when world prices are low, unlikely as that possibility may seem at the moment! If subsidies are considered undesirable, restrictions will probably be needed on sugar production, at least in Tucumán. Since the government does control prices and production, a farsighted and stable policy would be of the highest benefit.

Two broad goals, aimed primarily at Tucumán, can be formulated: 1) A reduction in the relative importance



of sugar among economic activities should be pursued, along with the creation of alternative means of production and employment, and 2) a system should be adopted to reduce cyclical variations in sugar production.

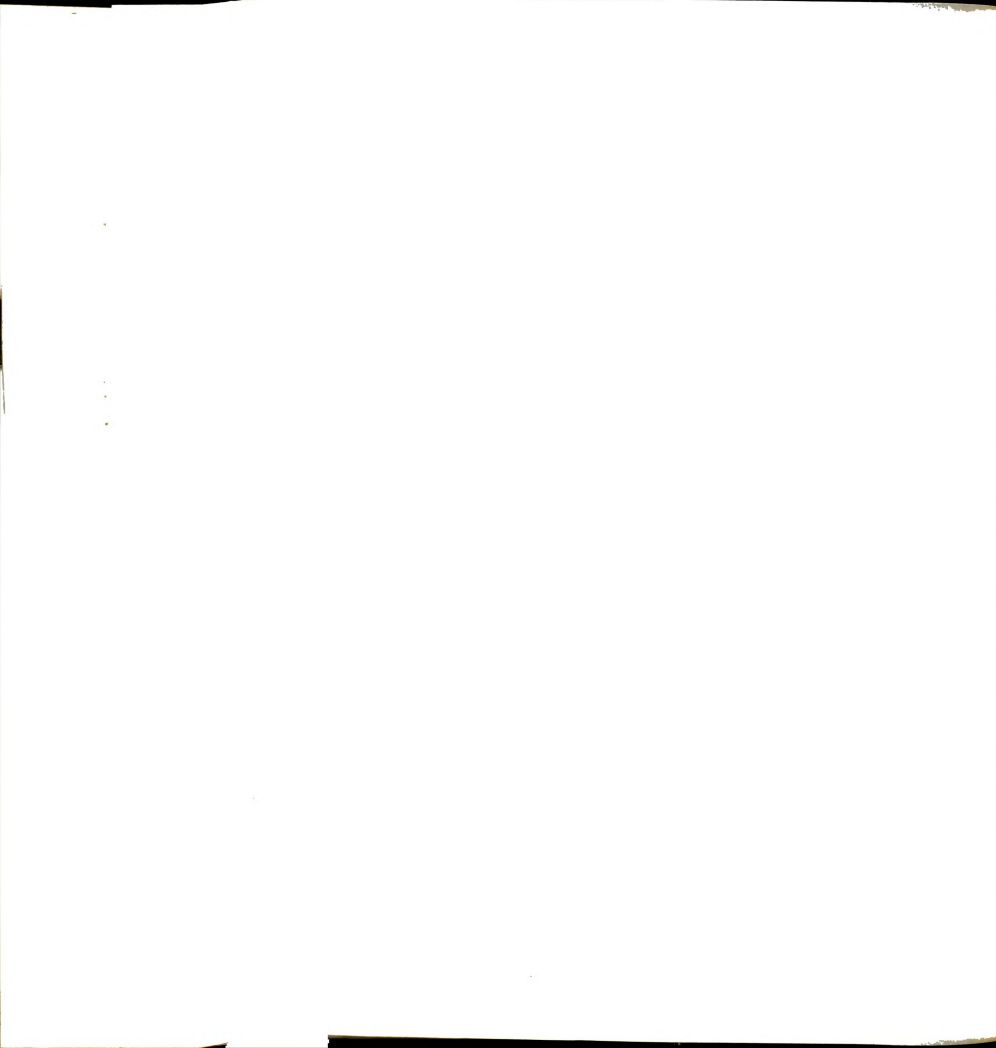
The following are more specific ideas and recommendations aimed at the achievement of a healthy national sugar industry. The items listed are not in order of importance, nor are the categories mutually exclusive:

1) High priority should be given to agricultural research on varieties of cane adaptable to conditions within the Northwest and on agricultural methods and techniques likely to increase productivity and yields. The agricultural experiment stations should make a concerted effort to disperse the resultant information to all sugar cane farmers and not primarily to the large operators.

2) Increased emphasis should be given to irrigation in Tucumán so as to assure a steadier harvest and increased production efficiency. A reduction of the cane area in Tucumán to that land most suitable for the crop would also be desirable.

3) Efforts at re-educating and retraining sugar workers for other jobs in the respective provinces should be intensified, since the harvesting process will continue to become more mechanized.

4) Measures should be taken to assure rapid movement of cut cane from the fields to the factory. This is particularly important in Tucumán where long delays in the



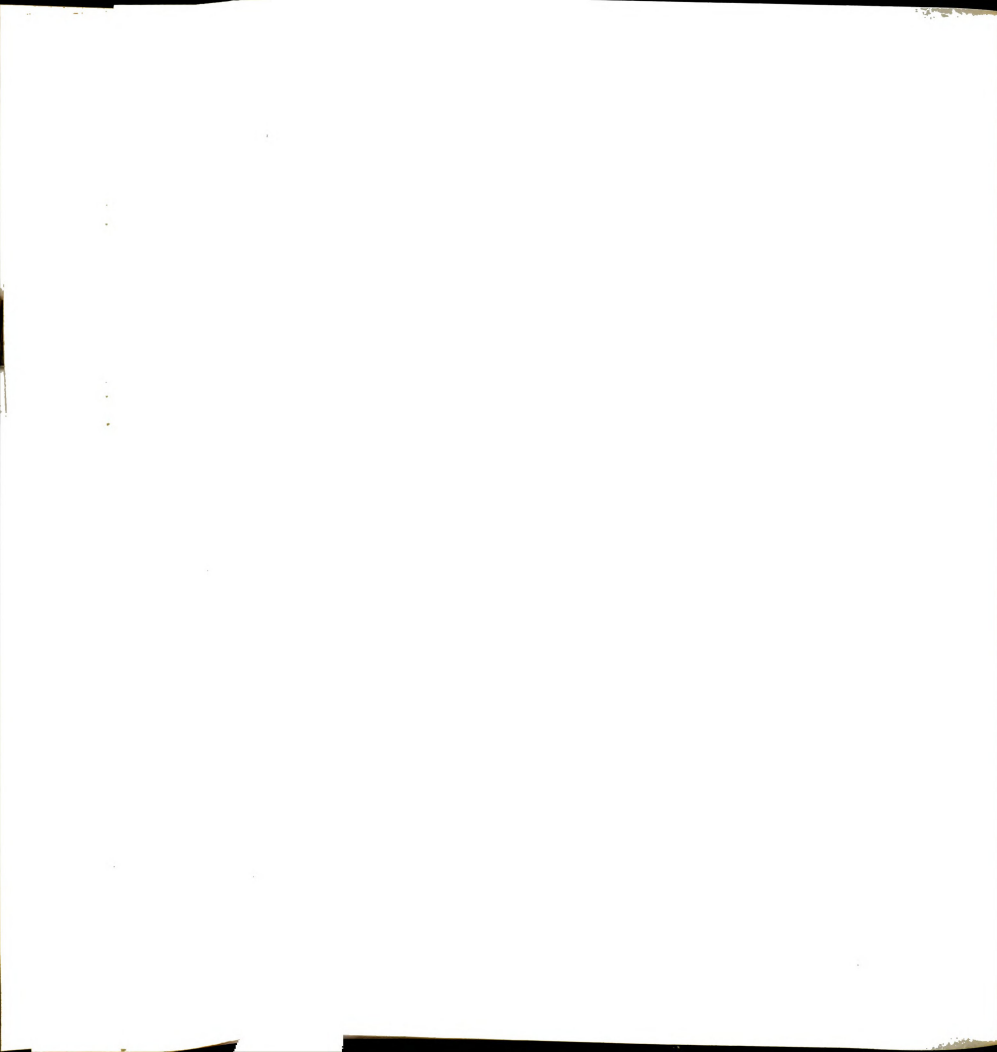
ingenio courtyards (canchones) have been the norm. Improved scheduling of loads and physical improvements such as portable cranes at the mills would facilitate quicker processing and thus assure higher yields.

5) Mill owners should be given the incentives necessary to improve their machinery so that factory efficiencies reach levels common to those in other parts of the world. Gains could also be made by concentrating refineries at fewer locations. Nearly every mill now serves jointly as a refinery, and more emphasis on crude sugar and fewer refineries could improve marketing and transportation of the finished product.

6) The more complete use of cane by-products should be implemented. Gradually, new uses are being discovered for the various "waste products" of the cane sugar process. A planned factory in Tucumán to produce newsprint from bagasse is one example of diversification within the industry.⁵

7) More reliable and detailed data are needed concerning natural conditions in the cane-growing regions. A comprehensive analysis of climatic elements related to specific crop needs including evapotranspiration studies, would be especially valuable. Studies comparing the advantages of irrigation versus natural rainfall would also be very useful. More detailed soil surveys are also needed,

⁵Bank of London & South America Review, Vol. 8, No. 9/74, 1974, p. 531.



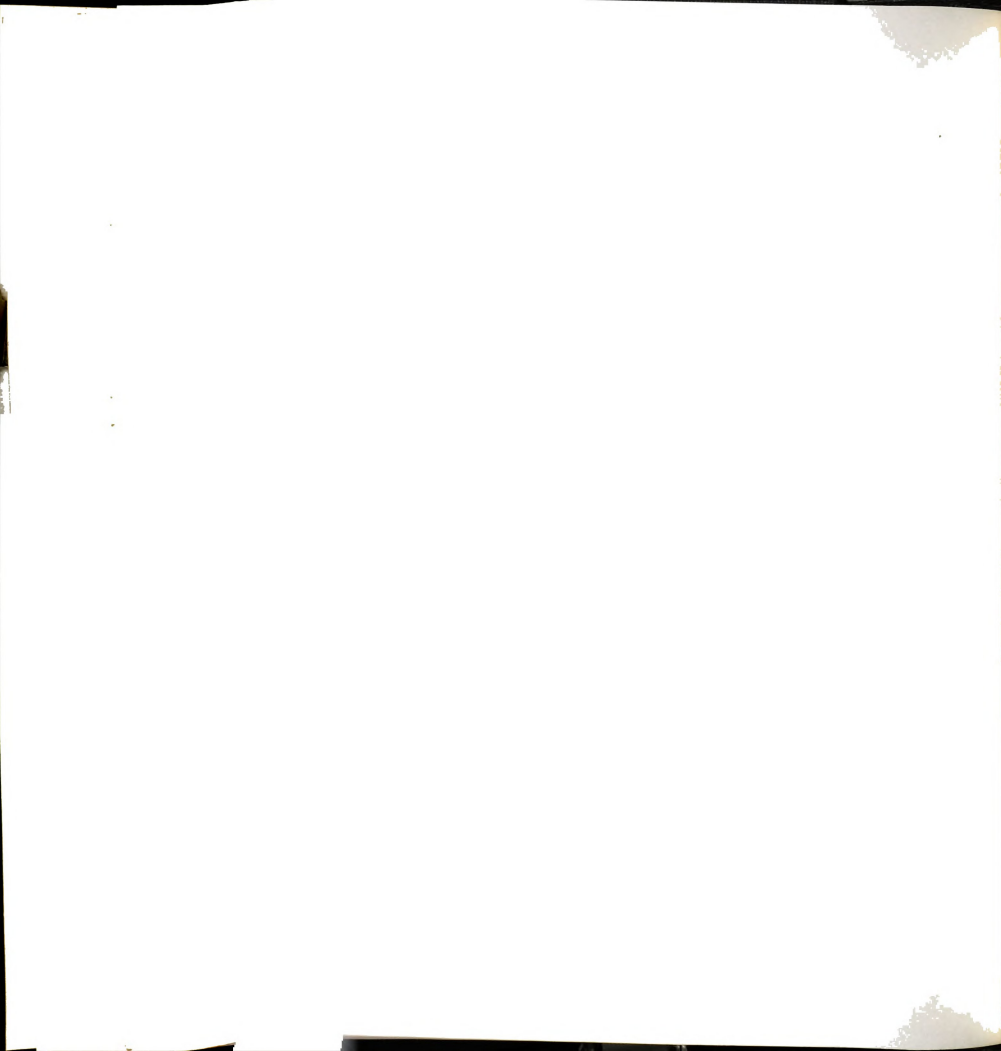
especially in the Norte where formal classifications have not yet been developed.

8) As a social measure it is desirable to restore the quotas of the small cane farmers. There are few alternative crops for the small landholders, and their contributions to the Tucumán crop amounts to less than 10 percent of the total. Reinstating the minifundista would not therefore markedly affect any production limitations placed on the province. This action would be taken at some cost in efficiency but with great social returns.

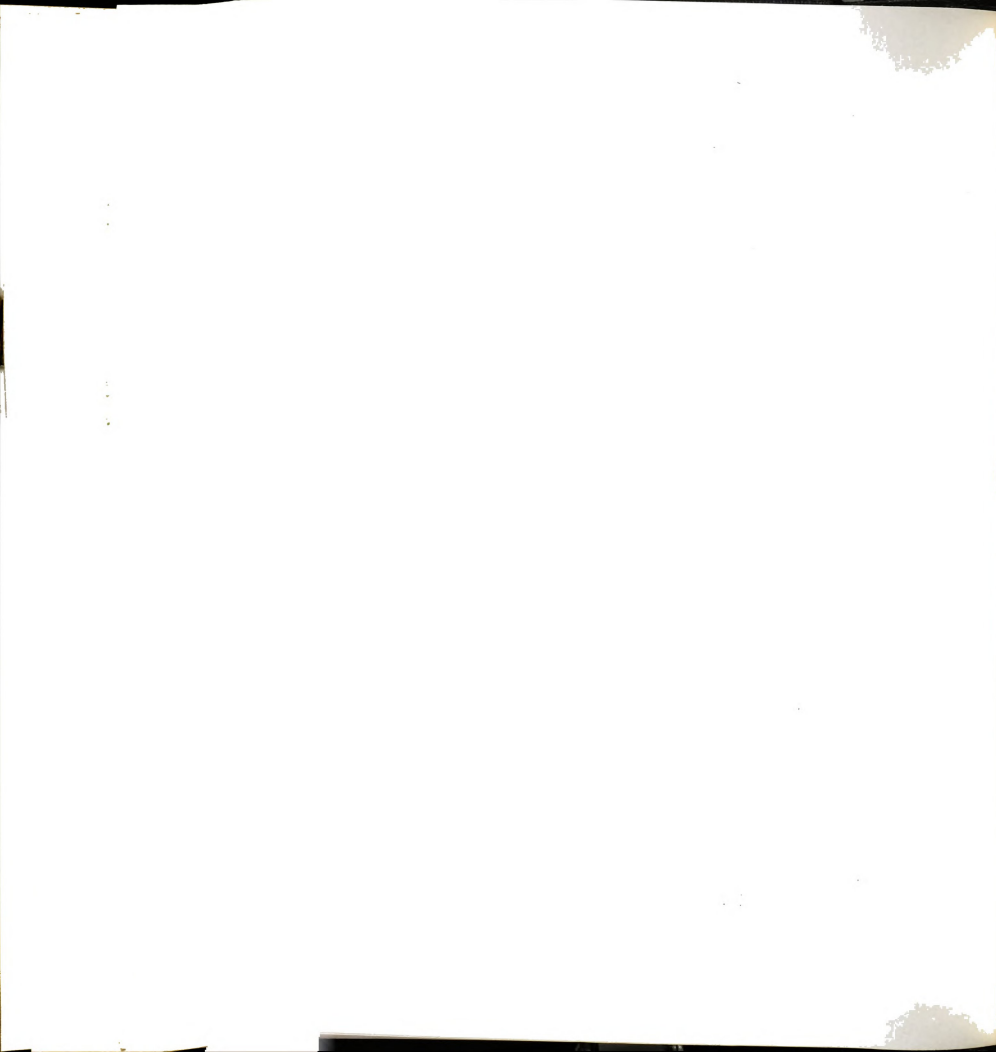
9) Individual mill enterprises should be converted into public corporations. In this manner the management of each ingenio would be made accountable to stockholders, which would ensure a greater degree of economic and social responsibility by the industry.

This study has attempted to synthesize a very complex issue. A challenge to the sugar supremacy of Tucumán was mounted by sugar producers in Salta and Jujuy and has apparently been repulsed for the time being. The elements favoring change still exist, however, and the situation is therefore not yet permanently resolved.

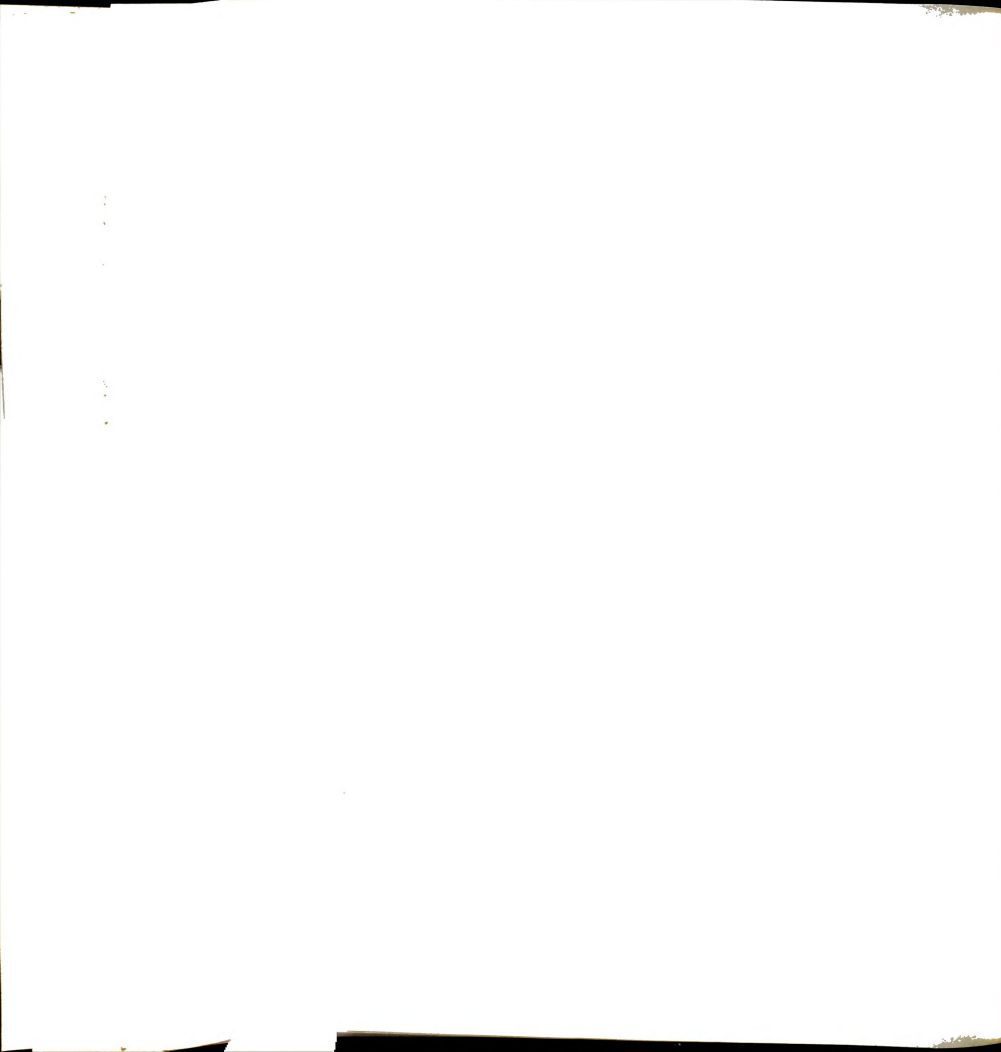
Since it is deemed vital to national interests to maintain sugar production at least equal to the level of domestic consumption, it is essential to have a viable and vigorous industry. As with any crop planted in



different areas, there will continue to be production shifts in sugar cane due to natural causes and human vagaries. The continued competition between Tucumán and Salta-Jujuy is not all negative, but some level of harmony should be reached that is equitable to both production zones. In any event, it seems certain that the two areas will continue as the major foci of Argentine sugar cane production throughout the foreseeable future.



APPENDIX



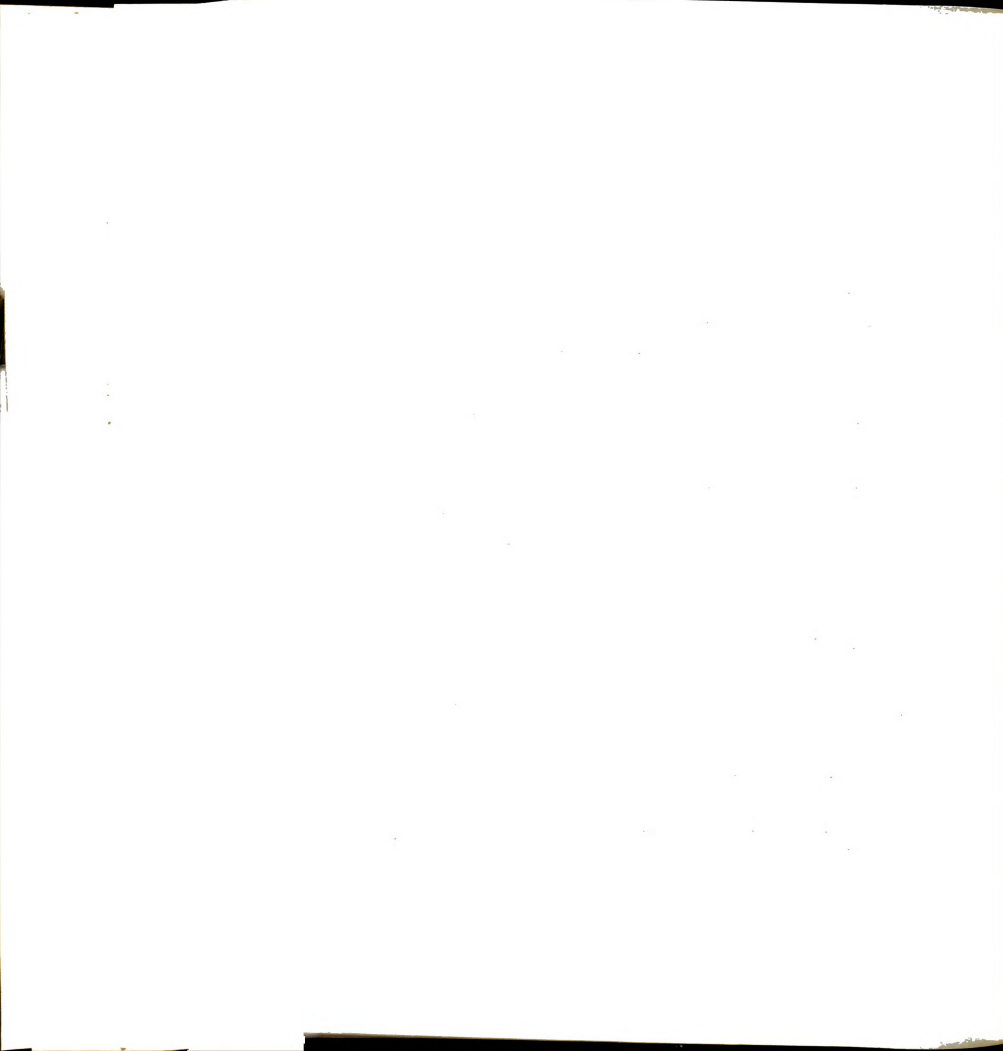
APPENDIX

METHODOLOGY

Information gathering techniques were direct and uncomplicated. To facilitate the collection of data in Tucumán province, a grid was aligned along the intersection of 27° South Latitude and 65° West Longitude. The province was divided into quadrants of ten square kilometers and demarcation of the area planted to sugar cane in 1970 formed the basis for selection of the appropriate units to investigate. Since the eastern crop margins were historically the zones of expansion and contraction, at least one quadrant east of the 1970 cane area was also placed within the study area. This system resulted in sixty quadrants to be sampled.¹

Each quadrant was divided into quarters, one of which was selected randomly. Then a specific site was chosen subjectively, as near the center of the sample area as possible. Usually, the land use of about one square

¹If roughly one-quarter of a quadrant was, or had been, planted in sugar cane, it was included as a sample unit.



kilometer was mapped.² In addition to the above method, several transects along major highways through the sugar zones were mapped and personal contacts facilitated concentration in still other sectors of the province.

The results of the personal samples were contrasted where possible with air photo coverage of 1965, a period of maximum cane expansion. Thirty-seven sites were comparable and these results are summarized in Map 11 and Table 8, pp. 99-101.

Interviews at the farm and mill levels were undertaken to help identify important socio-historical and economic factors in the evolution of the sugar industry. Of particular interest were changes that occurred after 1965. Prepared interview schedules assured some uniformity and considerable leeway for open-ended questions. Formal contact was made with 104 cane farmers, fifty-six farm and factory workers and representatives of all twenty-one working mills. Most individuals within the first two categories were chosen in the sample areas for their willingness to converse with a Yanqui! These interviews proved extremely useful for general information and personalized insights into the industry but detailed analysis proved difficult because of conflicting information and the lack of precise data.

²The area covered was occasionally much more than one square kilometer, depending on the day and the ease of mapping (See Maps 9 and 10, pp. 97-98).



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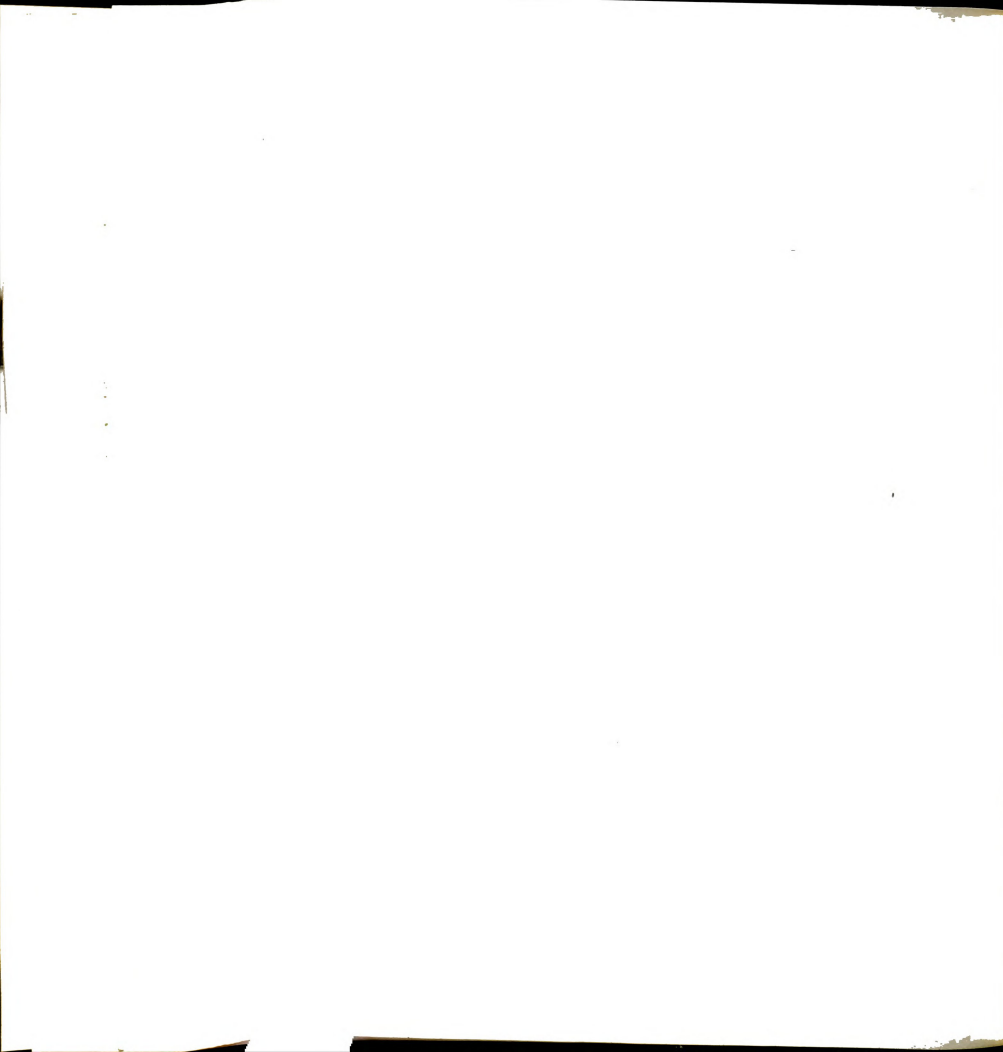
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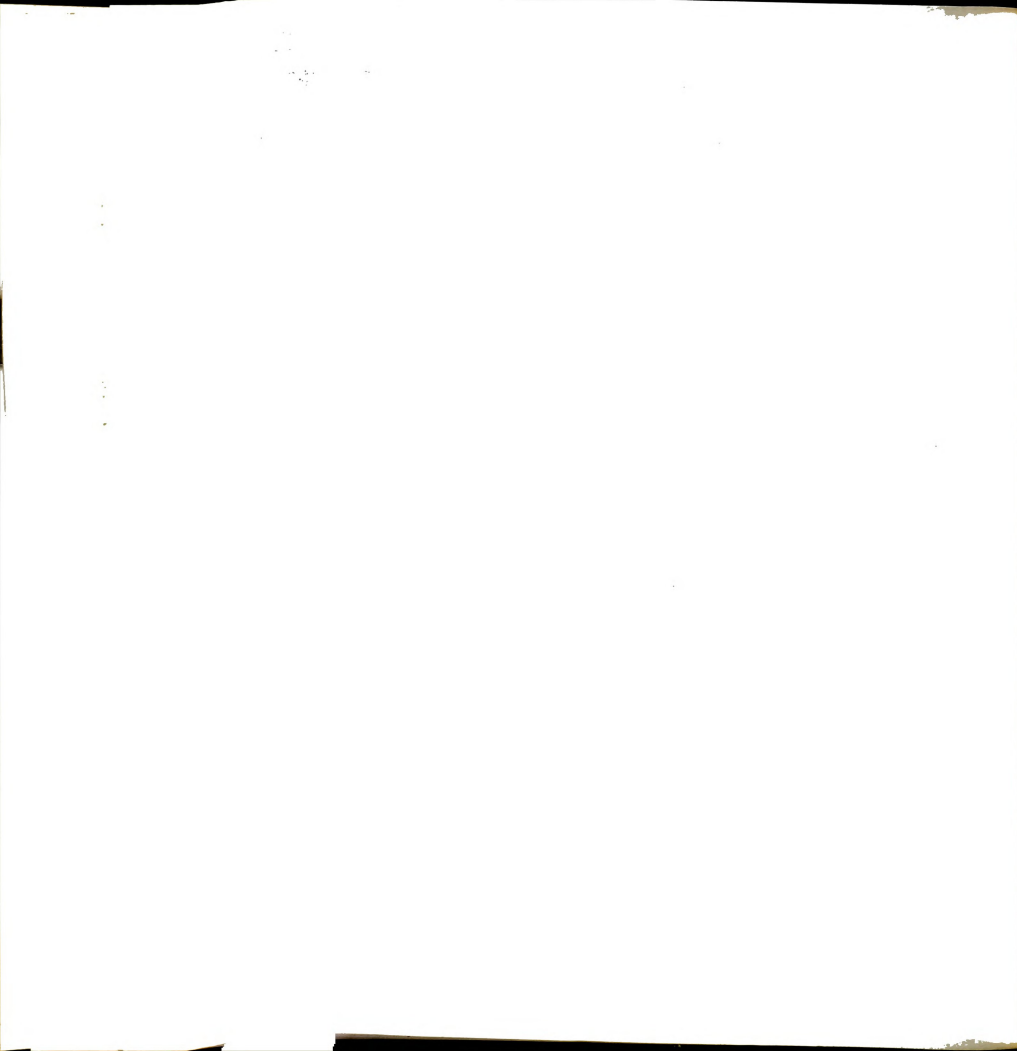
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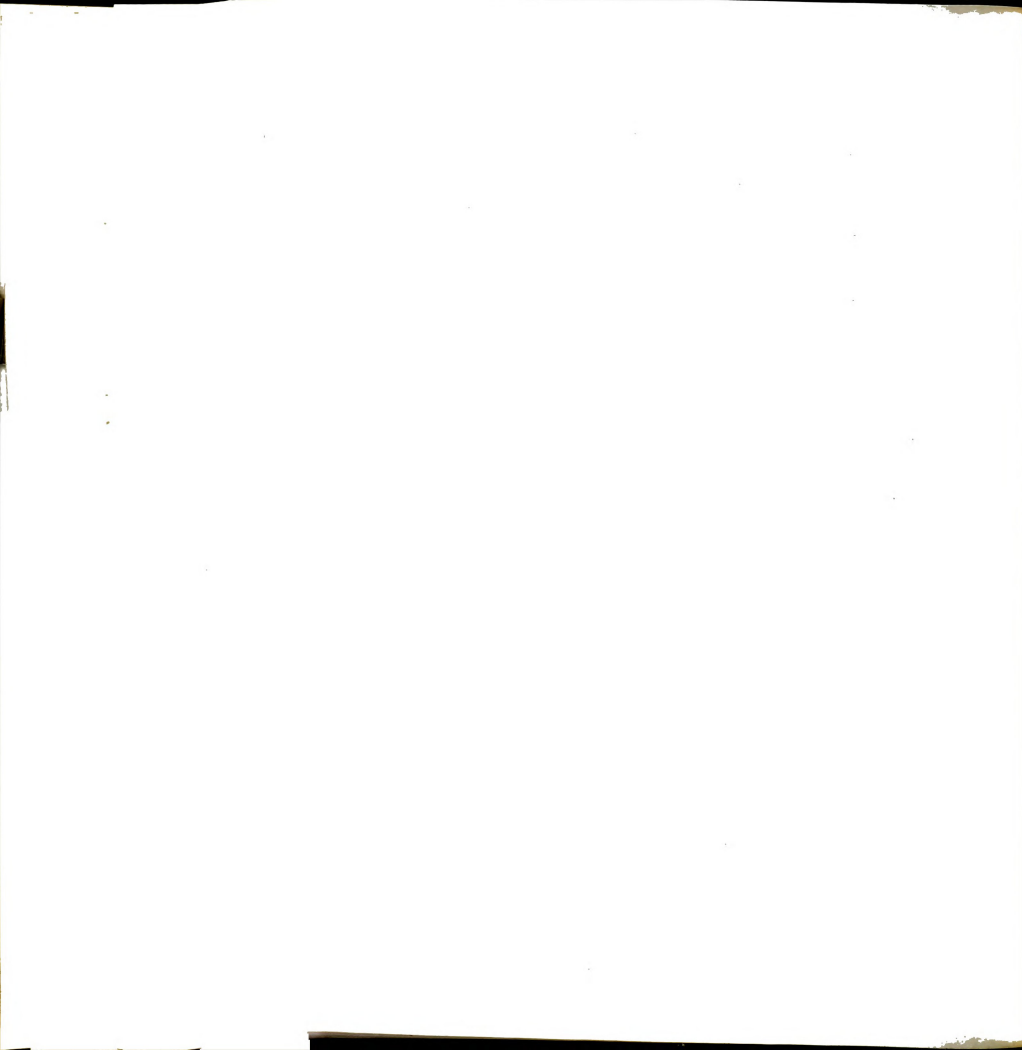
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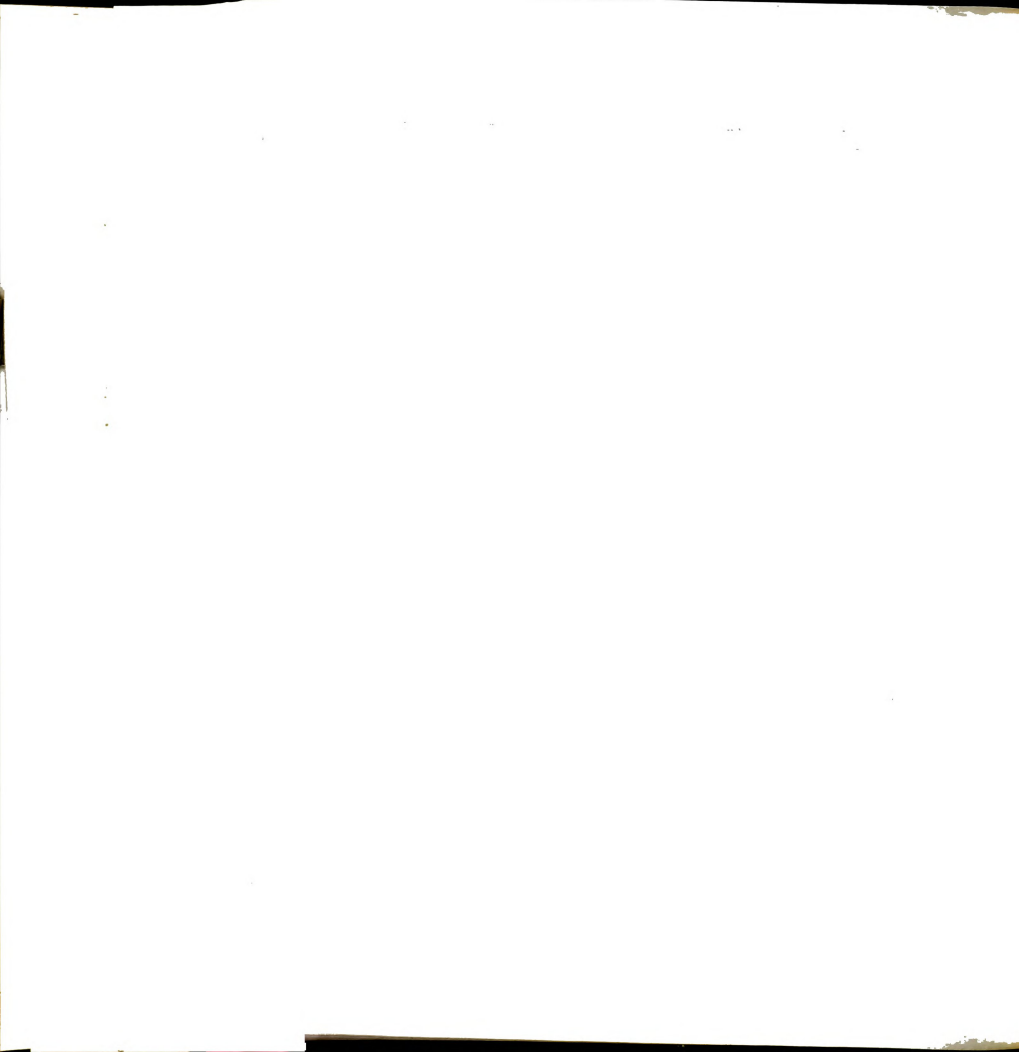
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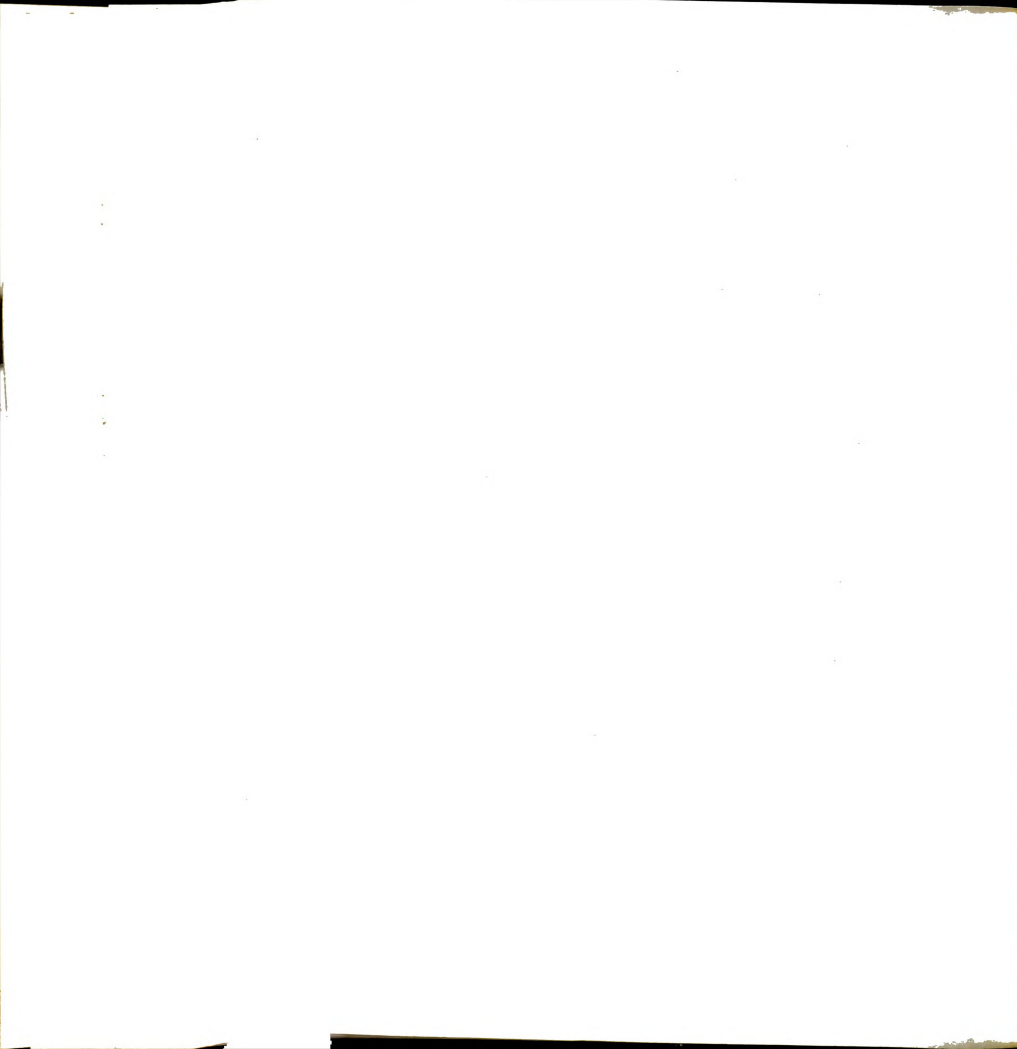
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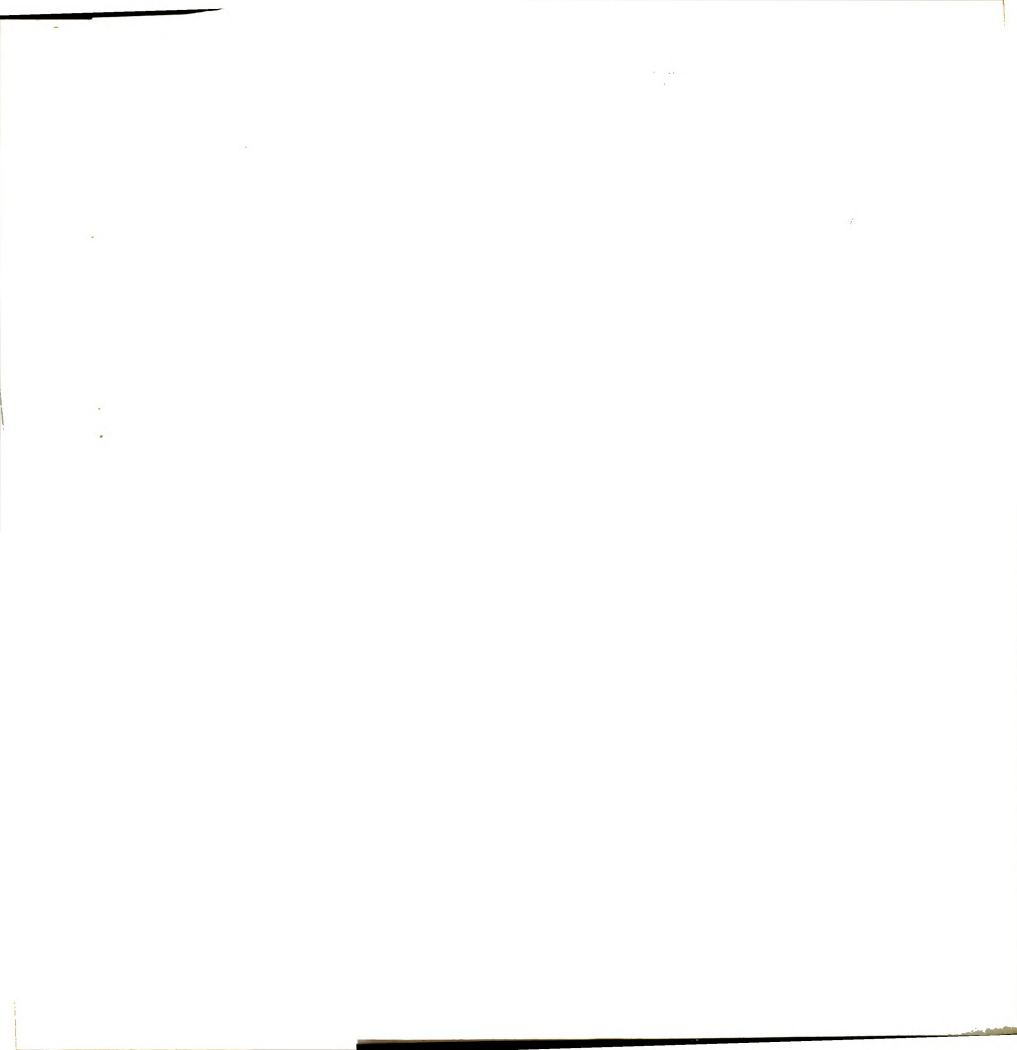
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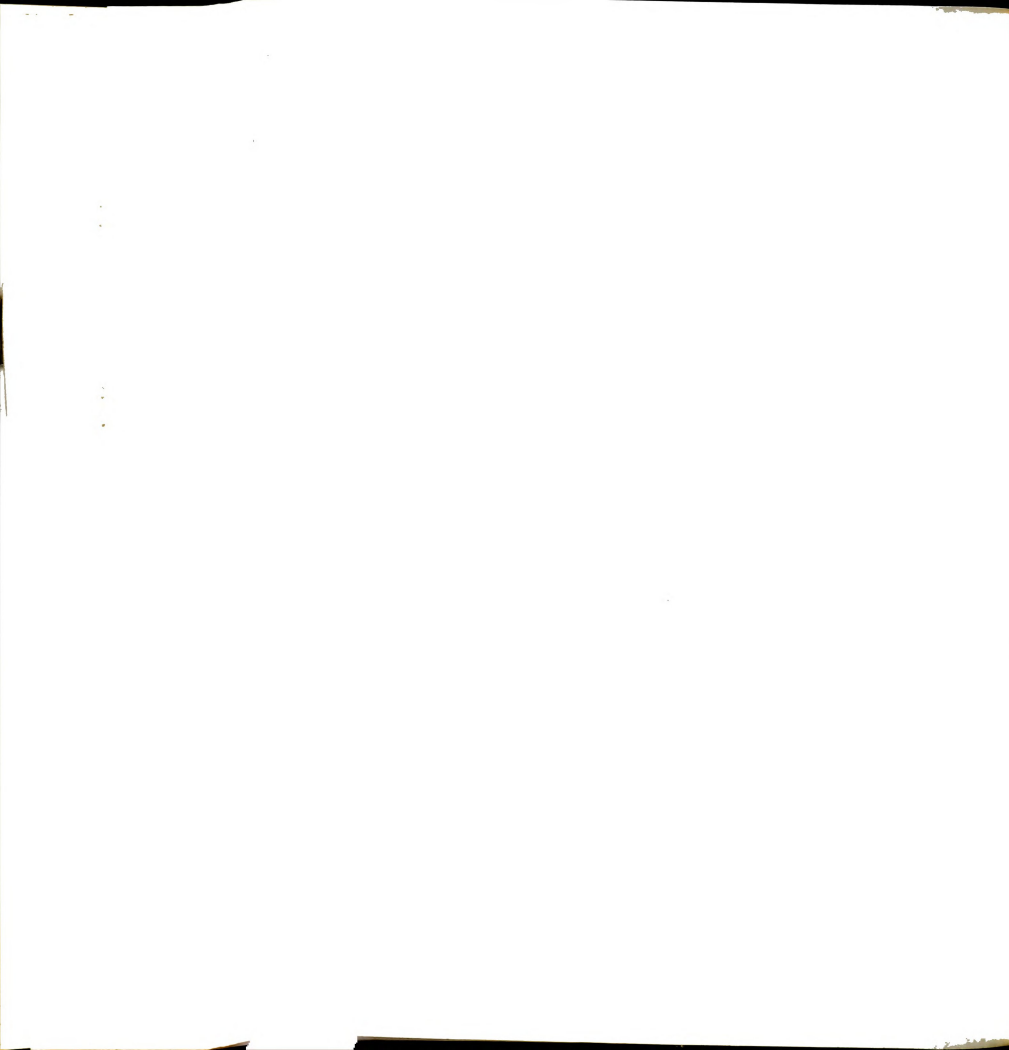


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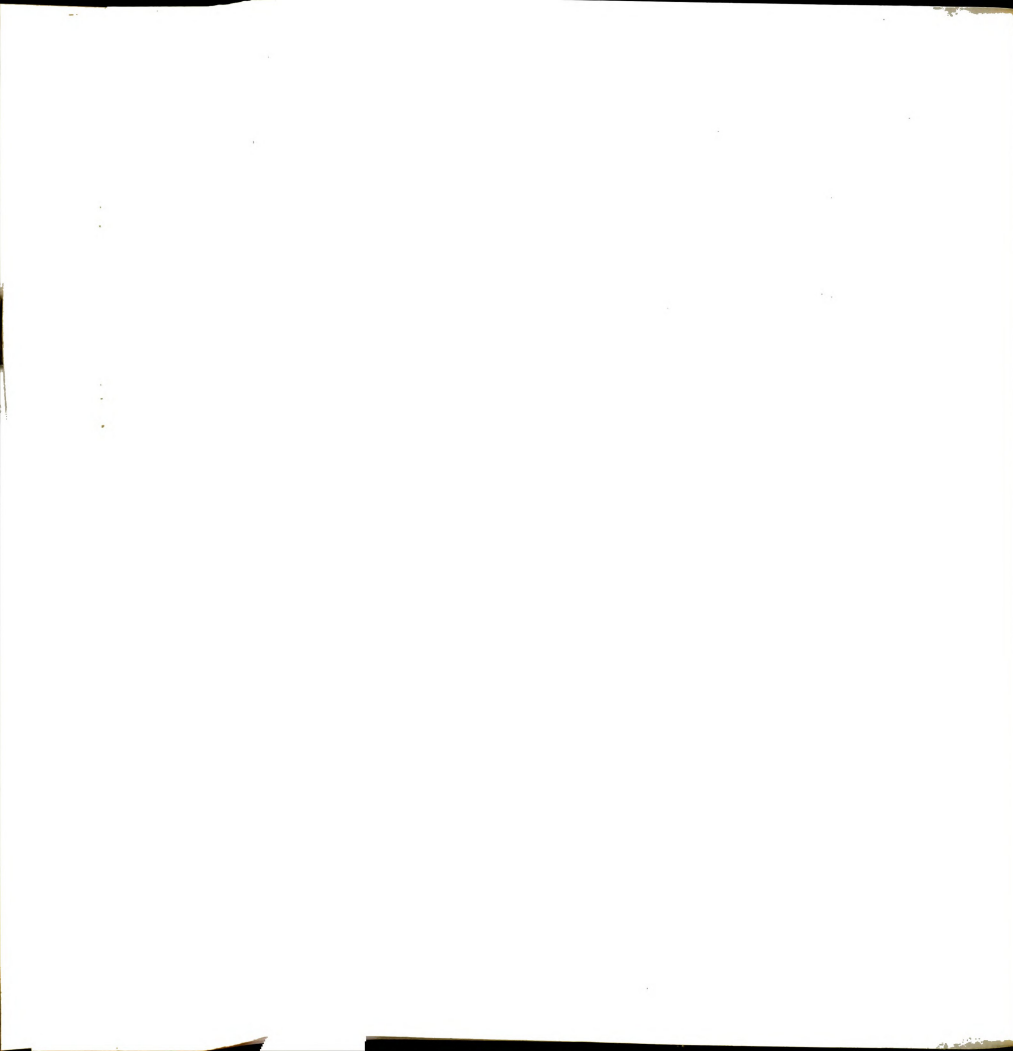
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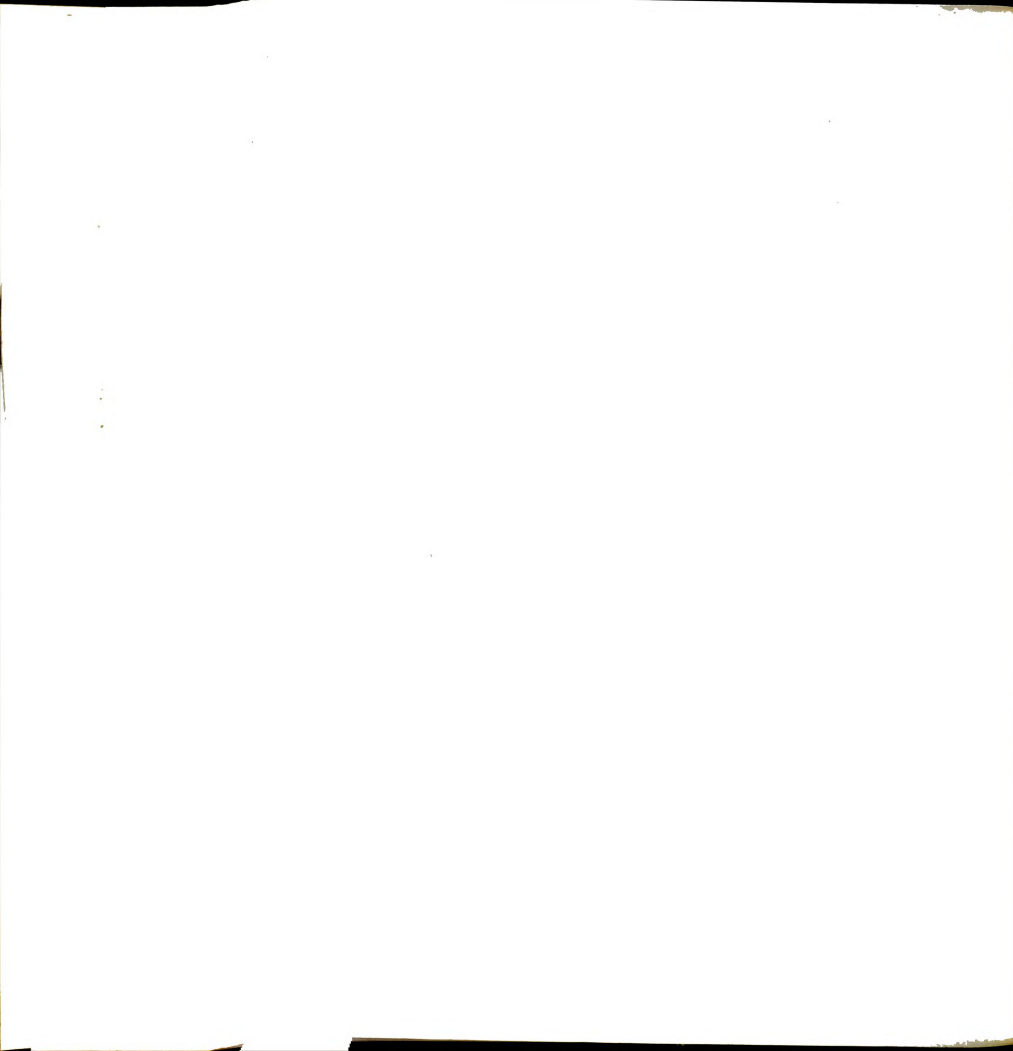
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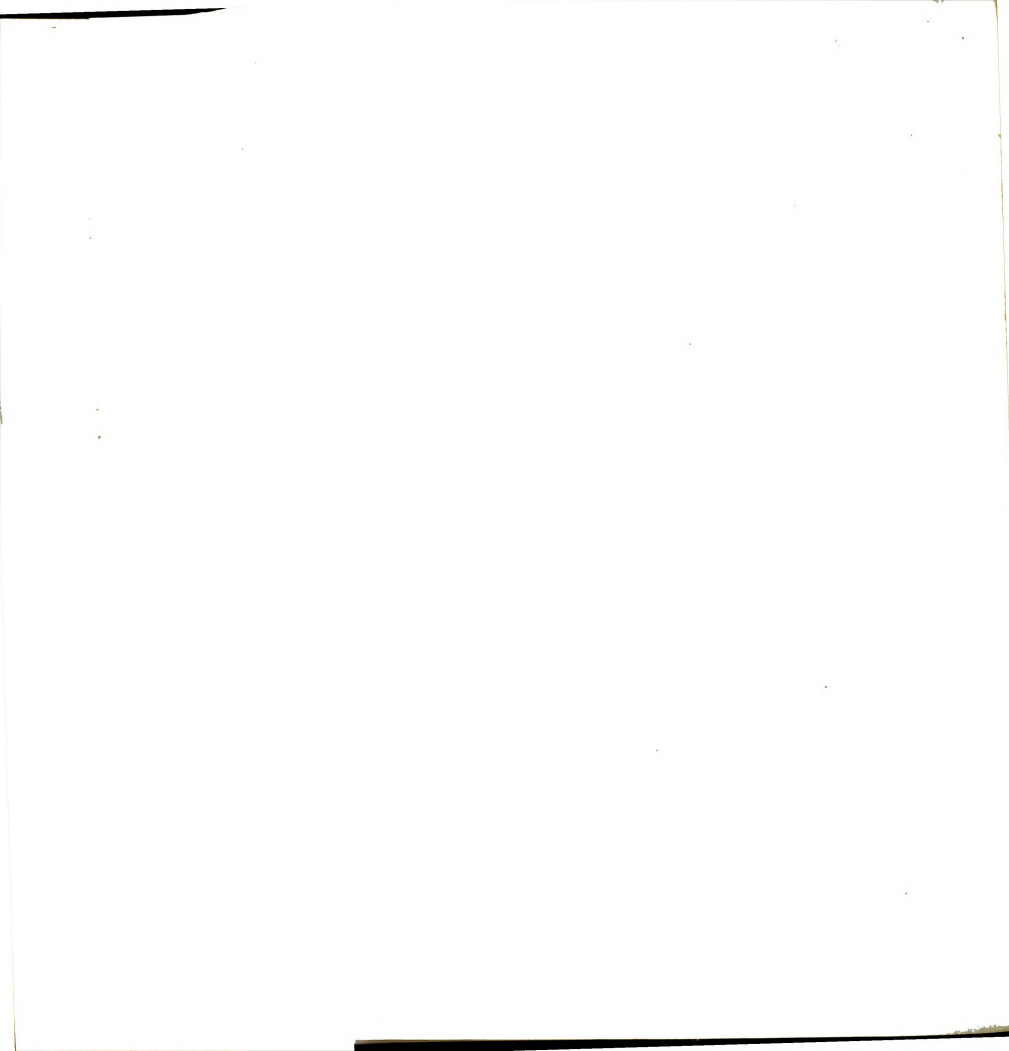
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