1976

The Changing Organization of Agriculture in the Southern San Joaquin Valley, California.

Steven John Zimrick
Louisiana State University and Agricultural & Mechanical College

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The Louisiana State University and
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Ph.D., 1976
Social Geography

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ABSTRACT

An area that has been largely neglected in the investigation of agricultural activities has been the role of the spatial and economic organization within the agricultural system. This area has become increasingly important when one considers the complexity of patterns and organization brought about by highly productive land, the erosion of transportation barriers, and the influence of government and producer groups in the direction of production and distribution.

This study deals with three commodity producing systems: dairying, citrus, and cotton, in the important agricultural region of the southern San Joaquin Valley, California. Each of these systems has its own history and organization, each is extremely important in the economy of the region, and the products of each appeal to particular types of consumers.

Among the points considered in the study were the role of the physical environment in the initiation, development, and growth of the system, the differences and similarities among the systems in terms of farm location, structure and size, comparisons and contrasts among the systems in the location and arrangement of processing.
facilities, types of processing activities, the organization of processing, and the factors involved in the location and distribution of markets, the organization of marketing, and the linkages between processor and market.

Although certain components, such as transportation development have affected agriculture in the region in general, each of the systems studied manifested peculiarities of development, size, and distribution of elements within each system. These have been due to the nature of the commodities, the adaptability of the technology to the systems at different times, and the markets served. Comparisons among the systems at any particular period show contrasts in size of farm operation, processing service areas, and market areas and means of commodity transport. Certain similarities existed. All systems were noted for grower choice in the means of processing and marketing. There were close links in all systems between processors and marketing firms, and the marketing of goods was controlled by relatively few organizations.
CHAPTER I

INTRODUCTION

The Organizational Background

Geographers concerned with agriculture have pursued their interests in a number of ways. Some have stressed the theoretical aspects of agricultural location, based on the work of J. H. von Thunen.\(^1\) Others have focused on the cultural impress made by different groups on land use and landscape patterns.\(^2\) Still others have concerned themselves with the regionalization of agricultural systems at varying scales. For example, Whittlesey studied the entire world, subdividing it into a series of regions based on agricultural types. Baker and Elliot regionalized agriculture in North America, while studies of smaller regions have been undertaken by a number of other geographers.\(^3\)

Traditional approaches taken by many geographers have been the investigation of relationships between


agriculture and the physical environment, and crop and livestock patterns and combinations. Consequently, a topic that has been largely neglected is the role of economic and spatial organization outside the sphere of farm and crop patterns. There have been exceptions; Durand stressed the role of processing and marketing in a number of his works on the dairying industry in the United States, as did Colby in his works on the fruit industry of North America. Nevertheless, a balanced consideration of the agricultural system has been largely ignored, despite its increasing importance in modern agriculture. Considering the complexity of patterns and organization brought about by highly productive land, the erosion of transportation barriers, the increasingly varied tastes of consumers, and the influence of government and producer groups in determining production and distribution, a study of the changing organization of agriculture is much needed.


One area noted for highly developed, modern agriculture is California. Combinations of soil, climate, growing season, and relief have laid the physical foundation for the production of over 200 different commodities, all of which help to bring California the highest income from agriculture of any state.

The most productive region within California is the San Joaquin Valley. Over sixty commodities are produced, accounting for almost half of California's agricultural income. The San Joaquin Valley, encompassing the southern two-thirds of the Great Central Valley, is a relatively featureless plain of deep alluvial soil, bordered on the west by the Coast Ranges and on the east by the Sierra Nevada, the source of great supplies of irrigation water. Rainfall is light, ranging from five to fifteen inches, most of which falls in the winter months. The Valley has moderate winters and hot summers, and a growing season of 250-300 days.

The move toward agricultural primacy in the Central Valley dates from the nineteenth century. Beginning with the Gold Rush, agricultural production spread southward from the northern limits of the Valley, and by 1889 half the irrigated acreage in the state was located there. Important irrigated crops were fruits and alfalfa, with

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additional large acreages devoted to dry-farmed grains, such as wheat and barley.

Fruits have maintained their importance in the region; by 1954 half the fruit acreage in the state was located in the Valley. The area also has gained dominance in the production of livestock and livestock products, as well as in vegetable production. Cotton also has emerged as a major crop in the southern half of the Valley, and today the overwhelming majority of cotton acreage in the state is located there. Often grown in rotation with field crops such as alfalfa, wheat, and barley, cotton has helped to stabilize acreages of these crops as well.7

One important characteristic of California agriculture is specialization; many farmers concentrate on only one or two crops.8 Since most commodities have their own particular schedule of planting, cultivation, and harvesting, considerable expertise in production and management is needed. Moreover, the speculative nature and perishability of many crops calls for a thorough knowledge of processing and marketing patterns, as changes in market


8 In 1969 ninety percent of California farms were classed as "specialized" by the Bureau of the Census. A farm is considered "specialized" if more than fifty percent of farm income is from a commodity or commodities in one of the several census categories. U.S., Department of Commerce, Bureau of the Census, United States Census of Agriculture: 1969, vol. 1, Area Reports, pt. 48, California, sect. 1, Summary Data, Appendix A.
demand can affect agriculture radically within a short period. In fact, the twentieth century farmer is much more likely to suffer decline in income from falling prices than from natural hazards.9

The emphasis on specialization is responsible for a large variety of agricultural systems which are complex, conditioned by a number of physical, social, and economic factors, and are often difficult to classify. Components of most systems include attributes of the physical environment, farm structure and arrangement, cultivation practices, and crop patterns, as well as the spatial and economic organization of processing and marketing.10

9Arthur Shultis, Agriculture in California (Berkeley: University of California Agricultural Experimental Station Circular Number 474, [1959]), p. 9.

10Several recent works have dealt with agricultural systems, and there is little agreement on the numbers or importance of components within the system. While Duckham and Masefield place major emphasis on the relation between the physical environment and commodity production, Morgan and Munton stress the importance of the individual farm, although linking the farm unit with processing, transportation and marketing. A recent article by Spencer and Stewart gives a very comprehensive survey of agricultural systems, and gives equal exposure to a number of factors from cultural organization and land use through the marketing pattern. See A. N. Duckham and G. B. Masefield, Farming Systems of the World (New York: Praeger, 1969); W. B. Morgan and R. J. C. Munton, Agricultural Geography (New York: St. Martin's Press, 1971); Joseph E. Spencer and Norman Stewart, "The Nature of Agricultural Systems," Annals of the Association of American Geographers 63 (December 1973): 529-544.
Statement of Purpose

One portion of the San Joaquin Valley which lends itself to the study of agricultural systems is the southern third of the region, consisting of the valley segments of Kern, Kings, and Tulare counties (Figures 1 and 2). Over sixty commodities are produced in the area, thirty of which account for over one million dollars in value per year (Table 1).

For the most part, our knowledge of the agricultural complex in this region is limited to descriptions of California agriculture in general, and such descriptions deal primarily with the production of specific commodities rather than with the organization of the agricultural system. The purpose of this dissertation is to describe and compare the systems for several of these commodities, focusing on the formation and alteration of the systems through time.

The study deals primarily with three commodity producing systems: dairying, cotton, and citrus. Each has its own history and organization, each is an important segment of the economy of the region, and the products of each appeal to particular types of consumers.

Dairying

Dairying became firmly established in the southern San Joaquin Valley in the latter part of the nineteenth century and continued to flourish as an enterprise in
Figure 1: Reference map: Southern San Joaquin Valley.

Figure 2: Location map: Southern San Joaquin Valley.
Source:—Lantis, Karinen and Steiner.
Table 1

Value of Leading Agricultural Commodities, Southern San Joaquin Valley, 1973

<table>
<thead>
<tr>
<th>Crop</th>
<th>Value (Millions of dollars)</th>
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<tr>
<td>Cotton</td>
<td>289.3</td>
</tr>
<tr>
<td>Livestock and poultry</td>
<td>193.1</td>
</tr>
<tr>
<td>Grapes</td>
<td>185.0</td>
</tr>
<tr>
<td>Milk</td>
<td>123.9</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>107.2</td>
</tr>
<tr>
<td>Citrus</td>
<td>76.4</td>
</tr>
<tr>
<td>Potatoes</td>
<td>76.1</td>
</tr>
<tr>
<td>Barley</td>
<td>31.1</td>
</tr>
<tr>
<td>Almonds</td>
<td>30.9</td>
</tr>
<tr>
<td>Plums</td>
<td>21.8</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>21.3</td>
</tr>
<tr>
<td>Olives</td>
<td>17.8</td>
</tr>
<tr>
<td>Walnuts</td>
<td>17.2</td>
</tr>
<tr>
<td>Carrots</td>
<td>16.9</td>
</tr>
<tr>
<td>Lettuce</td>
<td>14.6</td>
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</table>

conjunction with the cultivation of alfalfa, tree, and vine crops. Recently, dairying has become a more specialized operation with less emphasis upon other crops. Herd size has increased and dry-lot operations emphasized. The farmstead has undergone marked rearrangement, and milking procedures have changed dramatically. Processing plants evolved from small cheese and butter factories into large plants manufacturing a greater variety of products. Dairy products formerly went to market by rail, but milk and manufactured dairy products now travel by refrigerated truck to markets throughout California, particularly to the San Francisco and Los Angeles areas. In 1973 over 400 dairies yielded products valued at almost 124 million dollars.\(^\text{11}\)

**Citrus**

Commercial citrus production began in the 1890s and was localized in the relatively frost-free districts along the eastern side of the Valley. Most early citrus farms were small, usually not more than ten acres, but operations have increased in size and diversity, with many growers now farming subsidiary acreages of other crops, such as deciduous fruits and nuts. Citrus cultivation focuses on

permanently planted acreage, and modern cultivation and harvesting practices call for a limited implement inventory. Processing activities are oriented primarily around grading and packing fruit, although some fruit is sent to processing plants for conversion to fruit based products. Packing houses have evolved from small, hand-packing concerns into highly automated houses with much greater capacity. Citrus always has had a wide market, much of it in distant parts of the country and overseas. Formerly, shipping to markets was by train, but now rapid transport is carried out by refrigerated truck, as well as by rail. In 1973 over 118,000 acres planted to citrus returned over 76 million dollars.12

Cotton

Large scale cotton production began in the San Joaquin Valley in the 1920s. Initially, cotton growing was restricted to the eastern side of the Valley, but improvements in irrigation technology permitted expansion into the western portions of the Valley. Generally, cotton is grown with other crops, particularly alfalfa, small grains, and vegetables. An annual cycle of cultivation includes field preparation, planting, thinning, and harvesting, all relying heavily on machinery. Ginning and seed-crushing facilities have increased in size and capacity, as well as number. In contrast to the other

12 Ibid.
commodities, ginned cotton is a non-perishable crop, without the need for rapid transportation or refrigeration. Although most of the cotton produced in the region is shipped overseas, some is sent to mills in the United States. In 1973 more than 565,000 acres planted to cotton in the three county region produced a crop valued at more than 289 million dollars.\textsuperscript{13}

\textbf{Dimensions of the Study}

This dissertation proposes to consider the following points.

1. The role of the physical environment in the initiation, development, and growth of each of the three systems of agricultural production.

2. The differences and similarities among the systems in terms of farm location, structure, size, distribution, and cultivation practices.

3. Comparisons and contrasts among the systems in the location and arrangement of processing activities, types of processing activities, the organization of processing, and the linkages between farm and processor.

4. The factors involved in the location and distribution of markets, the organization of marketing, and the linkages between processor and market.

\textsuperscript{13}Ibid.
In order to give an added dimension to the study, the development of the systems from their formative periods will be undertaken, for:

Without the perspective afforded by a knowledge of the developments leading up to it, the present lacks a vital dimension and certainly the future can be projected with little assurance. The absence of a time-range concept compresses expanding novelties together with fading relics into a common flatness. The geographical scene is likely to be regarded unconsciously as fixed and changeless when actually it is in a constant state of flux.\textsuperscript{14}

The "constant state of flux" certainly can be seen in the three agricultural systems under investigation. At the individual farm level for example, size of holding and methods of cultivation have continually changed over the past century. Changes have been made in processing to alter commodities into new and varied products, as well as to increase volume and efficiency. Linkages between farm and processor and processor and market have undergone alterations to take advantage of new types of transport and technical innovation.

It would be false to state that changes in the three systems occurred simultaneously, thereby allowing precise comparisons for a particular period. Nevertheless, perspectives on contemporary patterns may be gained by focusing on past chronological periods.

The basic settlement and transportation pattern in the region had been laid down by the end of the first

\textsuperscript{14}Fred Kniffen, "Geography and the Past," Journal of Geography 50 (March 1951): 126-129.
decade of the present century. By that time irrigated agriculture had become firmly established, and agricultural products found important markets outside the region. Mechanization was not yet widespread, consequently farm traction as well as most of the transportation within the region relied on animal power, affecting both the structure of the farm and the range of transportation.

By the end of the fourth decade of the twentieth century mechanization was well established, altering transport patterns and cultivation practices. Technical advances were made in irrigation and refrigeration, and processing facilities had increased output and in some cases altered products.

**Hypothesis**

The hypothesis of this dissertation is that the various agricultural systems have evolved different patterns of structure and organization, and that these differences are manifest at different levels within each system.

**Framework**

The remainder of the dissertation is divided into five chapters. One chapter discusses the background to development in the region. While a number of factors have been of importance in cementing the agricultural framework in the Valley, the development of transportation, settlement networks, and, in portions of the study area,
landholding patterns have been very influential in the construction of the contemporary landscapes of the area. A chapter is devoted to each of the agricultural systems under investigation, focusing on the evolution of the particular commodity system, and a concluding chapter compares and contrasts the components of the systems.
Numerous factors have been important in forming the spatial framework of agrarian activities in the San Joaquin Valley. Among the most important were the development of irrigation, the evolution of large scale holdings, and the development of the urban pattern and transportation network.

The Development of Irrigation

California was ceded to the United States in 1848, the same year gold was discovered near Sacramento. Shortly thereafter, small groups of settlers, many of them disillusioned miners, pushed into the southern San Joaquin Valley from the north. Minor irrigation projects were started near Visalia in 1853 and near Bakersfield in 1858. The economic impact of the projects proved negligible however, for the economy of the area during this period centered on the grazing of sheep and cattle.¹

A substantial influx of settlers began with the introduction of the railroads in the 1870s. Wheat became an important cash crop, and much of it was grown on large holdings formerly devoted to grazing. It soon became apparent, though, that returns from wheat or grazing were low when compared to those for irrigated fruits and alfalfa, and this realization led to large scale irrigation projects.\(^2\)

Such projects usually were financed through private corporations or farmer cooperatives. In some cases farmers formed cooperatives to build irrigation works, apportioning construction work and costs among the members. In other instances large landholders or groups set up irrigation companies, built systems of water distribution, and sold water from their canals to individual growers. Many of these undertakings were extensive and very costly; in some cases the canals were as much as thirty-five miles in length.\(^3\)

Early irrigation depended primarily upon surface water. In 1910 over ninety percent of the irrigated acreage was watered by flow from Sierran streams, with wells providing water for the remaining acreage. Since artesian water was available at favored sites on several alluvial

\(^2\)Ibid.

fans, some growers invested in artesian wells. Most wells, however, were pumped, the power provided by wind, steam, gas, or electricity. The majority of the wells were relatively shallow, extending in depths to 200 feet and costing less than 100 dollars to drill. A few, though, were larger, extending to more than 1,000 feet in depth and costing over 3,000 dollars to drill.4

Important as part of the settlement fabric in the region were a number of agricultural colonies which relied heavily upon irrigation. For the most part, they were started by landholding companies which divided one to five thousand acre tracts into blocks of ten to forty acres. A number of colonies were formed between 1870 and 1920, some of which were thriving undertakings that laid the foundations for contemporary communities such as Dinuba, Wasco, and Shafter. Poor location and poor management practices caused others to fail.5

During this period almost all agricultural and settlement activity occurred on the east side of the Valley. Fertile soils were abundant, water was available, and rail transport connected this portion of the region with points

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outside the Valley. The relative economic importance of
the east side during this period is illustrated by land
prices; land with good soils, available water, and proxim-
ity to the railroad sold for as much as 250 dollars per
acre. In contrast, land on the west side of the Valley,
blessed with fertile soils but lacking water or transport,
brought but twenty dollars per acre.\(^6\)

During this period most agricultural commodities
were grown for shipment out of the Valley. The most
important crops were deciduous fruits, particularly
peaches, apricots, grapes, and oranges. Dairying also
was an important activity, feed for dairy cattle being
supplied from a large acreage of irrigated alfalfa.
Barley and wheat were grown on land not suitable for irri-
gation, but the quality of the dry-farmed grain was poor,
and most if it was cut for hay before it reached maturity.\(^7\)

Irrigation in the Valley increased in scale and
complexity through time. From the late nineteenth century
until the late 1940s, irrigation water flowed only from
Sierra Nevada streams and from wells, both uncertain
sources. Surface water depended upon winter precipitation
in the catchment areas of streams and rivers, which often
proved variable, and the overuse of groundwater rapidly

\(^6\)U. S., Department of Agriculture, Bureau of Soils,
Reconnaissance Soil Survey of the Upper San Joaquin Valley,
California, by J. W. Nelson, Field Operations of the Bureau

\(^7\)Ibid.
reduced the underground supplies.

Probably the greatest reason for the depletion of irrigation water was the excessive use of groundwater. From 1919 to 1929 the capacity of pumped wells in the southern half of the Valley nearly trebled, and by 1929 the pumping capacity was almost twelve times as great as the average stream flow from the Sierra Nevada in July and August. Such heavy use took its toll and by 1936 20,000 acres of highly developed land had been abandoned because of the falling water table and water was being overdrawn on more than 400,000 acres.8

Beginning in 1933, an irrigation project combining both state and federal resources and financing was approved, and full control was turned over to the Department of Interior's Bureau of Reclamation in 1935. This Central Valley Project consisted of a network of dams and canals that permitted water from the Sierra Nevada and Cascade Mountains to be used for irrigation in both the Sacramento and San Joaquin Valleys. Project work started in 1938, was slowed by World War II, but was completed by the early 1950s. The part of the project affecting the southern San Joaquin Valley most directly, the Friant-Kern Canal, was completed in 1951. This canal carries water from Friant Dam near Fresno via the east side of the Valley to

Bakersfield. Although it supplemented existing irrigation districts rather than opening new irrigated regions, its waters increased irrigated acreage sharply (Figure 3).\(^9\)

While the Friant-Kern Canal served the east side of the Valley, other facilities were developed along the west side to supply the dry, but inherently fertile soils found there. During the late 1940s, the development of large turbines, capable of lifting water from great depths, allowed the tapping of water supplies in deep formations at depths down to 4,000 feet.\(^10\)

Recent additions to the irrigated acreage in the southern Valley have been facilitated by the California Aqueduct. This section of the California Water Project, a recent state-federal project brings water from the Sierra Nevada. It transfers water from Northern California to Southern California via a system of canals, reservoirs, and pumping units located along the west side of the Valley (Figures 4 and 5). In Kern County a massive pumping unit sends water across the Tehachapi Mountains into southern California. Work commenced on the project in 1959; by 1969, it was serving the west side of the San Joaquin

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Figure 3: Irrigated acreage, Southern San Joaquin Valley, 1890-1973 (millions of acres).

Figure 4: The San Luis Reservoir on the west side of the San Joaquin Valley. This reservoir is part of the California Water Project, and stores water during the winter and spring for release to irrigation districts and urban regions during the summer and autumn.

Source.—California Department of Water Resources photo.
Figure 5: Looking south, the California Aqueduct paralleling the Coast Range on the west side of the San Joaquin Valley. The aqueduct delivers irrigation water to the San Joaquin Valley and municipal supplies to Southern California.

Source.—California Department of Water Resources photo.
Valley. Although the project allowed new acreage to be developed, the water is expensive, increasing in price as it travels from the project source region. Project water sells in Kern County for 25 to 35 dollars an acre foot, compared to 8 to 15 dollars for water from Sierran streams.  

Under such high water costs, economic survival depended upon high value crops. Studies have shown that high value crops, such as fruits, nuts, vegetables, cotton, and alfalfa can return profits enough to pay the high charges for water. It has been estimated that by 1980 over 65,000 acres of fruits and nuts, 108,000 acres of vegetables, 51,000 acres of cotton, and 36,000 acres of alfalfa will be added to the region served by the project.  

From these large scale canals the water is delivered to individual farms by smaller canals and then applied to the fields by furrow.

One method of irrigation which is increasing in importance is sprinkler irrigation. Some citrus acreage in the region was irrigated by sprinkler as early as 1935, but not until the 1950s did other crops begin to utilize

11Ron Harley, "Kern County," Farm Quarterly (Summer 1970): 44.

the system. Most row crop acreage continues to be irrigated by the furrow method (Figure 6), and many field crops (such as alfalfa and small grains) are usually irrigated by flooding, but sprinkler irrigation is increasingly important in the irrigation of vegetable, cotton, and citrus acreage. In 1960 less than five percent of the irrigated acreage in the region was watered by sprinkler, while today the total stands at almost twenty percent. Approximately 25 percent of the cotton in Kern and Kings counties is irrigated by sprinkler, as is almost 50 percent of the citrus in the region. The initial cost of a sprinkler system is high, but it is labor saving, an efficient user of water, and obviates expensive land leveling in many instances. A high percentage of the sprinkler systems have been installed in newer agricultural districts (Figure 7).

The Dominance of Large Scale Agriculture

Agriculture in the southern San Joaquin Valley is renown for the large scale of many of its agricultural operations. This is not a recent phenomenon, since large scale agriculture has been common since the inception of


14Communications from James Stockton, Commissioner of Agriculture, Kern County, Bakersfield, California, 18 June 1974; Gene Deal, Commissioner of Agriculture, Kings County, Hanford, California, 22 June 1974; and Elvin Mankin, Commissioner of Agriculture, Tulare County, Visalia, California, 3 July 1974.
Figure 6: Cotton being irrigated by the furrow method. This is the most common method of irrigation in the San Joaquin Valley. It is particularly important for the irrigation of row crops.

Source.—California Department of Water Resources photo.
Figure 7: A mobile sprinkler irrigation system irrigating newly planted vegetables. This method of irrigation is becoming increasingly popular in the region, particularly in the areas of recent agricultural expansion.

Source.—Rain Bird Sprinkler Irrigation Systems photo.
American settlement, beginning in the second half of the nineteenth century.

Perhaps the most important factor in the formation of large scale agriculture has been the generous disposal laws of the federal and state governments, permitting the acquisition of large landholdings. Among these have been the Swamp and Overflow Land Act of 1850, the Homestead and Railroad Acts of 1862, and the Desert Land Act of 1877. 15 Although much of the land alienated under these acts was acquired legitimately by individuals, large portions were not. The absence of land classification information, inadequately informed government officials, lax administrative practices, and outright fraud combined to produce large landholdings, with much of the land going directly or indirectly to only a few persons. 16 Between 1862 and 1880 federal land sales in California often amounted to more than half the sales of the entire country, and much of this went to large speculators. In fact, during the 1860s over one and one-quarter million acres were acquired by five individuals. 17


The Swamp Land Act conveyed to the various states all the swamp and overflow land within their boundaries. These lands were relatively useless in most of the western states, but not so in California. Many large tracts had the appearance of being swamp and overflow land during the rainy season but actually could be cultivated for nine or ten months of the year even without drains or other reclamation works. Perhaps the most notable case of fraud associated with this act was that of one individual who reportedly hitched a team of horses to a skiff and had himself pulled over a vast tract of land so he could swear that he had travelled over the property by boat.  

In the case of the Homestead and Desert Land Acts, parcels of land, varying in size from 160 to 640 acres, had to be settled and improved by the homesteader. By falsifying entry forms and buying the homestead lands of actual settlers for a nominal price, other large holdings were built up by various individuals.  

The Railroad Act of 1862 granted railroads alternate, odd-numbered sections of land for ten miles on each side of the road. This distance was increased to twenty miles in 1864. By 1876 the Southern Pacific Railroad had acquired 329,063 acres in Fresno and Tulare counties (which then included Kings County), and in 1879, with additions in  

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19Wilson and Clawson, p. 12.
Kern County, their holdings had increased to 858,220 acres. The Southern Pacific continues to control large acreages. In 1973 it was the largest private owner of land in California, holding altogether approximately 2,411,000 acres of land.\(^2\)

The early rise and subsequent dominance of these large landholdings created a pattern of tenure which has dominated the region to the present. Although few of the landholdings of 50,000 acres or more persist, a high percentage of land in the southern San Joaquin Valley has remained in blocks of 2,000 acres or more. In numbers the small farm units predominate, but in agricultural acreage large operations hold a dominant position, particularly in the central and western part of the region.

The preponderance of irrigated acreage in Kings and Kern counties also lies with the large operations, particularly those over 1,000 acres (Figure 8). Because of its history of small-farm settlement on the alluvial fans of the Sierra Nevada streams the pattern is somewhat different for Tulare County, where a great number of small citrus and deciduous fruit operations exist even today. Northern Kings County also has been associated with small operations, but this small-farm image dulls in the light of the large irrigated operations in the southern part of that county.

Figure 8: Farm size and irrigated acreage, Southern San Joaquin Valley, 1969.

Source.—U.S., Department of Commerce, Bureau of the Census, United States Census of Agriculture: 1969, vol. 1, Area Reports, pt. 48, California, Sect. 1, Summary Data, pp. 113-128, 417-424. This figure portrays the relative importance of the different sized operations. Data are for irrigated farms having a gross income of more than 2,500 dollars per year.
Interestingly enough, almost one-fifth of the operations in Kern County are over 1,000 acres in size, and three-eighths exceed 500 acres.

The Transportation Network and Urban Settlement

The relative isolation of the southern San Joaquin Valley crumbled as transportation connections were made with other sections of the state. Beginning in 1854 a number of stage-coach operations linked the southern San Joaquin Valley to both San Francisco and Los Angeles. Although most of these lines were local, the Butterfield Overland Mail used the San Joaquin Valley on its route between Missouri and San Francisco. Such lines served the Valley until completion of the railroad to Los Angeles in 1876, after which stagecoach transportation withered. 21

The railroad had a dramatic effect on the Valley, in both the evolution of transportation patterns and urban development. Initial penetration was a combined effort by the Central Pacific and Southern Pacific Railroads. Construction by the Central Pacific began in 1869 near Stockton, in the northern San Joaquin. By August of 1872 the railhead had progressed to midway through Tulare County, to juncture with the Southern Pacific. The railroad reached the northern boundary of Kern County in 1873, a year

later it was in the vicinity of Bakersfield, and the final leg was completed to Los Angeles via the Tehachapi Pass by 1876. 22

A second major line was built by the Sante Fe Railroad. It began in Stockton in 1896, and arrived in Bakersfield in 1898. There it joined the Southern Pacific, and they shared the track across the Tehachapi Mountains. 23

The network was fleshed out when a number of subsidiary lines were built throughout the region by the Southern Pacific and Sante Fe Railroads. A series of electric rail lines served the Tulare County citrus district but these were short lived. The railroads also were extremely important in the evolution of the urban settlement pattern in the region. With the exceptions of Visalia, Porterville, and Bakersfield, which were founded in the 1850s and 1860s, almost all agricultural towns in the region owe their existence to the railroads (Figure 9). 24

By the last decade of the nineteenth century, the three counties began to improve their road networks. Improvement consisted mainly in grading, with oiled roads gradually coming into use. The township and range system,


23Ibid.

Figure 9: Rail network, Southern San Joaquin Valley.

together with the flat topography, led to placing most roads along township and section boundaries, resulting in a rectangular road pattern which persists to the present.

A surge in automotive type transportation began in the second decade of this century (Table 2) and was accompanied by a sharp improvement in the network of highways (Figure 10). Again, we find the influence of the railroad, for the primary north-south highway through the Valley developed along the main line of the Southern Pacific Railroad. At Bakersfield the highway left the railroad and turned southwest, passing through Tejon Pass to the Los Angeles area. This section of the highway was paved in 1919, which greatly facilitated travel from Los Angeles into the San Joaquin Valley. Improvements and additions to the basic highway network have continued. The main artery through the central part of the region (Highway 99) has, in stages, become a limited access road. A second limited access highway (Interstate 5) was completed in 1971. It connects Southern California with regions to the north, and skirts the west side of the Valley (Figure 11).

Summary

Several factors have been important in the development of agricultural in the southern San Joaquin Valley. Irrigation was introduced in the mid-nineteenth century and was, in large part, responsible for the production of a

25 Miller, pp. 440-442.
Table 2

Motor Vehicle Registration, Southern San Joaquin Valley, 1918-1930

<table>
<thead>
<tr>
<th>Year</th>
<th>Kern</th>
<th>Kings</th>
<th>Tulare</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1918</td>
<td>4,875</td>
<td>1,943</td>
<td>3,729</td>
<td>10,547</td>
</tr>
<tr>
<td>1923</td>
<td>22,921</td>
<td>7,151</td>
<td>21,564</td>
<td>51,636</td>
</tr>
<tr>
<td>1930</td>
<td>32,727</td>
<td>6,582</td>
<td>17,915</td>
<td>57,494</td>
</tr>
</tbody>
</table>

Sources.—California, State Board of Equalization, Report of the State Board of Equalization for 1918 (Sacramento: State of California, 1919); California, State Department of Motor Vehicles, First Biennial Report of the California State Department of Motor Vehicles (Sacramento: State of California, 1931); California, State Board of Equalization, Report of the State Board of Equalization for 1930 (Sacramento: State of California, 1931).
Figure 10: Rural road network, Southern San Joaquin Valley, 1916-1917.

Figure 11: Limited access highways, San Joaquin Valley, 1973.

Source.—Lantis, Karinen, and Steiner.
number of high-value crops. Technological improvements and large-scale irrigation projects have been important in opening new acreage for agricultural utilization and stabilizing older farming districts.

Specialized, large-scale production is another feature of the region. Although in numbers small farm units predominate, much of the agricultural acreage is farmed by operations of 2,000 or more acres in size. This is particularly apparent in the central and western part of the study region.

During the late nineteenth and early twentieth centuries transportation and settlement focused on the railroad. By the third decade of the twentieth century though, a highway network had been laid, and became increasingly important in the movement of agricultural commodities. Improvements and additions to the basic highway pattern have continued, and today the area is linked to Northern and Southern California by limited access roads.
CHAPTER III

DAIRYING

Early Development

Although cattle have been associated with European settlement in California from the onset, dairying had its real beginning in the mid-nineteenth century. The huge herds of Spanish and Mexican range cattle, kept primarily for their hides and tallow, were of limited value for milk production. Even if these had been "milk" cattle, the scattered ranchers would not have produced dairy products because of a lack of concentrated markets for milk products.

With the discovery of gold in California, an influx of migrants from the eastern United States swelled the state's population, and, since dairy cattle accompanied almost every wagon train, their numbers increased as well. Early migrants found that dairy products brought high prices in the mining districts; women often made more money from dairy products than their husbands did from

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prospecting. Thus, the first commercial dairy region developed in the gold-producing counties of the Sierra Nevada foothills of interior California.

A second important dairy region appeared in the San Francisco Bay area, a rapidly growing commercial center serving as a focal point for migrants arriving in California by sea. Its mushrooming population greatly increased demand for dairy products.²

These two regions, the San Francisco Bay area and foothills of the Sierra Nevada Mountains dominated dairying until the 1880s, when a shift in the location of dairying began. In 1890 nearly three-fifths of California's dairy cattle were located in these two regions, but by 1925 this proportion had fallen to less than one-third. In the remaining parts of the state, the San Joaquin Valley showed the greatest increase during the forty-five year period, rising from ten per cent of the state's dairy animals in 1880, to about one-third of the state's total in 1925.³

Several factors were responsible for the expansion of dairying in the San Joaquin Valley. Irrigation received an impetus from the wave of settlers who came to the area


during and immediately after the Gold Rush. The first irrigation scheme in the Valley was initiated in Tulare County in 1853, and a number of programs followed which utilized both the surface waters of the rivers flowing from the Sierra Nevada and underground supplies tapped by artesian wells. During the same period, alfalfa was found to be well suited to the soils in the region, and it flourished under irrigation. The dry farming of grain was the dominant agricultural activity, but its riskiness became apparent in years of low rainfall. Farmers gradually began to switch to irrigated crops, often a combination of alfalfa, deciduous fruits, and vines, with alfalfa proving to be excellent feed for cattle.

Despite the development of crops and the establishment of irrigation, large-scale commercial dairying awaited rapid and dependable transportation which began with the development of rail transport. Development of the Southern

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5Although attempts to grow alfalfa in the United States began as early as 1736, the first successful plantings were made during the 1850s in the San Joaquin Valley with a variety imported from Chile. Chilean varieties were not resistant to colder climates, and it was not until hardier varieties from other regions were imported that alfalfa culture began to spread. O. S. Aamodt, "Climate and Forage Crops," in Climate and Man: Yearbook of Agriculture, 1941 (Washington, D.C.: Government Printing Office, 1942), pp. 440-441.

6U.S. Department of Agriculture, Irrigation in the San Joaquin Valley, pp. 16-17.
Pacific network in the 1870s and 1880s and the completion of the Sante Fe line in 1898 opened markets for Valley dairy products.

The introduction of the centrifugal cream separator shortly after 1885 further encouraged dairying. Before the separator, cream had been laboriously skimmed by hand from the milk set to cool in shipping cans. The hot summers of the Valley added to the problem by preventing natural cream formation on top of the milk, but the use of the separator alleviated both of these problems, and it became widespread by the turn of the century.\(^7\)

Alfalfa: The Physical Environment

As already noted, successful cultivation of alfalfa was an important constituent of the dairy industry in the southern San Joaquin Valley, and its success depended upon several physical characteristics of the region, including climate, soil adaptability, and water availability. Although alfalfa will grow under a number of climatic conditions, it is best suited to regions having relatively arid climates, low precipitation, and mild winters. Consequently, a number of varieties have flourished in the study region.\(^8\)

\(^7\)Wallace Smith, *Garden of the Sun* (Los Angeles: Lymanhouse, 1939), pp. 533-535.
\(^8\)Aamodt, pp. 440-442.
A major reason for aridity of the area is the presence of a subtropical high pressure cell located off the coast of California. The eastern portion of this cell is noted for dry, stable, descending air which militates against atmospheric humidity and instability, and the cell also acts as an impediment against northern Pacific storms originating in the Gulf of Alaska. Added barriers to high humidity in the region are the Coast Ranges, located between the Valley and the Pacific Coast. Although most peaks only range in elevations up to about 4,000 feet the several ranges attain widths of fifty miles which aids in precluding moist maritime air from the Pacific Ocean and precipitation from Pacific storms.9

Consequently, relative humidity in the region is low; with readings on summer afternoons measuring only fifteen to twenty percent. Precipitation is also sparse; most of the area experiences less than ten inches of precipitation per year, and rarely is there rain between May and October. Aridity is doubly important since most varieties of alfalfa are affected adversely by acid soils which often form under more humid conditions, as well as diseases such as leaf spot and bacterial wilt, both of which are particularly destructive in wetter areas.10

9C. R. Elford and Max R. McDonough, The Climate of Kern County (Bakersfield: Kern County Board of Trade, 1964), pp. 3-10.

Alfalfa also flourishes under warm growing season conditions. Maximum temperatures are 75 degrees or higher from April through October, and June through September is especially hot. Bakersfield, for instance, reports 110 days per year with a daily maxima of ninety degrees or above. Combined with this warm temperature regime is a long growing season. Frosts are a regular feature of the winter, but seldom occur before December or after February, giving the region a growing season of 250-300 days. Under such favorable conditions as many as seven or eight cuttings per year are possible, on a three week to monthly basis from April to October.\(^{11}\)

The wide variety of soils in the region also suit the growing of alfalfa. The best yields are obtained on deep, friable soils of medium texture which permit efficient root development and water retention. It is grown though, on all textures from sand to heavy clay adobe, utilizing all types of young alluvial soils and a number of the older valley-filling soils.\(^{12}\)


\(^{12}\)The soils of the southern San Joaquin Valley are of three types. Old alluvial soils are found predominantly on the east side of the Valley, occupying the sloping or rolling surfaces of old, partially eroded alluvial fans or stream terraces. Young alluvial soils occupy most of the plains on the west side of the Valley as well as the fans of the streams that debouche from the Sierra Nevada. They
Many of the soils in the study region are impregnated with varying amounts of alkali, for which alfalfa is moderately tolerant. For the most part alkali is confined to areas with a high water table and is most common in slight depressions, level areas, and on very gentle slopes where ground waters carry salts in solution at depths shallow enough to allow capillary transport to the surface. This alkali-tolerance allows alfalfa cultivation in areas and on soils less suitable for more sensitive crops.

have gentle slopes and smooth surfaces, and both soil and sub-soil are generally open and permeable. Included in this category are the soils along the axis of the Valley which were laid down in the beds of lakes once occupying the area. These soils tend toward heavy texture and are very susceptible to alkali formation. A third type of soil, of limited areal extent and economic importance when compared to the alluvial soils, is wind-laid soil. Wind-laid soils result from wind action on alluvial soils and consist mainly of sand. These soils cover a small area south of Bakersfield. U. S., Department of Agriculture, Reconnaissance Soil Survey of the Middle San Joaquin Valley, California, pp. 35-38.


Soils of "moderate" alkali content possess 0.40-0.99 percent alkali, while soils with greater amounts are classed as "strong" alkali soils. There is no critical threshold of alkali concentrations. Rather, there is a gradual decrease in growth as the salt concentrations become greater. Hans Jenny, "Exploring the Soils of California," in California Agriculture, pp. 345-346.
Another important factor in the introduction and maintenance of alfalfa has been the availability of water for irrigation, since alfalfa is a heavy user of water, requiring 2.5 to 4.0 acre-feet per acre per year. In the early period of cultivation most of the water was provided from streams discharging from the Sierra Nevada. Gravity flow from the rivers and creeks was sometimes supplemented with well water, particularly in the late summer and autumn when stream flow was minimal. In some districts with high water tables the pumping of underground water served a second purpose; it lowered the water level which helped prevent the formation of alkali deposits.

Dairying: The Early Organization

The Farm

Although dairying had emerged as a notable activity by 1890, it by no means dominated agriculture. The shift to mixed-crop farms involved the production of deciduous fruits and grapes as well. On many farms dairying was carried out as an ancillary activity, with small herds

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15 The term "acre-foot" of water refers to the amount of water needed to cover an acre of land with water to a depth of one foot.

16 U. S., Department of Agriculture, Reconnaissance Soil Survey of the Middle San Joaquin Valley, California, p. 24.
comprising generally one to twelve cows.  

By the late nineteenth century the landscape of the southern San Joaquin Valley was marked by a large number of farms. Although there were differences in the arrangement and components of the farm unit, common features of the mixed-fruit and dairying operation included a residence, a large barn, sheds, a well house and corrals, with alfalfa, vine and tree crops in adjacent parcels (Figure 12).

The preparation of a field for planting alfalfa required several steps. The field was first thoroughly soaked with an acre-foot or more of water per acre which loosened the soil and flooded the burrows of badgers, gophers and squirrels. The field was then plowed, cross-plowed, harrowed, and irrigation checks constructed. The field was then seeded, with ten to twelve pounds of seeds broadcast per acre.  

Plowing and replanting on an annual basis was not needed. One seeding would suffice for as long as six years, but the gradual invasion of weeds, combined with a falling output of hay, necessitated reconditioning and

17Kathleen Small, History of Tulare County (Chicago: S. J. Clarke, 1926), pp. 323-324.

Figure 12: Early mixed crop and dairy farm in Tulare County. Farm of Thomas H. Thompson, Tulare, California, 1890.

replanting at that time. Growth was prolific; usually two to three cuttings could be made the first year and six or more per year for several years thereafter.  

For the most part alfalfa was flood irrigated using the border check method which was the most efficient and left a distinct field pattern. A check system consisted of a series of slight ridges eight to fourteen inches high, 40 to 80 feet apart, and extending in length from 250 feet to a quarter-mile. These checks were crossed at angles by other checks, forming a group of basins within the field. The size of the basin depended, for the most part, on the type of soil, with the larger basins found with heavier soils. Soil texture also dictated irrigation frequency; lighter soils required three irrigations for every two cuttings, but because of their ability to retain moisture the heavier textured soils required only one irrigation between cuttings.

Portions of the study region with particularly sandy soils were suited to a second type of irrigation, known as sub-irrigation or "seepage." Ditches one-quarter to one-half mile apart were laid across fields; water was then turned into the ditches, which then percolated beneath

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19 Ibid.  
the fields, nourishing the extensive root network of the alfalfa. Although this method of irrigation required little time and expense, the very permeable soils sometimes worked to the detriment of the farmer. During the spring and early summer, when streams and canals were particularly full, seepage beneath the fields sometimes raised the groundwater to within several feet of the surface, resulting in accumulations of salt.21

Cattle were kept in corrals, small pastures, and, particularly after the last hay cutting of the season, put out to pasture on the alfalfa fields, often joined by sheep and hogs. Although grazing was a means of applying fertilizer, the fields also were trampled destructively, particularly after a rain. Cured alfalfa was stored in large stacks, and cattle were fed from racks which often adjoined the stacks. The relative lack of inclement weather and low humidity permitted the storing of hay in the open for long periods; if properly cured, hay could be used for stock feed for up to a year or longer after being cut.22

Livestock were watered by stream where possible, but more often by irrigation canal and wells, many of which were artesian; one survey in 1915 noted that approximately two-thirds of the 200 artesian wells in Kings and Kern

21Ibid., p. 81.

22Nordhoff, pp. 35-38.
counties were used for domestic purposes and stock watering.23

Milking was undertaken in a section of the barn, or in a special milking barn of simple design (Figures 13 and 14). Once drawn from the cow, milk was taken to a shed where it was cooled and separated. The milk was cooled by passing it in a thin sheet over a series of metal tubes which contained cold water. The separated cream was placed in ten-gallon cans and stored in a cool place until it was sent to the processing plant.24

Processing

With the emergence of dairying as a commercial activity, small processing plants for cheese and butter making appeared. Many of these early ventures were not successful, foundering on the shoals of farmer apathy, transportation problems, and lack of administrative experience on the part of the manager or owner. Most of the plants in operation before the turn of the twentieth century had a life span of only several years.25


24Herbert Hopper, The Cream Supply (Berkeley: University of California Agricultural Experimental Station Bulletin Number 209, [1911]), pp. 130-137.

Figure 13: Interior of early California milking barn. Note interior features compared to modern dairies.

Source.—Photo from R. L. Adams, The Cost of Producing Market Milk and Butterfat on 246 California Dairies (Berkeley: University of California Agricultural Experimental Station Bulletin Number 372 [1922]).
Figure 14: Exterior of early California milking barn. Note simplified corral structure compared to modern dairies.

Source.—Adams, California Dairies.
While some processing plants continued to be owned and operated as individual enterprises others were found as cooperatives. Usually a group of farmers banded together, issued shares of stock based on cash contributions, and obtained added assistance from local banks. Despite their modest size several of these ventures were noted for innovation during the period. One plant in Tulare for instance, gained a large patronage by sending out a fleet of wagons to gather cream at the farms, thereby releasing the farmers from long hours of transporting his own products to markets. Two other small cooperatives joined their operations, and opened a sales office in Los Angeles, thereby removing themselves from the vagaries of Southern California wholesalers. This method spread rapidly throughout the region during the early years of the twentieth century; by 1912 five of the eight dairy processing plants in Tulare County were run on a cooperative basis.\(^{26}\)

Early California processing plants for butter and cheese were simple in design, consisting of a series of vats, a churn, cream testors, a storage room and a boiler room. If the plant manufactured cheese a curing room was added, often in the basement. Butter was by far the

\(^{26}\)Menefee and Dodge, pp. 136-138; Small, pp. 323-324; Dairyman's Cooperative Creamery Association, DCCA-A Long and Successful History of Cooperation (Tulare: Dairyman's Cooperative Creamery Association, n.d.), p. 3.
dominant dairy product in the region. In 1913, for example, almost 8.5 million pounds of butter was produced, while less than 150,000 pounds of cheese was manufactured.  

Transport and Marketing

By 1914 twenty-five processing facilities were located in the major dairy districts of the region. Though few roads of the era were oiled, the dense network, combined with lack of topographic barriers and infrequency of inclement weather, facilitated the transportation of dairy products from farm to plant. Most dairymen had a journey of six miles or less to reach a processor, although some hauls were longer. One large Tulare plant ran wagons to the Porterville area, a distance of fifteen to eighteen miles (Figures 15 and 16).


28 Although detailed data concerning the location of all dairy districts in the study area for this period are not available, a description of dairy concentrations in Tulare County is presented by Menefee and Dodge (page 138). This description substantiates surveys made by Wickson and Copley. Wickson noted in 1896 that most journeys in Tulare County from farm to plant was less than six miles, and Copley states that this was about the same distance for journeys in the northern San Joaquin Valley in 1912. Wickson, p. 24; Richard Copley, "An Historical Geography of Dairying in Stanislaus County" (Master's thesis, University of California, 1961), p. 45.

Figure 15: The method of transporting cream from farm to the processor before the introduction of motorized transport. Note small capacity wagon compared to Figure 27.

Source. -- Photo from Herbert Hopper, The Cream Supply (Berkeley: University of California Agricultural Experimental Station Bulletin Number 743 [1945]).
Figure 16: Irrigated acreage and creamery location, Southern San Joaquin Valley, 1914.

The early transportation of dairy products from the southern San Joaquin Valley to market was by rail, and, with the exception of one small plant west of Porterville, all processing concerns were located in settlements served by either the Southern Pacific or Sante Fe railroads. Dairy products were placed in refrigerated rail cars and carried over the Tehachapi Mountains to Los Angeles, an eight to twelve hour journey. The trucking of dairy products was a later development, because grading of a highway route between the San Joaquin Valley and Los Angeles was not completed until late 1915. Even with a graded highway, it was not until the late 1920s that refrigerated trucks transported dairy products into the Los Angeles area.

A combination of several important physical and economic factors were responsible for the rise of the dairy industry in the region. On the physical side, the long growing season and aridity permitted the profuse growth of alfalfa. The time-saving cream separator, the provisions for rail transport, and markets gave the industry the needed economic impetus. Because of the relative lack of labor involved in alfalfa culture, farmers

30 Thelma Miller, History of Kern County (Chicago: S. J. Clarke, 1929), pp. 440-442.


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were able to combine two distinct agricultural pursuits, the growing of tree and vine crops as well as dairying, which was often a sideline activity.

Although dairy processing got off to a stuttering start, the initiative of a few men, combined with financial backing and the cooperation of a number of farmers, provided the basis for a processing system based on butter and cheese. By necessity, early patterns of farm-processor relations were localized by the rudimentary forms of transport. Rail transport, however, provided the outlet for early products, and the urban region of Southern California provided the market.

Dairy Organization: 1920-1940

Following the First World War the number of dairies in the southern San Joaquin Valley declined sharply, a trend which continued until recently. In 1930 there were 1,982 dairies in the region. By 1950 there were 1,394, a drop of 29.7 per cent, and by 1969 there were only 396 dairies in the three-county area, a decrease of 80.0 per cent from the 1930 total (Figure 17).  

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Figure 17: Dairies, Southern San Joaquin Valley, 1930-1969.

The Farm

An important reason for the marked decrease in the number of dairies was the economics involved in specialized dairy farming. Various local political bodies in California instituted dairy regulations of some degree, beginning with Tulare County in 1908. Other counties and municipalities followed until 1927, when the State of California assumed authority for sanitary control of milk and cream through the Pure Milk Act, which sharply raised sanitary standards.

To qualify as "Grade A" (market milk for human consumption) rigid standards of purity and wholesomeness had to be met. Uniform dairy-building standards set by the state in 1937 involved specifications concerning building site, location and drainage of corrals, and the construction, ventilation, drainage, and refrigeration of milkhouses and milking barns.

These improvements were expensive, but incentives for change were provided by the expanding market for "Grade A" milk and cream in the Los Angeles area and by

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33 Small, p. 325.

34 Leland Spenser, An Economic Survey of the Los Angeles Milk Market (Berkeley: University of California Agricultural Experimental Station Bulletin Number 513, [1931]), p. 16.

the erosion of transportation barriers which had prevented quick transit of perishable products.\textsuperscript{36} Individual farmers who combined crops and dairying were faced with the choice of putting capital resources into new equipment for either crops or dairying, but not both.

Despite the new regulations and the attraction of specialization, the change to specialized farming spread slowly. Many farmers became specialized dairymen or shifted completely to field crops such as cotton, but a number retained combination dairy-crop enterprises. Records from 241 dairies in the San Joaquin Valley in 1940 reveal that approximately half the dairies had herds of fewer than twenty cows.\textsuperscript{37} A herd of this size occupied about one half a man's time, and such operations occurred most frequently in association with row and tree crops. Furthermore, most of these herds were producing "Grade B" milk which was used for manufactured dairy products. However, the trend toward specialization continued between 1940 and 1960. One dairy processor in the region collected milk from 175 "Grade B" and 32 "Grade A" dairies during the

\textsuperscript{36}Tinley, p. 12.

\textsuperscript{37}Arthur Shultis, Dairy Management in California (Berkeley: University of California Agricultural Experimental Station Bulletin Number 640, [1940]), p. 55.
mid 1930s, but by 1960 all collections were from large "Grade A" dairies.\textsuperscript{38}

Even though many farms on which dairying constituted the major activity did not cultivate high-value crops such as fruits or cotton, large acreages continued to be devoted to feed crops for stock. A survey of dairies in the study region in 1922 found that the average farm size was 107 acres, with an average herd size of 45 cows. The greatest portion of all farms was in crops, primarily alfalfa, with secondary crops of corn, oats, barley, and sorgham.\textsuperscript{39}

Most of the early milk cattle were Durhams, but many had mixed with the native range cattle. Breeds better suited to milk production, such as the Holstein, Jersey, and Guernsey, soon replaced these early varieties, with the Holstein rapidly becoming the dominant breed. The 1922 survey, cataloguing thirty-two herds, found twenty-four herds of Holsteins, five predominantly Holstein, one Guernsey, one Jersey, and one Durham.\textsuperscript{40}

Older farms, particularly those which combined dairying with high-value crops such as cotton or fruits, ...
maintained an arrangement similar to operations of the earlier period. Prominent landscape features included the residence of the farmer, the pumphouse, the barn and corral complex, and cultivated crops in adjacent fields. Most of these farms produced "Grade B" milk, and were not required to maintain the high levels of cleanliness found in dairies specializing in "Grade A" production.

Newer dairies, particularly those specializing in "Grade A" production, manifested differences in farmstead arrangement and components. While the residence, pumphouse, and general barn were often present, new components included a silo, and milking barn-corral complex whose location was dictated by state regulation. 41

A major consideration for the maintenance of high sanitary standards is a milking barn complex located for proper drainage and lack of contamination. Sites were restricted to locations where the milking barn, milkhouse, corrals and ramps could be washed down and kept clean at all times. Consequently the milking complex could not be located in an area of poor drainage, nor near contaminating influences such as refuse heaps. Regulations also

41 Prior to the adoption of state regulations, each city and county had its particular standards. The farmer was obliged to conform to regulations in all localities where his product was sold, and consequently subject to compliance with several sets of standards. This situation created dissatisfaction and confusion, and was, to a large degree, responsible for state legislation. A. E. Reynolds, pp. 155-158.
stipulated the types of construction materials to be used in the milking complex. Milking barns and milk houses (often separate sections of the same building), had to be built of cement block or reinforced concrete, with waterproof concrete or tile on interior walls for easy cleaning. As in earlier periods the milking barn remained the conventional stanchion design. A string of cows was washed, brought into the barn, milked, and released to walk out a ramp or lane, often the one by which they entered.\textsuperscript{42}

One advance in technology which saved time and labor was the milking machine, which made its appearance in the region during this period. Although experiments with milking machines began in the nineteenth century, these early machines used methods such as rollers, mechanical fingers, or tubes to extract milk but proved cumbersome and unsanitary. Not until the early twentieth century, with the inception of a machine that used vacuum operated teat cups, was a reliable, efficient, implement utilized. These portable machines milked cows singly or in pairs, and cut milking time about in half.\textsuperscript{43} Gradually they diffused through the region; in 1922 less than half the dairies used milking machines, but they had become widespread by 1940.\textsuperscript{44}

\textsuperscript{42}Ibid.


\textsuperscript{44}Adams, pp. 73-79; interview with Gayle Gurtle, Tulare County Farm Advisor, Visalia, California, 7 June 1973.
Milk was cooled and stored in the milk house, which was, particularly on the new dairies, a part of the milking barn structure. It was cooled by passing in a thin sheet through a cooling machine, then put in ten-gallon cans, and stored in a refrigerated space or in a tank of cold water. Beginning in the 1920s however, California processing plants changed from a "gathered cream" to a "gathered milk" basis, with separation taking place at the plant rather than at the farm.45

Processing

Prior to 1920 few processing plants in California received whole milk from producers. The great majority received milk fat from producers in the form of cream, with the skim milk being retained on the farm. In the 1920s with the change from "gathered-cream" to "gathered-milk," whole milk was separated at the processing plant and there converted to by-products.

This change in the method of creamery operation was one of the consequences of basic changes in dairying. Changed breeding and feeding practices resulted in substantially increased production per cow, and farmers found it increasingly difficult to utilize large volumes of skim milk on their farms. Few dairy farms in California were equipped for producing the grain needed in raising large

45J. M. Tinley, Creamery Operating Efficiency in California (Berkeley: Giannini Foundation of Agricultural Economics Mimeographed Report Number 41, [1935]), pp. 8-10.
numbers of hogs and other livestock to which the skim milk could be fed. Consequently, processing plants developed new markets for the augmented volumes of skim milk. Markets for products made from skim milk increased after World War I. Milk prices increased appreciably and with increased supplies, creameries installed equipment such as evaporators and driers to handle skim milk and produce a variety of by-products.

The change from a "gathered-cream" to a "gathered-milk" basis, as well as the increase in total volume of milk, altered both the internal and external arrangements of the creamery. Among these were the installation of separating and by-products processing machinery and an increase in the size and number of trucks. Previously cream had been gathered only two or three times a week from each farmer, whole milk now had to be gathered daily and sometimes twice daily.46

Transport and Marketing

Immediately prior to World War I, eighteen processing plants served the study area. These were scattered throughout the dairy districts, with only one community, Tulare, having as many as three plants. By 1940 the number of plants had increased to nineteen, with noticeable localization. Tulare, Hanford, and Bakersfield accounted for

46Ibid.
over sixty per cent of all plants, with Tulare accounting for almost one-third (Figure 18).

By 1940 the service areas of processing plants had increased dramatically, due in large part to the upsurge in motorized transport following World War I (Table 2). Plants bought fleets of trucks which carried milk in large loads of ten-gallon cans from dairy to processor. This rapid means of transport, combined with the dense road network, permitted the enlargement of the service area to between fifteen and twenty miles.47

A marked change also took place during this period with regard to the transportation of dairy products to markets outside the region. In 1914 the railroad was the sole means of transport, but by the 1920s the use of motor vehicles began to predominate. The distance by road from the southern Valley to the Los Angeles area was forty to sixty miles shorter than by rail, and rail rates were generally slightly higher for equivalent distances. In addition, trucks offered the advantage of picking up dairy products from processors and delivering them directly to the plant of the buyer with no intervening transfer.48

47Interview with Nels Anderson, Transportation Manager, Knudsen Creamery, Visalia, California, 2 July 1973; and interview with W. C. Olsen, Secretary, California Milk Producers Association, Tulare, California, 2 July 1973.

Figure 13: Dairy districts and processing plants, Southern San Joaquin Valley, 1940.

After World War I, a noticeable decline in the number of dairies in the southern San Joaquin Valley began, due in large part to the increased costs in dairy modification necessary to meet state standards. Cash crop farming focusing on crops such as fruit or cotton offered an alternative, and a number of dairymen switched to the crop system. Some farmers continued to pursue both dairying and crop farming, although they produced inferior grades of milk from their small herds under this system.

The capital outlay needed for specialized dairying had its parallel in the processing industry. Many small processors were slowly forced from business, while those surviving were associated either with large commercial or well-established cooperatives. With the decreasing number of processors a consolidation of processing activities began, with the larger urban centers gaining prominence.

The transportation patterns also underwent a marked change during this period. The influence of motorized transport expanded after World War I, and dairy processors were quick to grasp the advantages of trucks for hauling. This new means of conveyance was not limited to farm-processor linkages. The completion of a highway link from the Valley to Southern California expedited the movement of dairy products from processor to market, as trucks proved faster and more efficient than rail.
Dairying Organization: 1973

The costs of dairy modernization continued to force many dairies out of business until the mid 1960s when the number of dairies again began to increase. One prominent reason for the recent expansion of dairying in the Valley has been the influx of dairymen from the Los Angeles Basin. The urban expansion in the Los Angeles area has been responsible for a sharp rise in land values, as well as restrictive land use ordinances. High land values caused high taxes, which many dairymen found unbearable. Public outcries concerning sanitation, smells, and other dairy activities were added burdens for the Los Angeles farmer. As a consequence many dairymen have sold their properties for substantial prices and moved to the southern San Joaquin Valley where they have built modern, compact dairies often costing a half million dollars or more (Figure 19). Recently one new dairy a month has been built in Tulare County, and the average size of the dairy herd is approximately 300 head. The number of dairy cattle in the region has increased apace, and now stands at over 100,000 head (Figure 20).  

The Farm

The design of the modern dairy in the southern San Joaquin Valley stands in striking contrast to those

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49 Interview with Gayle Gurtle, 7 June 1973.
Figure 19: Dairy districts, Southern San Joaquin Valley, 1973.

Source.—Fieldwork by author.
Figure 20: Dairy cattle, Southern San Joaquin Valley, 1890-1969.

operations of earlier periods. A number of changes are apparent in the contemporary operation, including the milking-barn structure, milking and milk-storage procedures, waste removal, and stock feeding and stock holding practices.

Although a number of older dairies maintain the conventional stanchion barn, most modern dairies have the "walk through" type of milking barn. In this style the cow is washed, enters the barn, is milked in a stall, and released to walk out a different passage, thereby keeping milked and unmilked cows separate. Milking efficiency is increased by another feature of the modern barn, the elevated ramp, a walkway thirty inches above the pit where the milker operates. This places the milking hand in an efficient position in relation to the cow, and eliminates stooping in preparation and milking (Figure 21). Although

50 The 1969 Census of Agriculture lists 396 dairies in the study area. U. S., Department of Commerce, Bureau of the Census, United States Census of Agriculture: 1969, vol. 1, pt. 48, sect. 1, pp. 345-346. A sample of twenty dairies or five percent of the total was taken to ascertain the organization of these units. To locate this sample, a map of the dairy region was constructed and a numbered grid was utilized. The grid consisted of ten vertical and ten horizontal lines, evenly spaced, laid out on the dairy map. Each line was marked with a single, consecutive number, ranging from zero to nine. At the points of intersection pairs of numbers were formed ranging from 00 to 99. Twenty sets of random numbers were selected, and plotted on the grid where they corresponded to the grid numbers. Frederick Mosteller, Robert Rourke, and George S. Thomas, Probability and Statistics (Reading, Mass.: Addison-Wesley, 1961), p. 366. The great majority of dairy farms lie in eastern Kings and western Tulare counties. Eighteen dairies were selected from this district. A minor region is centered in Kern County, and two dairies were sampled from this district.
Figure 21: Interior of a modern "herringbone" milking parlor. Notice the depressed floor which facilitates the operations of the milker, and the pipeline milking system.

Source.--Dairy Engineering Company photo.
the vacuum milking machine made its appearance in the 1920s and 1930s, the conversion to vacuum operated pipeline systems was not completed until the 1950s. These systems transport milk via a pipe several inches in diameter from the udder to a large, refrigerated, bulk milk tank located in the milk house, located adjacent to the milking barn. Milk is piped from the milking machine to the tank, thence to the tanker truck. Attached to the side of the milking barn are circular or rectangular elevated bins for the storage of concentrates, which are fed to the cattle during milking.

Changes have taken place in the feeding and management of herds over the past two decades. On most contemporary farms grazing is limited to heifers and dry cows. Milking cows are kept in "dry-lot" corrals where all feed is brought to them. Baled hay is kept adjacent to the pens, either under a "pole barn" (Figure 22), or left in the open. Small pastures are usually positioned alongside or to the rear of the pens. Nurseries and calf pens also are found adjacent to the main pens, usually in front. Sheds for equipment storage, and small storage tanks containing fuel for farm machinery also are located in this area.

The number of employees on the modern dairy depends on size and the presence or absence of associated field crop activities. Two or three men can handle a large herd in a modern milking barn, although others may be assigned tasks in conjunction with the dairy itself or
Figure 22: A large pole barn used for hay storage on a dry-lot dairy in Tulare County. Mild weather permits year round storage.

Source.--Photo by author, June 1973.
field crop operations. Most dairies employ two to five individuals in addition to the dairyman.

Today ninety to ninety-five percent of the dairy cattle in the southern San Joaquin Valley are Holstein. The remainder are, for the most part, Jersey and Guernsey. Although the Jersey and Guernsey produce a richer grade of milk than the Holstein, the latter is favored because of its greater milk production.

Artificial insemination accounts for eighty-five percent of the dairy cattle breeding in the area, which permits the choice of high grade sires to improve the quality of the herd, and releases the farmer from maintaining bulls.

New methods of waste disposal also are practiced. On older farms it was the practice to collect animal wastes from the barn in a manure cistern set outside the barn. Today waste from the milking barn and pens are piped into a manure sump, which is usually found adjacent to the pens. Sumps range up to 200 yards in length, forty yards in width, and twenty feet in depth. They are emptied two to four times per year and the wastes are spread on pastures. Very little reliance is placed on watering stock by stream or irrigation ditch; almost all watering is now by pump.51

Most of the new dairies share a common design. A very prominent feature is the appearance of the dairyman's

51Communication from Gayle Gurtle, Tulare County Farm Advisor, Visalia, California, 16 June 1974.
house and the milking barn-milk house complex. They are often equally spaced from the road and are of the same architectural design and color. To the rear of the milking barn is a wash area which is connected to a series of pens by alleys (Figure 23). The pens are fenced with metal panels, mounded for drainage and covered by sunshades of corrugated metal, plastic or wood. The shades are usually ten to twelve feet high, which allows the cattle to radiate heat satisfactorily. Each pen has a capacity of forty to fifty cows (Figure 24).

The older dairies show a variety of forms, particularly in the assemblage of pens. Fences are often of wood, and the pen sizes vary. The home of the dairyman and those of his employees often are juxtaposed into the assemblage of buildings and do not give the impression of architectural coordination which is found in the newer dairies. A consistent feature (especially on newer dairies) is the milk house-milking barn complex easily accessible by road, and a series of pens which focus on the wash area and the milking barn. Other features commonly found on newer dairies are elevated feed bins, large haystacks adjacent to the pens, and sunshades. Storage buildings often are


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Figure 23: Milking barn-milk house complex on a modern dry-lot operation in Kings County. Note facilities for milk pick-up and washing area at rear of the barn.

Source.—Photo by author, June 1973.
Figure 24: Corral organization on a modern dry-lot dairy in Tulare County. All feed is brought to cattle in the corral complex.

Source.—Photo by author, June 1973.
converted barns (Figures 25 and 26).

Appendix A provides data on the farms sampled. The size of the dairy herd has increased over previous periods, and the farmstead is intensively used in accommodating cattle in the dry-lot operation. Forty-five percent of all dairies sampled had herds of less than 300 head although the smallest herd, consisting of 110 cows, was larger than the average for the pre-World War II period. Fifty-five percent of the herds had more than 300 head, with most falling in the range of 300-800 head per herd. Two of the operations sampled had herds of over 1,000 head, making them among the larger herds in the region. Intensive land use is also a notable feature; it is not uncommon to observe several hundred head of cattle on thirty to forty acres of land.

On only two dairies did the farmstead constitute the complete farm unit, all others having at least some acreage devoted to pasture or crops. Sixty percent of the operations grew alfalfa, and thirty percent cultivated feed crops such as corn or oats. Four operations had small acreages of cotton, although in two cases the cotton land was leased to field crop operators.

No dairies sampled were completely self-sufficient in feed crops. While a large percentage of cattle feed is supplied by field crop farms within the San Joaquin Valley, supplemental supplies of alfalfa are trucked into the area.
Figure 25: Modern dairy, Southern San Joaquin Valley, 1973.

Source.—Field work by author.
Figure 26: Modern dry-lot dairy, Southern San Joaquin Valley, 1973.

Source.—Field work by author.
from the desert valleys of southeastern California and Arizona, and occasionally from as far away as Utah. In addition to regulations concerning milking facilities, especially sanitation, the California state government has had a strong influence on the size of the dairy operation. Dairymen have received minimum prices for dairy products since the mid 1930s, but problems of market allocation, oversupply, and retailer marketing practices plagued the dairy farmer through the post World War Two period. In order to alleviate this situation legislation was enacted in 1967 which, in effect, gave milk allotments to the dairy farmer, in the hopes this would aid the stabilization of the milk market. Each dairyman was given an allotment which corresponded to his milk production for a period prior to 1967, and a certain price was guaranteed for his output. Markets demands and stability are reviewed each year, and changes made in the allotment plan accordingly. A dairyman may increase his milk output by requesting a new quota if market demand warrants, or he may purchase all or a portion of another farmer's quota. Although the allotment is tied to milk production rather than the number

55 In the first thirty months of the allotment plan there were 1219 allotment transfers. Ibid., p. 25.
of cows, herd size is affected. It is much more efficient to produce a given quota of milk from a small herd of high-producing cows than a larger herd of poor-producing animals.

Processing

Beginning in the 1930s, and given an impetus by the demands of World War II, commercial dairy products retailers began entering the processing segment of the industry. Technology for the manufacturing of new types of dairy products had recently become available, and commercial retailers had capital to invest in new plants. The combination of processing and retailing or "vertical integration" had a great impact on the industry. It allowed efficient planning for the increased market demands for various products; it permitted the streamlining of functions between processor and retailer, eliminated some functions, and reduced procurement costs.56

Competition from these large, modern, vertically integrated plants soon made itself felt, and the small cooperative or independent processor began to fade from the business scene. By 1973 there were only nine large processors serving the region, seven of which were associated with commercial organizations such as Safeway Stores or

56Daniel I. Padberg and D. A. Clarke, Jr., Structural Changes in the California Fluid Milk Industry (Berkeley: University of California Agricultural Experimental Station Bulletin Number 802, [1964]), pp. 34-36.
Foremost Dairy Products. The two remaining cooperatives serving the area had substantial sales outlets of their own in a number of urban centers in California.  

Transport and Marketing

A marked change in the transport of milk from dairy to processor was initiated in the early 1950s. Dairies switched from holding milk in ten-gallon cans to refrigerated, bulk milk tanks, a more convenient and sanitary method of storage. Truck transport changed as well. The milk-can transporting vehicles were replaced by large, tractor-trailer tank trucks which collected milk directly from the dairies on a daily basis (Figure 27).

The service areas of the plants have increased over those of the earlier periods, but the periphery of the service area for the modern processor rarely extends beyond thirty miles from the plant. The density of dairies served decreases with distance from the plant, and most processors are centrally located within their service areas. Most plants are located in the larger urban centers of the Tulare County-Kings County dairy district (Figure 19). One

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57 One of the cooperatives is located in Fresno, and serves only a small portion of northern Kings and Tulare counties, receiving milk from a dozen dairies. The other, Dairyman's Cooperative Creamery Association, located in Tulare, received milk from 140 dairies in Tulare County in 1973, making it the largest processor in the region. This company was founded in 1909, and quickly established its own marketing outlet in Los Angeles, and has continued to expand its operations throughout the state. DCCA-A Long and Successful History of Cooperation; interview with Gayle Gurtle, 7 June 1973.
Figure 27: A 5,000 gallon capacity tank truck receiving milk from a Tulare County dairy for transfer to a processing plant in Tulare.

Source.—Photo by author, July 1973.
plant, located in Bakersfield, serves most Kern County dairies, while one large plant located in Fresno serves segments of northern Kings and Tulare counties (Figures 28 and 29).

Improved methods have effected considerable changes in the transport of dairy products from the Valley. With the completion of limited access highways and the use of powerful refrigerated trucks and tankers (Figures 30 and 31), the market area has expanded into Northern California. Travel time from the southern San Joaquin Valley to the Sacramento-San Francisco Bay area is four to six hours, and three to five hours to Los Angeles. Although the great majority of market milk still goes to the Los Angeles area, some loads are sent north. Most manufactured products such as yogurt, cottage cheese, and butter are sent by truck, while dry products such as powdered milk and ice-cream mixes are often transported by rail (Figure 32).

Although dairies are not as prominent in absolute numbers as twenty years ago, the past decade witnessed an upsurge in activity, due in large part to dairymen who have migrated from Southern California.

The modern dairy has undergone a great change in organization from those of earlier periods. Modern milking

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Figure 28: Processing plant service areas, Southern San Joaquin Valley, 1973.

Source.—Field interviews; unpublished data from Tulare County Department of Agriculture.
Figure 29: Processing plant service areas, Southern San Joaquin Valley, 1973.

Source.—Field interviews; unpublished data from Tulare County Department of Agriculture.
Figure 30: Refrigerated truck used for hauling fresh milk from the San Joaquin Valley to markets throughout California.

Figure 31: Refrigerated truck used for hauling processed dairy products from the San Joaquin Valley to markets throughout California.

Figure 32: Marketing areas for Southern San Joaquin Valley dairy products, 1912-1973.

Source.—Calculations by author.
and storage facilities have been introduced, as well as new feeding practices which focus on large herds quartered in small areas. With great amounts of feed available, some coming from as far as Utah, the maintenance of the herd in a small space has proved more economical than utilizing large amounts of land for pasturing. The role of the government in dairying has increased, and, in effect, controls the size of the herd in the modern dairy as well as the structure of the farmstead.

Contemporary processing is consolidated in the hands of a few firms, and dairy products have shown continuing variety, to meet popular demand, and use excess milk. Most firms are not cooperatives, although two cooperative concerns, both with long histories of "vertical integration" maintain influence in the area. Transport linkages have kept pace with changes as well, with an almost complete reliance on truck helping to expand market area to throughout most of the state.

Summary

Commercial dairying was introduced into California with the Gold Rush, and spread into the southern San Joaquin Valley in the latter stages of the nineteenth century. The region was found to be appropriate for dairying because of several factors, notably the suitability of irrigated alfalfa, rail transport, and the growth of urban markets.
The early organization of dairying was noted for a reliance on alfalfa for cattle feed, a farm enterprise which combined dairying with tree and vine crops, a rather simple farmstead complex, and a relatively small herd, consisting of one to twelve cows.

After milking, the milk was cooled and separated at the farm, and transported by horse and wagon to a processing plant, usually located six miles or less from the farm. Plants were small, and produced cheese and butter for the Los Angeles market. Processing was in the hands of small cooperative or independent producers, and products were sent by rail to the Los Angeles market.

Following the First World War changes in the organization of dairying began. The cost of building dairies to meet sanitary standards began to rise, and, although some farmers continued to do both, many farmers began to specialize in either dairying or cash crops such as fruit or cotton. Those who chose dairying were forced to meet rigid standards concerning the structure of the farmstead, sanitation, and building materials. Herd size increased; while early dairies had one to twelve cows, the specialized dairy in this period often had as many as forty-five cows.

Processing changed from gathered cream to gathered milk, and plants themselves underwent internal modifications to manufacture new products. Large amounts of capital were put into plants, and "vertical integration"
between processor and retailer began on a large scale. Although there was no great change in the number of plants, there was a noticeable consolidation of plant locations, with the larger urban centers of Tulare, Bakersfield, and Hanford accounting for over sixty percent of all plants, and Tulare almost one-third.

Milk was transported by truck from dairy to processor, and the service area of plants increased to fifteen miles or more. The truck also became important in the movement of milk to market; trucks carried products from the Valley to Los Angeles by highway through the Tejon Pass, which was forty to sixty miles shorter than rail.

The number of dairies in the southern San Joaquin Valley declined until recently, when dairymen from Southern California began migrating into the area. Dairies today are generally much larger than earlier dairies, both in acreage and herd size. Most herds are fed under "dry-lot" conditions where all feed is brought to them, and often consist of three hundred head or more. Although some dairies are completely dependent on outside sources for all feed; over half the dairies sampled grew at least some portion of their own feed. Technical innovation is apparent in the milking barn-milk house complex, with new types of milk conveyance and storage and more efficient milking procedures.

Processing plants have declined by over half in number since 1940, but receive milk from a much higher
dairy cow population. Most processors are allied with commercial retailers, although two cooperative organizations serve the region. The service area for plants has increased to thirty miles, with milk carried from dairy to plant by bulk tanker. Large trucks, in addition to better highways have extended the marketing areas to many sections of the state.
CHAPTER IV

CITRUS

The Introduction of Citrus into California

Citrus probably was introduced into California with the institution of the Spanish mission system. The missions attempted to produce their own foodstuffs, and most of them maintained orchards and gardens. Initially, almost all supplies of seeds, plants, and domestic animals came from the missions of Baja California, and both oranges and lemons were cultivated there prior to 1739. The date of introduction of citrus into California was probably around 1769, the date of the establishment of the first mission at San Diego, although the first specific reference to citrus was made by the explorer Vancouver, who noticed oranges in the garden at the Mission San Buenaventura in 1793.¹

Small, non-commercial groves, not associated with the missions, were under cultivation in Southern California

by 1834. The first known commercial orchard was two acres in size, planted by William Wolfskill in Los Angeles in 1841.  

The initial stimulus for commercial citrus production in Southern California began in 1849 with the Gold Rush to Northern California. Fruit was shipped by sea from Southern California to San Francisco and then transported to the mining districts of the Sierra Nevada. San Francisco and the mining regions became a great market for the industry for three decades, and even though the northern market laid the foundation for a viable citrus industry in Southern California, the production was not sufficient for the Northern California market. For example, San Francisco, at that time by far the largest city in California, imported some three million oranges from Mexico and the Pacific Islands in 1866, but only 250,000 were received from the vicinity of Los Angeles.

A greater impetus to the expansion of citrus in California came in the late 1870s and 1880s, with the completion of the transcontinental rail lines connecting Southern California with the East and South. Although scattered plantings had been made throughout the state during the period from 1850 to 1870, the Los Angeles and Riverside areas in Southern California were the most

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2Ibid., pp. 34-39.
3Ibid.
important at that time for commercial production. The first carload of fruit shipped east from California was from the William Wolfskill orchard in 1877, and the first train shipment consisting entirely of fruit was in 1886. Technological advances were made with the introduction of the ventilated boxcar in 1887, followed by the refrigerated boxcar in 1889.\(^4\)

**Early Citrus Culture in the Southern San Joaquin Valley**

Plantings were made in the southern San Joaquin Valley as early as 1860, but production supplied only local markets. Production for more distant markets began about 1890 when a successful orange grower from Riverside examined the region, and concluded that the area was suited to citrus production. Numerous tracts were subdivided into small blocks, and commercial groves were planted in the vicinity of Porterville, Lindsay, Exeter, and Bakersfield.\(^5\)

The principal fruit established in the region was the sweet orange (*Citrus sinensis*) and even to this day, two varieties of the sweet orange, the Washington navel and Valencia, grow almost to the total exclusion of all others. Of these two, the greatest acreages always have been planted in the navel variety. Introduced into the United States from Brazil in 1873, the navel orange became established in southern California during the 1880s.\(^6\)

\(^4\)Ibid.

States from Brazil in 1870, and into California in 1873, it is highly regarded as a table orange. It is harvested from late October through mid December, which makes it ideally suited for the holiday-season market. The Valencia was introduced into the United States from Europe, and first arrived in California in 1876. It has many attributes of the navel. Although not quite so sweet, it is a prolific bearer and ripens during the spring and summer, which allows it to capture a good share of the off-season market.  

The lemon (Citrus limon) has enjoyed limited success in the Central Valley region. Although a prolific bearer with multiple uses the lemon has several disadvantages. It requires more moisture than the orange; the fruit is subject to damage from improper care; and most importantly, it is extremely sensitive to frost, a fact which precludes its growth, except in the most favored of locations. Other citrus crops (such as grapefruit, tangerines, and tangelos) have enjoyed periods of popularity in the region, but never have been as important as other citrus, particularly the orange.

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Citrus: The Physical Environment

In considering physical factors affecting the production of citrus, the timing and duration of low temperatures are perhaps the most important. The minimum temperature at which citrus suffers serious injury varies considerably, depending upon the duration of the cold period, the species and variety of fruit, and tree condition. Although any temperature below freezing can be dangerous if continued long enough, there are variations in a fruit's ability to withstand cold. Generally, sweet oranges freeze at temperatures between 27.0 and 29.5 degrees Fahrenheit while lemons freeze between 29.5 and 30.5 degrees Fahrenheit. Variations in the growth cycle affect fruit as well; the Valencia orange and lemon bloom in the winter which increases their susceptibility to frost damage.\(^8\)

In an attempt to avoid damaging frosts, citrus in the southern San Joaquin Valley is limited to the relatively frost free sites located in the narrow belt of slopes comprising the lower segments of the Sierra Nevada foothills and the upper segments of westward sloping alluvial fans adjoining them. The foothill slopes are more precipitous, occasionally rising a hundred feet or more per mile, while the gradient on the upper segments of the alluvial fans

averages fifteen to twenty feet per mile. These graded
slopes preclude the collection of cold, dense air damaging
to citrus, forcing it to flow into lower-lying areas.\footnote{U. S., Department of Agriculture, Bureau of
Soils, Reconnaissance Soil Survey of the Middle San Joaquin
Valley, California, by L. C. Holmes, Field Operations of
Printing Office, 1919), pp. 9-10.}

Maximum temperatures which can be endured by citrus
are rarely reached in important citrus producing regions,
and are not a major problem. Most of the damage caused
under extremely hot weather conditions appears to be due
to a complex reaction of several factors including water
availability, humidity, and wind, as well as temperature.\footnote{Herbert J. Webber, "Plant Characteristics and
Climatology," pp. 55-56.}

The physical character of the southern San Joaquin
Valley has particularly affected the establishment and
maintenance of the most important orange variety in the
region, the Washington navel. Although this variety is
successfully grown in the Southern California citrus
districts, it does particularly well in the Valley, attain­
ing a degree of maturity and sweetness not usually found
in coastal areas. Important factors in this success
include the high summer temperatures in the Valley (not
found in Southern California coastal districts), as well
as sufficient early season precipitation provided by the
Pacific cyclonic storms which occur during the spring, a
critical time in the budding and early growth of this variety.\textsuperscript{11}

Inadequate precipitation during the budding and early growth season impedes the successful cultivation of the Washington navel in other important citrus regions of the United States. Due to its early success in California, the navel was planted in Florida, but proved a light bearer, as evidently the spring dry period in Florida prevented the successful "setting-in" of the fruit. Cultivation has also been attempted in the desert citrus districts of Southeastern California and Arizona, but the lack of moisture in these areas during the crucial spring period also adversely affected the navel plantings.\textsuperscript{12}

Soil quality is not a paramount factor in citrus cultivation, and there are a number of soils in the frost free areas of the study region suitable for the growth of citrus. Although citrus grows best in sandy loams of medium texture, it does well in many of the heavier soils of the older alluvial types found throughout the area.\textsuperscript{13} Unfortunately, many of the heavier soils are underlain

\footnotesize{\textsuperscript{11}Herbert J. Webber, "Cultivated Varieties of Citrus," p. 533.}
\footnotesize{\textsuperscript{12}Ibid.}
\footnotesize{\textsuperscript{13}Deeper, medium-textured soils produce a higher tonnage per acre and a longer-lived tree than shallow, heavy soils. U. S., Department of Agriculture, Bureau of Plant Industry, Soil Survey of the Pixley Area, California, by R. Earl Storie et al., Series 1938, Number 23 (Washington, D. C.: Government Printing Office, 1942), p. 10.}
with layers of hardpan at depths of two to five feet, and to provide proper drainage and deeper root development must be blasted or otherwise shattered.\textsuperscript{14}

Another feature of soils in the citrus districts of the Valley is the absence of alkali. The graded slopes prevent the accumulation of salt deposits, an important factor in citrus production. Citrus is extremely sensitive to alkali, and the constituents of the various salts have several adverse effects on plant growth. Among these are the impairment of fruit quality and quantity, the discoloration and burning of leaves, and increasing tree sensitivity to low temperatures. With the possible exception of the walnut and the avocado, citrus trees are probably the most alkali-sensitive of all the economic plants.\textsuperscript{15}

Irrigation water is provided by diversion from streams and canals, as well as by underground pumping. During the early periods fluctuations in stream flow were

\textsuperscript{14} The region has areas of pronounced hardpan soils, although they are fragmented and of varying extent. They consist of accumulations of clay, silt, or sand which are cemented together in horizons of from several inches to more than a foot, and often approach the hardness of concrete. Claypans are found in the central portions of the Valley, while hardpans of sand or silt are found near the Valley margins. Hans Jenny, "Exploring the Soils of California," in California Agriculture, edited by Claude Hutchison (Berkeley: University of California Press, 1948), pp. 337-340.

particularly damaging, and most growers relied on underground supplies, particularly in the late summer and autumn. In some instances wells were located on the property of the farmer, but because of the hillside locations and low water table in the area, wells were deep and expensive. An alternate method was practiced by a number of farmers, either individually or in cooperative ventures. Wells were sunk adjacent to the streams where the water table was higher, and water pumped by pipe to hillside orchards using electric motors or gasoline engines.16

Citrus: The Early Organization

The Farm

Citrus farming manifested several differences from the other agricultural systems under discussion. For the most part operations were smaller; rarely more than ten acres in size. Citrus being a permanent crop, once the initial land preparation was completed cultivation needs were relatively light. Citrus farms also were very specialized; most farms cultivated no other crops.

The location of many citrus orchards on gradients, and the need for proper slope for irrigation called for extensive land preparation. Initially a deep plowing was undertaken to free the ground from stones which were prevalent in some of the older soils of the area. Where

16U. S., Department of Agriculture, Soil Survey of the Porterville Area, California, pp. 38-39.
hardpan was encountered the layer was broken by a subsoil plow or pickaxe. If the hardpan was particularly thick and resistent, a charge of one or two sticks of dynamite was placed in the ground at the proposed location of each tree and then detonated. The resultant concussion shattered the hardpan for approximately five feet in all directions, greatly facilitating drainage and tree root development. The land was then graded, the irrigation system installed, and the orchard planted.  

Orchard planting, particularly the resultant tree pattern, depended on the type of citrus, variety of tree, and the fertility of the soil. Although several patterns were utilized, by far the most common method was the square or rectangular method. The rectangular pattern gives equal root accessibility and, since rows intersect at right angles, permits cultivation in two directions. Since most lemons and oranges are planted twenty by twenty feet to twenty-four by twenty-four feet, the rectangular pattern results in from 76 to 108 trees per acre.  

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18 Less popular methods of planting include the quincux method where four trees constitute a square with a fifth in the middle, and the hexagonal method where six trees form a hexagon with a seventh in the middle. Although these systems permit more trees per acre they often result in overcrowding. Another system is the triangular, which gives fewer trees than the rectangular, but permits cultivation and irrigation in three directions. Ralph G. LaRue and Marion B. Rounds, "Planning and Planting the Orchard," in *The Citrus Industry*, vol. 2, Production of
The annual cycle of cultivation included several plowings and harrowings at the end of the rainy season for the purpose of incorporating a weed crop into the soil. Light cultivations were carried out after each irrigation to conserve moisture.\textsuperscript{19}

Additional orchard practices focused on insect control and orchard heating. Most citrus pests could be controlled effectively by the farmer, using a mobile spray rig containing a mixture of oil, soap, and water. If infestations proved too severe, fumigation was undertaken by a contractor using specialized equipment such as fumigation tents, generators, and gasses.\textsuperscript{20}

Orchard heating was often mandatory during the colder periods of the year, though usually only for short periods. Various means of heating the citrus areas were used, including wood fires, as well as the burning of coal and tar. However, by 1915 the use of oil, burned in heaters with a five to ten gallon capacity, was widespread in California. Usually an acre of citrus required about 100 heaters.\textsuperscript{21}

Initially, irrigation water was distributed to the orchard by open ditch or wooden flume. This method soon

\begin{thebibliography}{1}

\bibitem{Coit} Coit, p. 169.
\bibitem{Ibid.} Ibid., pp. 433-434.
\bibitem{Ibid.} Ibid., pp. 250-269.
\end{thebibliography}

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proved unsatisfactory, as ditches filled with weeds and silt, and wooden flumes rotted. These methods were gradually replaced by concrete pipes, which were common by World War I. The pipe was laid across rows at depths of about fifteen inches, and joints in the pipe were sealed to prevent leakage and the intrusion of weeds. At the end of each row a subsidiary pipe, attached to the main pipe, rose to a height of a foot or more above ground, and served to water each row.

Pipeline systems were especially suited to the furrow method of irrigation. Furrows were laid down each row, the depth, width, and length depending on soil type. Generally shorter and narrower furrows were found on more porous soils. If soils proved extremely porous, or hard to control ditch water was used, the basin method of irrigation was utilized. The orchard was divided into a series of basins separated by short levees. After the first basin had been irrigated the levee connecting it to the adjoining basin was cut. This sequence was followed until the entire orchard was watered. Regardless of method, usually four to six irrigations were undertaken per year, with an annual water use of two to three acre-feet per acre.²²

The small size of the citrus operation, the relatively light annual cultivation practices, and the permanent nature of the citrus planting required only a small inventory of implements. In 1913 one author wrote that equipment needs could be satisfied with a team, a wagon, several plows and harrows, a furrower and a sprayer for insects. Consequently, the citrus farmstead was noted for simplicity of structure, usually consisting of a house, a pumphouse, a shed for equipment storage, and a barn and corral for stock (Figure 33).  

Processing

Although the earliest packing houses were nothing more than barns or grain warehouses where the fruit was laid on canvas to be sorted by hand, by the early 1900s houses built exclusively for citrus had appeared in the Valley. The primary fruits were oranges and lemons, and the packing procedures differed for both. Oranges were not picked until edible. After hauling to the house, relatively clean oranges were gently brushed to remove orchard dust and then packed. Others were washed in a tub, and then dried by spreading the fruit in a single layer on a rack or by giving the fruit a blast of air as it passed along the grading belt. The grading belts were divided by wooden strips into three lanes, and graders stood on

23 California, State Department of Agriculture, California Citrus Culture, by A. J. Cook (Sacramento: State of California, 1913), p. 31.
Figure 33: Farmstead, early California citrus operation.

Source.— Thomas Thompson and Albert West, History of Los Angeles County (Berkeley: Howell-North, 1959).
either side and sorted the fruit into the three categories of fancy, choice, or standard. The grading belt carried the fruit into gradually widening slots which separated the oranges by sizes. The citrus was wrapped in tissue paper and placed in boxes according to size. In warm weather the packed fruit was precooled to a temperature of forty degrees Fahrenheit either in a pre-cooler room or in a refrigerated rail car. The fruit reached the Eastern auction markets in fourteen to twenty days.  

Lemons were picked less ripe than oranges. After transportation to packing sheds they were passed along a moving belt for separation according to color and maturity, then placed in storage boxes. Partially ripe fruit was sent to the "sweat room," a cement block building with an upper room and a basement, which housed kerosene stoves and pans of water. Temperatures were kept at 90-95 degrees, and humidity at 90-100 percent. Five to fourteen days were required to secure the desired color, depending on the stage of maturity at picking. From the "sweat room" they were placed in storage areas for further maturation if necessary. After maturation the fruit was graded in a manner similar to oranges, packed, and loaded onto rail cars for shipment.  


Ibid.
Transport and Marketing

Citrus was harvested by hand, placed in field boxes, and loaded onto wagons. It was then transported by horse and wagon to one of the area packing houses, located along rail lines, in or near the citrus-belt towns.

The small urban settlements of the citrus-belt were located in the narrow corridor along the east side of the Valley, and were usually spaced six to eight miles apart. The short distances between towns, combined with the narrow confines of the citrus districts themselves, meant that most growers had a three to five mile journey or less from grove to packing house (Figure 34).

The transport of citrus to market was by rail. Refrigerated boxcars were loaded at rail sidings adjoining each packing house, made up into units of several cars, and sent to marshalling yards at Bakersfield or Fresno where they were collected into freight trains for shipment east. Pre-cooling the fruit was undertaken either at the packing house or by the railroads at their larger yards. Railroads such as the Sante Fe and the Southern Pacific had facilities for chilling as many as thirty cars simultaneously, by circulating cold air through the cars. Icing facilities for the chilling of fruit were available at points throughout the rail routes east.26

26Coit, pp. 297-298.
Figure 34: Citrus districts, packing-house locations and numbers, Southern San Joaquin Valley, 1912.

Source.—Menefee and Dodge, p. 77; U. S., Department of Agriculture, Irrigation in the San Joaquin Valley.
During the early years of the twentieth century there were several methods of marketing California citrus, namely large independent shippers, individual growers, and cooperative organizations. Several large growers, particularly in Southern California, farmed enough acreage to maintain their own packing houses and shipping facilities. They sold direct to markets in the eastern United States. Other individuals or small groups of growers marketed their fruit through commission merchants or large commercial organizations such as railroads and hotels. By far the most popular method of marketing fruit was through the California Fruit Growers Exchange, a large cooperative organization.27

The cooperative marketing of California citrus began in the late nineteenth century, when growers found themselves at the mercy of wholesalers who could dictate amounts and quality of fruit to be marketed, as well as time of picking. Growers found conditions intolerable, and several abortive attempts at cooperation were made, but growers lacked marketing knowledge, capital was scarce, and the scattered locations of the citrus districts proved a barrier to communication. Nevertheless, these early attempts provided experience for a more successful venture though, the California Fruit Growers Exchange, formed in 1895. The popularity of this organization quickly grew,  

27 Ibid., p. 344.
and by 1915 sixty-two percent of all citrus in California was marketed through this cooperative.\textsuperscript{28}

There were several levels within the organization, including local associations (packing houses), district exchanges, the central exchange, and marketing districts. Growers formed local associations at packing houses, where fruit was cleaned, assembled, and packed for shipment. A number of local associations in a citrus district, usually four to eight, were then affiliated with a district exchange. Each district exchange ordered and routed rail cars for the houses under its jurisdiction, kept car-shipment records, and maintained communication with the central exchange on all phases of marketing. The district exchange also served as disburser, distributing returns from fruit to the local associations. By 1915 there were 115 local associations belonging to the California Fruit Growers Exchange, as well as seventeen district exchanges, three of which were located in the southern San Joaquin Valley.\textsuperscript{29}

The California Fruit Growers Exchange was a non-profit organization, and growers were paid for their fruit after operating expenses were deducted. Attempts were constantly made to maintain efficiency and to cut operating

\textsuperscript{28}Rahno M. MacCurdy, \textit{The History of the California Fruit Growers Exchange} (Los Angeles: G. Rice and Sons, 1925), pp. 7-15.

\textsuperscript{29}MacCurdy, pp. 66-67; Coit, pp. 347-348.
costs, as well as to expand services to growers. Soon after inception the early organization began supplying fertilizer and equipment at low cost to growers, and labor for harvesting usually was available through the local association. The Exchange also invested in peripheral interests. In order to cut packing costs and maintain a supply of lumber for packing boxes, a lumber mill and tracts of timber were purchased in Northern California in 1907.30

The central exchange was located in Los Angeles, and governed by a board of directors operating through a general manager. Facilities also were provided for the distribution and marketing of fruit, and agents were located in the major cities of North America.31

As with dairying, the stimulus for citrus production came about because of necessary physical characteristics and accessibility to markets. Citrus is the most localized of all the commodities studied, because of its requirements for frost-free area.

Early citrus cultivation and farm organization differed from dairying. Although few farms were larger than ten acres, a heavy input of labor was necessary for initial land clearance and planting. Due to the small


31MacCurdy, pp. 68-70.
size and permanent nature of the crop, requirements were diminished after the initial activity, and a rather simple farmstead organization resulted.

Early packing houses were rudimentary by contemporary standards, and were located on rail lines within the narrow confines of the citrus belt. The early markets were, for the most part, located in distant parts of the United States. While a number of small concerns were instrumental in the dairy industry, citrus was early dominated by one large marketing organization, the California Fruit Growers Exchange, which extended its sphere of influence to other grower activities.

The early transport movements revolved around the horse and wagon, and, due to the configuration of the citrus district and house location, few journeys were more than five miles. Fruit was shipped from the area by rail, utilizing refrigerated boxcars.

**Citrus Organization: 1920-1940**

The Farm

The basic organization of the citrus farm between the First and Second World Wars was the same as that of prior periods with one major exception, an increase in the use of inanimate power. Beginning in the second decade of the twentieth century, tractors gradually took over jobs performed by animals and trucks replaced wagons in transporting citrus to market. Table 3 gives some
<table>
<thead>
<tr>
<th>Year</th>
<th>Tractors</th>
<th>Farms reporting tractors</th>
<th>Total farms in area</th>
<th>% of farms reporting tractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930</td>
<td>4,524</td>
<td>3,794</td>
<td>11,707</td>
<td>32.4</td>
</tr>
<tr>
<td>1940</td>
<td>6,463</td>
<td>4,882</td>
<td>10,692</td>
<td>45.6</td>
</tr>
<tr>
<td>1945</td>
<td>9,913</td>
<td>6,470</td>
<td>11,215</td>
<td>57.6</td>
</tr>
<tr>
<td>1964</td>
<td>21,580</td>
<td>6,212</td>
<td>8,351</td>
<td>74.3</td>
</tr>
</tbody>
</table>

indication of the shift from horses to tractors for power.

Although horses and mules had the advantage of flexibility for small tasks such as hauling equipment around the farm, particularly in the more precipitous hillside areas, tractors also had a number of advantages. They were efficient users of time, fuel was abundant, and they were immune to the heat of the interior valleys.  

Experimentation with the physical conditions of the area also led to changes in the schedule of cultivation. During the early years of the industry, several light cultivations were carried out between irrigations, but it was found that numerous harrowings promoted excessive weed growth, and the number of cultivations was cut to once every two irrigations.

Another practice which gained in popularity during the 1930s was "non-cultivation." With this system a permanent set of irrigation furrows were maintained, but all weed control was accomplished by light hoeing or scraping, sometimes accompanied by light applications of oil. In the long run labor and effort was saved by this method, but it proved very laborious in the initial stages, particularly where manure had been used extensively for fertilizer, or where young trees did not provide enough shade to curtail weed growth. 

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32 Coit, pp. 174-175.
Transport and Processing

As with dairying, the introduction of truck transport greatly altered the pattern of grove to packing house hauling. Although there were two packing houses to serve citrus acreage near Bakersfield, the great majority of houses were in the contiguous citrus region of Tulare County. The number of houses and the narrow limits of the citrus region offered the majority of growers a packing establishment within an eight mile area, and rarely did a farmer travel more than ten to fifteen miles from grove to packinghouse.34

In 1912 there were thirty-six packing houses in the citrus districts, to serve approximately 28,000 acres, of which about one-third bore fruit.35 By 1942 the number of houses had increased to fifty (Figure 35), while the acreage had expanded to almost 40,000 acres. Although the number of packing houses increased, there was a corresponding increase in the capacity of the houses brought about by larger size and technical improvements such as automatic dumpers for fruit, automatic lidding machines for the packed boxes, the use of alkaline solutions to prevent rot, and

34 Interviews with Stanley Trueblood, District Manager, Sunkist Growers, Incorporated, Santa Paula, California, 29 May 1973; Karl Opitz, Horticultural Specialist, University of California Agricultural Experimental Station, Reedley, California, 8 June 1973; Robert E. Stark, Manager, Stark Packing Corporation, Strathmore, California, 3 August 1973.

Figure 35: Citrus districts, packing-house locations, and numbers, Southern San Joaquin Valley, 1942.

improved methods of heating or cooling the storage rooms. 36

Trucks were used locally and to some extent to haul fruit to Southern California. Rail transport though, continued to dominate in long distance hauling, especially cross country.

Marketing

Government regulation has exerted some control over the citrus industry, focusing on commodity movement rather than size or structure of the farm. During the 1920s and early 1930s nationwide production of citrus grew almost two thousand percent while demand was only a fraction of that amount. In order to harness output with demand, an agreement for fruit control was initiated by the citrus industry, but monitored by the U. S. Department of Agriculture. A consortium of growers and distributors met once a week to study nationwide demands for California citrus, and to delegate shipments to meet demand. This agreement was known as the "pro-rate" or controlled marketing agreement, and went into effect in 1934. Although there have been minor adjustments in the program, relating to demands for different types of fruit, the "pro-rate" has essentially remained in force. 37


37 F. D. Lockman, "Controlled Production or Prorate," California Citrograph 25 (November 1939): 16-17; U. S., Department of Agriculture, Farmer's Cooperative Service, Sunkist Growers, Incorporated, A California Adventure in
With the exception of the shift to mechanization, and the continuing experimentation with the environment which reduced cultivation practices, the organization of citrus remained essentially unchanged in the inter-war years. The tractor began to replace the horse and mule, obviating the need for a barn, and lessened cultivation practices required even fewer implements.

Although capacity became somewhat greater, the organization of the packing houses remained unchanged. There were only minor locational shifts in house position. The introduction of the truck altered service to some degree, but the restrictions of the citrus area kept movements at a minimum. The government began to regulate the flow of fresh fruit during the period, when the overproduction of citrus ensued during the 1920s and 1930s.

Citrus Organization: 1973

The expansion in citrus acreage that began in the decade following the Second World War has continued to the present. An important factor in this expansion has been the migration of citrus growers out of the rapidly urbanizing areas of Southern California into the Central Valley. Urban encroachment onto prime citrus land in the southern counties had the effect of greatly increasing land values and, consequently, taxes. Certain farming practices,

particularly the use of chemical sprays, drew criticism from suburban residents, and, as a consequence, many citrus growers sold out in Southern California and developed orchards in the San Joaquin Valley. These individuals found it possible to buy and develop four or five acres in the Valley for the price they received for one acre in Southern California (Figure 36). 38

A second source of acreage increase has been the professional or businessman who sees a small orchard as a long term investment. Many of these individuals do not live in the Valley and, since they have no means of developing or caring for their property, rely on farm managers or full-time resident growers to handle their groves. In some cases managers contract to acquire the land, develop it, grow the fruit, deliver the product to the packing house and pack it, in addition to maintaining a complete accounting service. 39

A third factor in acreage expansion has been the appearance of the corporate farm. The corporate farm is important in Kern County, where large acreages have been developed by large, diversified corporations, as well as the new farming subsidiaries of major oil companies which


Figure 36: Shifts in citrus acreage, 1950-1969.

have been developing their property on the west side of Kern County.  

Despite important plantings on the west side of the Valley, the principal citrus area remains in a belt of land adjoining the Sierra foothills in Tulare County. Its borders have expanded and contracted throughout its history, depending upon the occasional heavy freezes which killed trees planted in unfavorable climatic locations, as well as diseases such as root rot which have affected citrus, but the core area remains (Figure 37). Scattered plantings have been tried since the turn of the century in different locations in Kern County. The prime producing areas have always been the Edison district, a short distance east of Bakersfield, and the Jasmine district, which is a southern continuation of the Tulare County belt. Recent additions have been in the Grapevine district along the southern rim of the Valley, the Belridge district on the west side, and increased use of the east-side belt adjoining the Sierra Nevada.

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41 Kathleen E. Small, History of Tulare County (Chicago: S. J. Clarke, 1926), pp. 315-316; Gordon Surr and L. D. Batchelor, Citrus Culture in Central California (Berkeley: University of California Agricultural Experimental Station Bulletin Number 405, [1926]), p. 22.

Figure 37: Citrus acreage, Kern and Tulare Counties, 1912-1973.

The Farm

The size of the citrus operation in the southern San Joaquin Valley has increased through time, particularly in the last decade. Prior to World War II there were few farms larger than ten acres, but by 1948 twenty to thirty acres were necessary for a viable economic unit. The farm grew slowly into the early 1960s; during that period most operations embraced twenty-five to thirty-five acres, but by 1973 few full-time growers farmed units of less than 75 to 100 acres.

Most contemporary operations consist of a number of individual parcels of land. The blocks of citrus vary in size from half an acre to 120 acres, with the great majority ranging from ten to forty acres. A number of growers have


45 The 1969 Census of Agriculture lists a total of 1,971 farms which reported Navel oranges as a crop in Tulare and Kern counties. U. S., Department of Agriculture, Bureau of the Census, 1969 Census of Agriculture, vol. 1, pt. 48, sect. 1, pp. 342-344. A sample of thirty farms was selected, using the grid network and random numbers method. This gives a sample of approximately 1.5 percent of reporting farms. Twenty-eight units were sampled from the Tulare County-northern Kern County area, and two were from the Edison district near Bakersfield. A total of nine detailed interviews were procured (see Appendix B). Data referring to the location and acreage of all samples were obtained from the regional office of Sunkist Growers, Incorporated, Lindsay, California.
acreages in lemons, as well as other tree crops such as olives, walnuts, or decidous fruits (Figure 38). These individual blocks of subsidiary crops are somewhat smaller, with many, particularly the deciduous fruit and nut parcels, under ten acres in size.

Of the nine growers interviewed, only two relied wholly on citrus crops while the others had some acreage devoted to subsidiary crops. Two growers had less than ten percent in crops other than citrus, while one large diversified farmer had forty-three percent of his acreage in crops other than citrus, including 250 acres of cotton. The remaining growers had approximately twenty-five percent of their acreage in crops other than citrus (Appendix B).

Of the total sample of thirty citrus operations, one-third were forty acres or less in size, while another third ranged from 40 to 100 acres (Figure 39). Most operations were located within a relatively small area, thirty percent within one mile, and over half within two miles.

Despite the increased size in operations, farmsteads have remained simple and take up a relatively small portion of the area. In some operations, particularly the smaller ones, a large garage (equipment shed) close to the

46It should be noted that almost one quarter of the operations sampled were those of non-resident growers, and most of these operations were less than forty acres in size.
Figure 38: Farmstead and spatial distribution of 163 acre citrus, deciduous fruit and nut operation, Southern San Joaquin Valley, 1973. Figure shows structure of farmstead and spatial distribution of subsidiary block from largest portion of operation.

Source.—Fieldwork by author.
Figure 39: Size-distance distribution of citrus operations, Southern San Joaquin Valley, 1973.

Source.—Field interviews by author; unpublished data from Sunkist Growers, Inc., Lindsay, California.
grower's residence is the only building utilized for equipment, although occasionally a barn has been converted to equipment storage. Most growers, particularly those who do not have acreage at some distance from the farmstead, lack a subsidiary equipment yard.

For most growers little equipment is necessary. Even if a moderate amount of heavy-duty chores must be undertaken, powerful equipment can be rented or leased, or the work can be done by contract. The almost total emphasis on non-cultivated acreage obviates the need for plowing or disking, and the widespread use of sprinkler irrigation eliminates furrowing. Most growers keep a mechanical rig for weed spraying, and a tractor for hauling miscellaneous equipment, such as orchard heaters and irrigation pipe.

The susceptibility of citrus to frost always has been a problem, but new additions to the frost prevention inventory have been beneficial. Among the most important have been wind machines, which often are used in conjunction with fuel-fired heaters. Wind machines were introduced into California during the 1930s, and have gained in popularity since World War II. These devices consist of large fans driven by electricity, gas, or diesel power, mounted on towers twenty-five to thirty-five feet high. Wind machines themselves are not always effective, but complement fuel-fired heaters. The heaters replace heat that has escaped from the orchard by radiation, while the wind machines mix warm air in overlying layers, helping
to break up inversion layers (Figure 40).  

Approximately half the citrus acreage in the study region is irrigated by sprinkler irrigation. Early systems were introduced into the area during the 1930s, and consisted of sprinklers mounted on risers which extended above trees, but proved cumbersome and difficult to move. They were replaced with hose or portable pipe systems which had a number of advantages. The output of water can be precisely controlled which eliminates wastage, they are easily adapted to steep slopes, and they require relatively little labor. This method of irrigation is often used with "non-cultivation," which now includes over ninety percent of all citrus acreage in the region.  

Processing

A number of recent innovations have been introduced into the packing and transportation of citrus fruit. One of the most widespread, which applies to picking, hauling, and packing, is the use of the "bin." This is a large box, approximately four feet square and two feet deep, which holds 900 to 1,000 pounds of fruit, the equivalent of about sixteen field boxes. At picking sites mechanical loaders


Figure 40: Tulare County citrus belt landscape, showing southward flowing Friant-Kern Canal. Note the preponderance of rectangular plantings.

Source.—California Department of Water Resources photo.
lift the full bins onto specially constructed trucks which carry the fruit to houses where they are mechanically unloaded to begin packing (Figure 41).

The modern packing house is larger than houses in the earlier periods, and packs a greater volume of fruit. In 1942 there were fifty-two houses in the study area, which handled fruit from less than 40,000 acres. In 1973 there were forty-one houses, but citrus acreage has increased to almost 120,000 acres (Figure 42). Much of this increased capacity has come about through automation. The use of forklift trucks in loading and moving for instance, allows two men to do the work that fourteen men did by hand. The wooden packing box has been replaced by corrugated paper cartons which are formed automatically and then sealed by machine when packed. Lemons are packed automatically, and some houses have installed mechanical packers for oranges, which consist of a series of suction cups that pack one layer of fruit in a box at a time. Fruit is no longer wrapped in tissue, but dipped in preservatives and labelled. Experiments for more efficient packing are continually under way, and one of the most promising is concerned with the sorting of fruit by means of an electronic eye.

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49 Corrugated paper cartons replaced the wooden packing box in 1952. These cartons hold thirty-seven and one-half pounds of oranges or thirty-eight pounds of lemons, half the capacity of the wooden boxes.

Figure 41: Bin truck used for hauling citrus from grove to packing house. Bins can be shifted within the truck frame by hydraulic mechanism, greatly facilitating loading and unloading.

Source.—Photo by author, July 1973.
Figure 42: Citrus districts, packing-house locations and numbers, Southern San Joaquin Valley, 1973.

Source.—Fieldwork by author; interview with Karl Opitz, 8 June 1973.
Transport and Marketing

Packing houses in the area are either cooperative or commercial. Cooperative houses are affiliated with Sunkist Growers, the large marketing organization formerly known as the California Fruit Growers Exchange. Commercial houses usually are concerns which are operated by an individual or group of individuals who have substantial acreages of citrus, and who pack their own produce as well as fruit from other growers, charging them a flat fee for this service. Although nine of these houses are independent, another eight are affiliated with Sunkist. Sunkist commercial houses offer the same grower services, such as low cost equipment and harvesting crews, as do the coop houses, and market their fruit through the District Exchanges.

The acreages served by the houses vary. One large, well established cooperative located in Porterville packs fruit from almost 6,000 acres, while one recently reorganized commercial house packs fruit from only 750 acres. However, these are extremes; over eighty-six percent of the houses packed fruit from between 1,000 and 3,600 acres, while only two coops and two commercial houses fell outside this range (Figure 43).

The number of house patrons also varied; one commercial house served only the owner, while one large coop had 130 patrons. The cooperative houses averaged a slightly higher patronage with seventy members, while the commercial
Figure 43: Acreages and maximum distances served by citrus packing-houses, Southern San Joaquin Valley, 1973.

Source.—Fieldwork by author.
houses averaged sixty-four.

The commercial houses tended to have larger service areas than the cooperative houses. Fifty-three percent of the cooperative houses hauled fruit from twenty miles or less, while sixty-four percent of the commercial houses transported citrus from 20 to 50 miles. Forty-six percent of all houses hauled fruit from ten to thirty miles, and eighty percent had a service area limit of ten to fifty miles.

Several houses in the Lindsay area transport fruit from as far south as the citrus district near Bakersfield; one house in northern Tulare County hauls fruit from the new district on the west side of Kern County, and another northern Tulare County house hauls citrus from Firebaugh, in western Fresno County, a distance of approximately seventh miles. However, these long-distance hauls are not typical; most houses are central to the majority of the groves they serve, and most fruit is hauled from within fifteen miles (Figures 44 and 45).

Transportation plays a minor role in the overall costs of picking, hauling, and packing. Although there are variations, depending on the particular way a house handles its fruit, a bin generally costs eight to ten dollars to pick, eighteen dollars to pack, and from one dollar to two and a half dollars to haul. 51

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51 Interviews with Donald Tyrell, District Manager, Sunkist Growers, Incorporated, Terra Bella, California,
Figure 44: Service areas, citrus packing-houses, Southern San Joaquin Valley, 1973.

Source.—Fieldwork by author.
Figure 45: Service areas, citrus packing-houses, Southern San Joaquin Valley, 1973.

Source.—Fieldwork by author.
The appearance of fast, powerful, diesel trucks after World War II initiated changes in the transportation pattern for citrus as well as for other commodities. Trucks provide rapid, direct service and more uniform refrigeration than rail transport, and charges are lower than rail for short hauls. Motor transport has some disadvantages. Costs are greater for long hauls, and it is more subject to breakdown, but in spite of these negative factors, the proportion of citrus transported by truck continues to increase. By 1960 the truck had become the major carrier for short and intermediate hauls of citrus and had made inroads into the long distance shipments to points east of the Mississippi River.\textsuperscript{52} By 1972 some of the houses in the region were shipping as much as eighty-five percent of their fruit by truck, regardless of destination.\textsuperscript{53}

Sunkist Growers continue to dominate marketing, accounting for the distribution of seventy-five to eighty-five percent of California-Arizona citrus in 1973. It is also the dominant organization in the southern San Joaquin Valley; thirty-two of the forty-one houses in the region


\textsuperscript{53}Interview with Robert E. Stark, Strathmore, California, 3 August 1973.
are associated with Sunkist, through five district exchanges. 54

Although Sunkist maintains its extensive network of North American distributors it has also expanded markets overseas, primarily in western Europe and the Orient. Markets have been initiated in other regions as well; in 1973 Sunkist delivered 1.7 million cartons of oranges to eastern European countries, and made its first sale of fresh fruit to the Soviet Union. Foreign sales are increasingly important in stabilizing the California citrus market; some experts state that without overseas sales over thirty percent of California orange trees would have to be uprooted in order to avoid oversupplying the domestic market. 55

One dimension of citrus transportation that has undergone a dramatic change is transit time. During the early days of the industry in California, the rail journey to the eastern United States was two to three weeks. By 1973 this had been cut to four to seven days to the East Coast, and three to six days to the Midwest. Truck


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hauls are somewhat faster.\textsuperscript{56}

There has been a decrease in delivery times to overseas markets as well. In the decade after World War II citrus from California arrived in Europe in not less than thirty days, whereas today containerized transport from California ports has cut delivery time from 18 to 24 days. Shipment to the Orient is even faster; fruit from Los Angeles reaches Japan after a twelve day voyage.\textsuperscript{57}

Fruit that is classed sub-standard has a poor chance of selling fresh; it is sent to a "products plant" for processing into a number of products, including juices, citrus oils, flavoring for carbonated drinks, and cattle feed. The amount of fruit sent to these plants varies. Between 1966 and 1970, for instance, fifteen to twenty-five percent of the navel orange crop from the Central Valley was sent to the products plant; the remainder was packed as fresh fruit. In 1968, a particularly bad year, over half the crop was sent for processing. Fruit for processing from houses affiliated with Sunkist is sent to their products plant in Ontario, near Los Angeles, while fruit from other houses is sent to a plant located in Lindsay.\textsuperscript{58}

\textsuperscript{56}U. S., Department of Agriculture, \textit{Interstate Hauling of Fresh Fruits and Vegetables}, pp. 21-36.


The citrus industry has seen a recent expansion in the size of the operation, acreage under cultivation, and distribution of the farm. One reason for the increase in the industry has been an influx of southern California growers, as well as individuals seeking citrus as an investment property. To maintain economic stability most full-time growers now farm 75-100 acres or more, with some of their acreage devoted to other tree crops. The reliance on new cultivation methods has cut the implement inventory even further, and many farmsteads consist only of a residence and a large equipment shed. Many of the operations are in several parcels, although most are contained within a relatively short distance.

Although there has been a surge in citrus acreage, the number of packing houses has declined in recent years. Most houses are highly automated, and have greater capacity than earlier houses, but remain restricted to citrus areas. The grower has a choice of two methods of packing his fruit, either commercial or cooperative. Most houses of both types have large numbers of patrons, and serve substantial acreages, but the service areas of the cooperative houses tend to be smaller, stressing the "local cooperative" nature of the cooperative house, and the aggressiveness of the commercial house in seeking customers. Regardless of packing house organization, Sunkist Growers, Inc. (formerly California Fruit Growers Exchange), dominates
the marketing scene, recently enlarging its markets to many overseas areas.

Summary

Citrus in California had little commercial basis until the mid-nineteenth century. A commercial market was provided by the Gold Rush, but the greatest impetus came with the completion of the transcontinental railroad and advances in boxcar design in the late 1880s.

The introduction of citrus into the southern San Joaquin Valley came in 1890 when the climatic advantage of the east rim of the Valley was recognized. Because of high summer temperatures and spring precipitation the area has been especially favored for the cultivation of the Washington navel orange.

Of all systems studied, citrus has maintained a spartan farmstead. The early farms were small, and the cycle of planting and cultivation was such that once land was prepared few implements were needed.

Due to the restricted citrus region, and the location of packing houses on rail lines, most growers had five miles or less to travel from farm to packing house. Most houses were very rudimentary by contemporary standards, with a heavy focus on manual labor in the packing process. A large marketing concern became prominent early in the citrus period, and set up a wide range of grower services as well as marketing fruit throughout North America.
Prior to the Second World War little change was noted in the organization of the citrus farm, with the exception of the introduction of mechanical power. A gradual diminishing of some cultivation practices was noted, and new methods of irrigation and heating were tried.

Few changes were noted in the organization of the farm in the World War II period. The tractor replaced the horse and mule as a power source, abolishing the need for barn and corrals. The tool inventory remained simple, for most of the citrus operations in the southern San Joaquin Valley had only a tractor, plow or disk, and some sort of furrowing implement. The citrus region continued to be restricted to the eastern side of the rim of the Valley, and packing houses remained in proximity to railroad settlements. The advent of the truck increased the service areas, and in 1940 ten to fifteen miles was the periphery of most houses. At this time houses were increasing in size with new automatic additions for dumping and lidding fruits, and new heating and cooling practices. Rail continued to be the dominant means of transport to eastern markets. Trucks were used to some extent, particularly for shipment of fruit to local markets, and hauling sub-standard fruit to processing plants in Los Angeles.

There has been a tremendous increase in the citrus acreage in the southern San Joaquin Valley in recent years. An influx of growers from southern California, non-resident
investment growers, and the enlargement of the resident operation have all been contributing factors. Today many resident full-time growers farm one hundred acres or more in conjunction with deciduous fruit and nut crops.

Modern packing houses have become more automated in such functions as carton forming, packing, and loading. A major innovation in trucking known as the bin truck has increased the service area of some houses in the Valley to between sixty and seventy miles. Transportation of citrus to market is increasingly undertaken by trucks. They provide speed and a more direct service to markets than rail.

The marketing aspect of the modern industry remains in the hands of several organizations with Sunkist dominating all others.
CHAPTER V

COTTON

Early Cultivation in California

Evidence concerning early cotton cultivation in California is scanty. There are reports of padres attempting its cultivation at Southern California missions in the early years of the nineteenth century, and although a successful crop was reportedly grown at the mission at San Luis Obispo in 1818 most of these attempts failed because of cold weather. Cotton fiber was used during this time for making blankets and sheets at a number of the missions but, reportedly, this cotton was brought from San Blas, Mexico.¹

The potential for commercial cotton production gained attention in the mid 1850s. In 1856 a reward of $75.00 was offered by the State Agricultural Society of California for the best bale of cotton grown in the state. Plantings were reported in the Sacramento and San Joaquin Valleys, as well as the Los Angeles area. Experimental

¹E. Philpott Mumford, "Early History of Cotton Cultivation in California," California Historical Society Quarterly 6 (June 1927): 159-166.
plantings were attempted in the coastal areas but were unsuccessful. Beginning in 1862 the California State Legislature offered rewards for cotton production, and the first reward of $3,000.00 was given to a grower in Los Angeles County who cultivated 108 acres in 1865.2

In 1871 a group of San Francisco financiers founded the California Cotton Growers and Manufacturers Association, with the purpose of growing and manufacturing cotton. Ten thousand acres of land were purchased in Kern County, and in 1872 one hundred and forty acres were planted.3

An adequate supply of skilled labor proved to be a problem. Negroes were brought into the Valley from the southern United States, but deserted to Los Angeles and San Francisco as soon as possible.4 Chinese were used but they did not manifest the skill of Negroes, and by the 1880s cotton was almost completely abandoned in the state.5

A resurgence in cotton production in California began in the early years of the twentieth century, and by


1910 eight thousand acres of cotton were harvested. Short staple Pima cotton, grown in the Imperial Valley during this time, also was introduced into the San Joaquin Valley but did not prove wholly satisfactory. In view of the relatively high production costs it appeared that a cotton industry could not be maintained in direct competition with the eastern cotton belt in raising ordinary short staple cotton.

In 1915 experiments began with another variety of cotton. This was Acala (Gossypium hirsutum), which was discovered in Chiapas, Mexico, in 1906 by the U. S. Department of Agriculture. Acala is a medium staple cotton, and seemed well suited to the high temperatures and soil conditions of the San Joaquin Valley. This variety proved so successful that it quickly became the regional favorite and attempts were made to set up a one variety region. Enthusiasm for Acala spread rapidly, and by 1926 support was so strong that the California State Legislature passed a special act which made it a misdemeanor to bring in or


7 U. S., Department of Agriculture, Cotton Culture in the San Joaquin Valley, California, p. 4.

plant any other variety of cotton in the San Joaquin Valley.  

**Cotton: The Physical Background**

Climate, particularly temperature, plays an exceedingly important role in the localization of cotton production in the southern San Joaquin Valley. The high day time temperatures in the spring provide acceptable conditions for the early development of the plants, and the hot temperatures during the summer expedite growth. Although fertile soils and abundant water are available in the northern San Joaquin Valley, temperatures there are slightly lower during the growing season; consequently, plant maturation is slowed. Growth retardation also...

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10 The southern end of the Valley closely approaches the BWhh category of the Koppen classification of three months mean maximum temperatures of 100 degrees Fahrenheit or more. R. J. Russell, Climates of California (Berkeley: University of California Publications in Geography, vol. 2 [1920]), p. 79.
increases the possibility of a late harvest, which could be adversely affected by precipitation from autumnal Pacific storms. Rain acts to slow the harvest, impedes transportation on farm roads, and negatively affects the quality of the cotton fiber. 11

The relatively light precipitation and low humidity of the southern San Joaquin Valley are also beneficial to cotton cultivation. The ravages of pests such as the boll weevil and boll worm are restricted by the dry climate, and the lack of moisture also impedes the growth of weeds. The area is almost treeless, which facilitates the use of mechanical equipment, and cotton can be stored in the open. 12

The relatively light precipitation during the growing season (summer) makes irrigation mandatory, a fact that increases costs but insures high yield. In contrast to the humid South where cotton squares often drop off the plant in periods of moisture variability, Valley-grown cotton seldom suffers moisture stress and reasonably constant fruiting can be expected. 13

11 L. A. Crawford and Edgar Hurd, Types of Farming in California (Berkeley: University of California Agricultural Experimental Station Bulletin Number 654, [1940]), pp. 40-41.


Soil type is a secondary consideration in cotton production, and there are a number of suitable soils in the region. Cotton can be grown successfully on a variety of soils ranging from light sands to heavy clays, but does best in loams of medium texture. Light, sandy soils are porous, and water rapidly leaves the plant zone, while soils of heavy texture impede the downward movement of moisture. Medium textured loams best meet plant requirements for the storage and transmission of moisture for optimum growth. Cotton, like alfalfa, tolerates moderate amounts of alkali, which increases the area of potential planting within the region.¹⁴

Cotton: Early Twentieth Century Organization

There were several reasons for the increasing importance of cotton in the southern San Joaquin Valley during the 1920s and 1930s. The overplanting and consequent overproduction of various fruit and nut crops during the first two decades of the twentieth century led to falling prices for these commodities. The demand for cotton, on the other hand, was increasing, and cotton cultivation promised a steady income. Yield per acre was higher than in most other cotton regions, and unlike perishable fruits, cotton could be stored and withheld from the market

indefinitely. Another factor was land availability. With an annual cycle of cultivation, it was not necessary to take land out of production for several years as with fruits and nuts, thus it could easily be shifted from cotton to another crop if demand warranted.  

Another factor in the switch to cotton was associated with alfalfa production. With overpumping and the resultant falling water table, the cost of water rose dramatically during the period. Farmers who grew alfalfa were especially hard hit, since alfalfa uses, depending on soil type, two to four acre-feet of water per acre per year. Many growers, feeling that alfalfa had reached its economic limit switched to cotton, which returned more per acre, and used only two to two and a half acre-feet of water per acre annually.  

The Farm

Before the Second World War most cotton operations were small when compared to contemporary farm size. For instance in 1930 over forty percent of cotton farms in the region had less than fifty acres, about two-thirds had less than 100 acres, while five percent had more than 500 acres (Table 4). 

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15 Archibald, pp. 15-16.

Table 4

Size of Cotton Farms, Southern San Joaquin Valley, 1930*

<table>
<thead>
<tr>
<th>Total acres</th>
<th>Kern</th>
<th>Kings</th>
<th>Tulare</th>
<th>Total cotton farms</th>
<th>% of total cotton farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20</td>
<td>68</td>
<td>4</td>
<td>24</td>
<td>96</td>
<td>5.8</td>
</tr>
<tr>
<td>20-49</td>
<td>361</td>
<td>17</td>
<td>200</td>
<td>578</td>
<td>34.9</td>
</tr>
<tr>
<td>50-99</td>
<td>186</td>
<td>22</td>
<td>199</td>
<td>407</td>
<td>24.6</td>
</tr>
<tr>
<td>100-174</td>
<td>113</td>
<td>16</td>
<td>144</td>
<td>273</td>
<td>16.5</td>
</tr>
<tr>
<td>175-259</td>
<td>23</td>
<td>14</td>
<td>55</td>
<td>92</td>
<td>5.6</td>
</tr>
<tr>
<td>260-499</td>
<td>40</td>
<td>18</td>
<td>62</td>
<td>120</td>
<td>7.2</td>
</tr>
<tr>
<td>500+</td>
<td>30</td>
<td>17</td>
<td>37</td>
<td>84</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Totals 821 108 727 1656 99.8

Sources.—U. S., Department of Commerce, Fifteenth Census of the United States, 1930: Agriculture, vol. 3, Type of Farm, pt. 3 Western States.

*In order for a landholding to be classified as a "cotton farm," at least forty percent of farm income had to be from cotton for the year of enumeration. Using this criterion there were 821 cotton farms in Kern County, 108 in Kings County, and 727 in Tulare County. In addition, a number of farms reported cotton acreage but were not classified as cotton farms because of the census definition. There were 256 of these farms in Kern County, 51 in Kings County, and 260 in Tulare County. In the entire study area, 2,163 farms produced some cotton but only 1,656 or 77 percent were specialized enough to be classed as cotton farms.
The cotton farm of the period was noted for a set of components which usually included a house, barn, pump-house, and occasionally corrals or a small fenced pasture. With the onset of mechanization in the 1920s though, many barns and fenced parcels were destroyed or turned into storage units for equipment. Figure 46 outlines an operation of this type. The farmstead was built in 1915, and was part of a forty acre holding. The size of the farm gradually increased, and by 1940 consisted of 100 acres, growing cotton and alfalfa, with about twenty acres devoted to grapes. A former pasture had been turned into cropland, and the barn converted to equipment storage.17

Mechanization has played an important role in the development of agriculture in the San Joaquin Valley, and perhaps its most notable impact has been in the cultivation of field and row crops. The flat land, huge fields, lack of heavy vegetation, and soils free from rocks offered advantages to machinery utilization.

Tractor cultivation of cotton began in the early 1920s, and improvements such as tricycle wheels and rubber tires facilitated cultivation. These developments permitted tractor mounted implements such as cultivators, planters and mowers, as well as increasing power and cutting fuel costs. Tricycle tractors on rubber tires also increased the speed of most field operations by as much as twenty-five

Figure 46: Farmstead, field crop and grape farm, Southern San Joaquin Valley, 1940.

Source.—Fieldwork by author; interview with B. Radondo, Wasco, California, 25 July 1973.
to fifty percent. The mechanization of cotton culture proceeded rapidly in California, in fact, the state led the nation in adopting the tractor as a power source (Table 5).

The production of cotton embraced a number of steps in land preparation, cultivation, and harvesting, and many of these were amenable to the extensive use of mechanization, particularly the use of the tractor as a power source for pulling equipment.

The first step in land preparation was concerned with removing detritus of the preceding crop. A stalk cutter was run over the harvested field, which cleared the land of any remaining vegetation. The land was then disced to a depth of six to eight inches, and left in that condition throughout the winter to absorb precipitation.

During the late winter or early spring the ground was given a preparatory irrigation, with the soil being moistened to a depth of about six feet. This irrigation was heavy, using 0.5 to 0.8 acre-feet of water per acre, and served several purposes. It loosened soil, moisturized

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Table 5

Percent of Cotton Land Cultivated by Tractor

<table>
<thead>
<tr>
<th></th>
<th>1939 California</th>
<th>1939 U.S.</th>
<th>1946 California</th>
<th>1946 U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>land breaking</td>
<td>85</td>
<td>30</td>
<td>97</td>
<td>60</td>
</tr>
<tr>
<td>harrowing</td>
<td>71</td>
<td>25</td>
<td>95</td>
<td>54</td>
</tr>
<tr>
<td>planting</td>
<td>71</td>
<td>21</td>
<td>85</td>
<td>43</td>
</tr>
<tr>
<td>cultivation</td>
<td>73</td>
<td>21</td>
<td>90</td>
<td>45</td>
</tr>
</tbody>
</table>

the plant zone, and helped rid soil of unwanted salts by flushing.\textsuperscript{20}

Before planting the ground was given a deep, flat breaking with a mold-board plow. The land was then planed or disced which broke up large clods of dirt, and the seedbed was formed with a light harrow. Fields were planted by one or two row planters, and usually twelve to thirty pounds of seed were used per acre. Once they began to grow, small cotton plants were thinned, and weeds controlled by a light harrow or by hand chopping.\textsuperscript{21}

After fruiting, cotton was irrigated at intervals of ten to thirty days, depending on soil characteristics and weather. Usually, three to five irrigations during the growing season were necessary. Although a small area of cotton acreage was irrigated by the basin system, the great majority of the cotton was irrigated by furrow. In most districts the usual arrangement of water distribution to each furrow was practiced, but in some areas of sandy soils and extreme flatness some farmers would irrigate only one furrow in ten, with the slowly moving water


sub-irrigating the remainder of the rows.\textsuperscript{22}

Irrigation water was supplied by the usual methods of stream flow from the Sierra Nevada and underground pumping. As with alfalfa, much of the area utilizing gravity flow from streams had its water supply supplemented by wells during the summer months. In other areas, where water from canals was not available, pumping was the only means of supply.\textsuperscript{23}

Processing

Cotton ginning in the United States has undergone several important stages in its evolution, encompassing changes in gin morphology, the loading and baling process, as well as methods of cotton cleaning and lint extraction. For the most part, though, these changes took place before the advent of cotton production in the San Joaquin Valley during the present century. As a consequence, the functional structure of the gin has remained basically unchanged, although there have been noticeable changes in


productive capacity, as well as number of gins in the region (Figure 47).\textsuperscript{24}

There are several steps in the cotton ginning process. Initially cotton is drawn from a trailer by suction, then carried by pipe to a cleaner or separator. Dirt and other detritus are removed, and cotton is carried to feeders above the gin stand, a unit consisting of a series of small circular saws mounted on a single shaft. The cotton falls from the feeder into a box where it comes into contact with the rapidly revolving saws. The saws separate the cotton lint from the seed, and the fiber is swept from the saw teeth by brushes of blasts of air. The lint is then collected in a press box, and when enough cotton for a five hundred pound bale is collected, pressure is exerted on the cotton by a hydraulic cylinder and the resulting bale is covered by bagging and secured by steel ties.\textsuperscript{25}

The central components of the cotton gin are the gin stand-saw complex, and these have shown a gradual increase in size and number of saws and gin stands per gin.\textsuperscript{26} With the increase in gin capacity there has been


\textsuperscript{25}Brown, pp. 339-409.

Figure 47: Cotton gins, Southern San Joaquin Valley, 1920-1970.

a concomitant increase in gin output. In 1930 the average annual output was about 3,000 bales, by 1940 output was approximately 5,000 bales, and by 1950 average output per gin was almost 9,500 bales per season (Figure 48).

Transport and Marketing

Harvested cotton was transported in specially constructed trailers from field to gin. Usually a cotton trailer with a capacity of three to six bales, was hitched to a tractor or small truck and hauled by road to the gin patronized by the grower. Gins were spread throughout the cotton districts, as they were not dependent on rail for either the transportation of cotton or other raw materials to the gin, nor for the transportation of cotton bales or seed from gin to warehouse. The hauling distance from field to gin during the period rarely exceeded ten miles, and the average haul was about five miles.²⁷

Baled cotton was hauled from the gins to storage warehouses at Fresno, Tulare, Corcoran, and Bakersfield, and from there shipped to textile mills when demand warranted. Cotton seed was carried from gins to crushing mills at Corcoran, Bakersfield, and Fresno, where the seed hulls were removed, the meat pressed into cakes, and oil extracted. The hulls and meat cakes were utilized primarily for stock feed, while the cotton oil was put to

²⁷Interview with R. M. Bradley, Manager, Farmer's Coop Gin, Wasco, California, 10 July 1973.
Figure 48: Average gin output, Southern San Joaquin Valley, 1930-1950.

a number of uses, being used primarily as ingredients in lard, soaps and oils (Figure 49). \(^{28}\)

In the era prior to World War II only a small percentage of California cotton was used domestically. For the most part it was shipped overseas, primarily to the Orient, through the ports of Los Angeles and San Francisco. \(^{29}\)

There were several reasons for the reliance on foreign markets for California cotton. Mills in the eastern United States discriminated against California cotton because its moisture content was lower than that of southern cotton, which caused a brittleness of strand; it had a different affinity for dyes; and it also produced a knotty yarn. Consequently, the price of California cotton was mediocre, even though staple length and cotton grade were consistently above average. As a result the nations of Asia received seventy percent of all cotton exports during the late 1930s. Sixty-one percent of exports to the Orient went to Japan, and most of the remainder to China and India. About twenty percent went to textile manufacturers in Europe, primarily the United Kingdom, Germany, and France. The remaining ten percent went to other nations of the world and a small portion went

\(^{28}\) Brown, pp. 512-523.

Figure 49: Cotton regions, 1930 and 1940, processing and storage facilities, 1940, Southern San Joaquin Valley. Sixty gins located throughout cotton district in 1940.

to mills in the eastern United States. 30

The establishment of the cotton industry in the southern San Joaquin Valley was facilitated by several physical factors, including the temperature regime, aridity and an adequate water supply.

The flat topography of the area, combined with the annual cycle of plowing, planting, harrowing, and harvesting, placed a heavy reliance on mechanization. California rapidly rose to prominence in the utilization of machinery in cotton production, and this early reliance also led to a rather distinct farmstead style which was part of a farm usually less than 100 acres in size.

For the most part, the period of cotton production missed the horse and wagon era. Trailers pulled by truck or tractor were used to haul cotton to the gin, a journey of not more than five or ten miles. Gins were small by contemporary standards, but had essentially the same organization of contemporary plants. The location of cotton processing facilities was different than for dairying or citrus, as cotton gins were not subject to the anchoring effect of rail networks. Consequently the pattern of plants was more diffuse. The small number of secondary processing facilities though, and cotton storage warehouses, were found on rail lines in large urban centers, as they

used rail to transfer bulk commodities.

Textile mills in the United States discriminated against California cotton because of its physical properties, and consequently, most cotton from the region was marketed overseas, primarily in the Orient.

Cotton Organization: 1973

In recent years government intervention has resulted in market fluctuations in cotton acreage (Figure 50). With the rapid expansion of cotton in the western United States after World War II and the termination of hostilities in Korea in 1953, it appeared that overproduction would ensue. An acreage allotment program was initiated, based on a complex formula which took into consideration yield and acreage nationwide. Farmers were allotted a certain number of acres, and guaranteed a minimum price for their product. The program began in 1954, and brought a one-third decrease in acreage that year. In the San Joaquin Valley, although the cut in acreage was marked, the reduction in yield was not so drastic. Astute farmers concentrated their cotton allotment on the best land which brought a higher yield, leaving the marginal land for crops such as small grains, vegetables, and alfalfa. Changes in yield were also brought about by other methods, such as the extensive

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Figure 50: Harvested cotton acreage, Southern San Joaquin Valley, 1919-1973.

Source.—California, Department of Agriculture, California Cotton; Kern County, Agricultural Crop Report, County of Kern, 1973 (Bakersfield: County of Kern, 1974); Tulare County, Annual Report of the Tulare County Agricultural Commissioner (Visalia: County of Tulare, 1974); Kings County, 1973 Crop and Livestock Statistics (Hanford: County of Kings, 1974).
use of fertilizers and "skip-row" planting.\textsuperscript{32}

Cotton is not the only commodity to receive government support. The great majority of cotton growers in the San Joaquin Valley rotate cotton with other crops, primarily alfalfa, sugar beets, vegetables, and small grains. A rotation schedule is maintained to replenish soils as well as to diversify in case a particular crop has a poor harvest. Some of these, such as wheat, barley and sugar beets are especially attractive because of government subsidies.\textsuperscript{33}

The Farm

In addition to fluctuations in acreage, the Valley has undergone changes in the number of cotton operations

\textsuperscript{32}By the "skip-row" method cotton is planted in only a selected number of rows between unplanted rows. This system is based on the premise that rows of cotton planted adjacent to unplanted areas produce higher yields because of less competition between plants. Since subsidy payments were made on cotton yield per acre rather than strictly on acreage, obtaining a higher yield was advantageous. Most growers would use the "plant four-skip four" system, thereby having two outside rows of higher yield, and only using half the area. If, for example, a farmer was allotted 10 acres, using the "plant four-skip four" system, he could claim that on 10 acres of land he was "cultivating" 5 acres. He could thereby utilize 20 acres in "cultivating" his 10 acre allotment, and obtain higher yields. L. H. Wilkes and T. E. Corley, "Planting and Cultivation," in Advances in Production and Utilization of Quality Cotton, p. 140.

\textsuperscript{33}In 1973 over 21,600,000 dollars in government subsidy payments were made to Kern County farmers. Over 19,500,000 dollars were paid for cotton, with the remainder paid for sugar beets, barley, field corn, sorghum, and wheat. Kern County, Agricultural Crop Report, County of Kern, 1973, p. 14.
as well. Minor upheavals in the numbers of farms reporting cotton acreage were noticed from 1930 to 1945, with a sharp jump in the number of operations reporting cotton during the 1950s. The 1950s proved to be the period that most farmers cultivated cotton, for by 1969 a dramatic decline in cotton operations was apparent (Figure 51).

Although the number of operations has shown a marked decrease in recent years, the size of the operation is greater. In 1930 two-thirds of all cotton farms were under 100 acres in size, while a recent sample of 92 units found less than nine percent in that category. Fifty-one percent of the recent sample ranged from 100-500 acres in size, while about twenty-two percent contained more than 1,000 acres.\footnote{Unpublished data collected from the U.S.D.A. Agricultural Stabilization and Conservation Service offices in Visalia, Hanford, and Bakersfield, California, July 1973.}

The expansion in size of the farm units has not occurred evenly throughout the region. Most smaller field crop-cotton farms continue to be found on the east side of the Valley, particularly western Tulare and eastern Kings counties. Many of the larger operations are found in the western districts of the Valley, where agricultural expansion has been marked since the late 1940s.

With one exception, the western portions of the southern San Joaquin Valley are admirably suited, in a
Figure 51: Cotton farms, Southern San Joaquin Valley, 1930-1969. Census does not define "cotton farm" for years 1940-1954.

Farms reporting cotton acreage

Cotton farms by census definition

(Thousands)

1930 1940 1945 1954 1959 1969
physical sense, for agricultural production. The area has the region's long growing season, aridity, and high temperatures. The west side streams drain mountains composed of soft serpentines, shales, and sandstones, fragments of which are deposited in alluvial fans. These soils have constituents which disintegrate more quickly than the granitic elements which compose east side soils, and the result is a mellow, loamy soil that is extremely productive where water can be applied.\(^{35}\)

The major physical problem is water supply. West side streams are on the lee side of the Coast Ranges, precipitation is scanty, the streams are intermittent, and consequently there is little stream runoff or recharge of groundwater. Although there is a small amount of groundwater, most of it is very old, fossilized water trapped in deep deposits overlain with layers of clays, and not subject to replenishment. Consequently, agricultural expansion could not take place until a water supply for irrigation could be secured.\(^{36}\)

During the 1940s large turbines capable of lifting water from great depths were developed, and were quickly


utilized in the area. The pumps were driven by motors ranging in output up to 300 horsepower, and well depth varied from 400 to 4,000 feet. The wells were expensive, costing from 25,000 to 80,000 dollars to drill. They were also relatively short lived; due to corrosion caused by the highly mineralized water, wells had an average life span of only seven years. 37

Agriculture on the west side of the Valley is an expensive undertaking. Adding to the costs of water development are costs for land leveling and development, irrigation systems, and mechanized cultivating and harvesting equipment. Consequently, for a sufficient return on the investment it is necessary to farm large acreages. A 1,000 acre unit is considered small, and many feel that for a reasonably paying operation at least 3,000 acres is necessary. 38

Probably the most important introduction in cotton farming since World War II has been the mechanical cotton harvester. Mechanical pickers first made their appearance in the Valley in the late 1940s, and by 1950 over one-third of the cotton in the area was picked by machine. 39 By 1960 over ninety percent of the crop was mechanically harvested,

37 Ibid.


39 Large, pp. 377-380.
and by the early 1970s almost the entire crop was harvested by machine. 40

The introduction of mechanical cotton pickers had a tremendous impact on labor expenditure and speed of picking. In 1936, seventy-two man-hours were expended in picking one bale of California cotton, while by the early 1950s one machine, operated by a single person, could harvest the equivalent of three hundred bales. 41 Although the initial outlay for the machine is substantial, when considered over the life of the mechanical picker savings of up to twenty dollars per bale accrue to the grower. 42 There are also some disadvantages. Cotton must be defoliated to rid plants of leaves and fields must be planted with precision for proper placing of rows and spacing of plants. Furthermore, machines do not pick as clean as hand labor, leaving some cotton on the stalks (Figure 52). 43

40 James R. Tavernetti and Lyle M. Carter, Mechanization of Cotton Production (Berkeley: University of California Agricultural Experimental Station Bulletin Number 804, [1964]), p. 4; interview with Robert Norris, Field Representative, Calcot, Ltd., Bakersfield, California, 10 July 1973.

41 Trimble Hedges and Warren Bailey, Economics of Mechanical Cotton Harvesting (Berkeley: University of California Agricultural Experimental Station Bulletin, Number 743, [1954]), p. 20.

42 Christidis and Harrison, pp. 602-603.

Figure 52: Cotton under cultivation on the west side of the Southern San Joaquin Valley. Note flat topography and lack of vegetation, which facilitates the use of mechanization.

Source.—Photo by author, June 1973.
While most of the cotton, particularly in the older districts, is irrigated by the furrow method, irrigation by sprinkler is gaining in popularity. Many of the newer sprinkler systems, most evident on the west side of the Valley, consist of large, mobile sets which can irrigate up to 320 acres at one time. They have the advantages of precise water delivery for various crops, and delivery rates can be adjusted for particular soils. They save time and labor in comparison with the furrow method, can be used on slightly rolling or rough topography, and in some cases save water over other methods.  

Earlier, the stark, functional appearance of the older cotton-field crop farmstead, composed of a residence, barn, sheds and pumphouse complex was described. This stark functionalism has remained, although, particularly with newer operations, there has been a noticeable alteration in components, building materials, and structure.

Generally the headquarters is found on the grower's largest parcel of land, and consists of an office, equipment sheds, yards, and shops (Figure 53). Most shops and equipment sheds are of corrugated metal, and many have no sides, the roof being supported on a metal frame. Where operations consist of several tracts, separated by large distances, a block of land at some distance from the headquarters will have a subsidiary yard, and often a small

44Christidis and Harrison, pp. 478-479.
Figure 53: Shop and equipment storage on a 9,000 acre Tulare County field crop operation. Note building materials and barren appearance of area.

Source.—Photo by author, August 1973.
shop to handle minor repairs, such as welding. Depending on the season and the crop, these subsidiary yards are utilized for irrigation equipment or other types of machinery. Many of the yards, particularly the subsidiary ones, are on private dirt roads at some distance from the paved highways. These remote locations inhibit trespassing and the theft of fuel and equipment.

A characteristic of the cotton-field crop operation in the southern San Joaquin Valley is that of multiple, spatially discrete units composing a single operation. This fragmentation has come about through the lease and sale of parcels by large landholding companies, and the amalgamation of small farms into large operations, and has been facilitated by the highly developed road network. Generally the grower farms a large tract of land which serves as his headquarters, and buys or leases smaller parcels at some distance from this block. 45

45To ascertain the organization of the cotton-field crop farm detailed field data were taken from a sample of ninety-two operations already noted. Fortunately for the researcher government subsidy programs require detailed record keeping of both cotton and other field crops by each operator. The records are registered with the County offices of the U. S. Department of Agriculture's, Agricultural Stabilization and Conservation Service. Such data give the location and acreage of a grower's holdings, as well as any acreage he might lease. Using the random numbers and grid network described previously, ninety-two locations were plotted on a map, and these locations were transferred to aerial photographs maintained by the various county offices. These photographs were keyed to cards which give the data for each grower. Thirty locations were from Tulare County, twenty-four from Kings County, and thirty-eight from Kern County, giving a 3.9 percent sample of the cotton growing operations in the region.
Dispersal of holdings offers several advantages. Water for irrigation may be less expensive for land at some distance from the main operation. Different soils may be more adaptable for various crops, and in some locations soil and drainage peculiarities may permit efficient use of machinery when other parcels are waterlogged and unworkable.

There are also disadvantages. Different soils may have different irrigation properties and consume time, expense, and materials in expediting their efficient use. A great deal of time is expended in travel, particularly among supervisory personnel. For instance one grower, who farms slightly over 3,000 acres in four different blocks, spends half his work day on the road. Another, who farms 2,200 acres within an eight mile diameter, drives 37,000 miles a year overseeing his operations, averaging 200 miles a day during the summer months.

The fragmented nature of many operations is apparent in Figure 54. Of the total sample, only three small operations were completely contiguous, and usually the larger the operation the greater the spread of the various

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Figure 54: Size-distance relationships fragmented farming operations, Southern San Joaquin Valley, 1973.

Source.—Unpublished data from the County offices of the United States Department of Agriculture, Agricultural Stabilization and Conservation Service, Bakersfield, Visalia, and Hanford, California.
plots being worked. For many growers, though, the diametric distances of their operations are relatively small. Twenty-six percent have a diameter of two miles or less, forty-seven percent have a diameter of four miles or less, and eighty-three percent of the farms are contained within ten miles. At the opposite end of the spectrum, five large operations have diametric distances of thirty miles or more, with two Tulare County growers, leasing land in western Kings and Kern Counties, having operations spread over sixty miles.

The leasing of agricultural land is an important aspect of fragmented farming in the southern San Joaquin Valley. Over forty-three percent of all farms sampled leased some land, and Table 6 denotes the importance of leasing within each acreage category. As might be expected, a higher percentage of large operations leased land, while in the 100 acre or less category no land was leased. Although in every other category at least twenty-five percent of farmed acreage was leased there were variations in each group. For instance six of the operations leased more than sixty percent of their acreage, and one large Kings County grower leased over 36,000 acres.

Leasing is usually on a cash or crop share basis, and often both types of leasing for the same crop exist side by side. Custom, habit, price outlook, and individual circumstances play an important part in determining both
### Table 6

**Leased Land, Southern San Joaquin Valley, 1973**

<table>
<thead>
<tr>
<th>Size of operation (acres)</th>
<th>Total operations</th>
<th>Number of operations leasing</th>
<th>% of leased land</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-99</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>100-249</td>
<td>17</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>250-499</td>
<td>22</td>
<td>8</td>
<td>36</td>
</tr>
<tr>
<td>500-999</td>
<td>26</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>1000-4999</td>
<td>13</td>
<td>6</td>
<td>42</td>
</tr>
<tr>
<td>5000 +</td>
<td>6</td>
<td>6</td>
<td>34</td>
</tr>
</tbody>
</table>

Source.—Unpublished data from the County offices of the United States Department of Agriculture, Agricultural Stabilization and Conservation Service, Bakersfield, Visalia, and Hanford, California.
the form and amount of rent to be charged. Well developed vegetable or cotton land with water supplied presently rents for about 100 dollars per acre annually, while crop-shares range from 15 to 25 percent of the crop. The share on onions is 15 percent, alfalfa 20 percent, but on cotton may range up to 25 percent. Leases are generally on a year to year basis, few being more than three years in duration. Water is usually, but not always, supplied by the owner, an important factor to be considered when deciding rents.

Another type of lease is the land development. In order to encourage development of new land, some growers pay but a nominal rent or obtain a rent-free period as an incentive to lay out the cost of land development. Any such improvements become the property of the landowner, and the lessee then works either on a crop-share or cash basis.

The Kern County Land Company may illustrate the influences of large holdings on the agricultural pattern. Founded in the latter part of the nineteenth century through the acquisition of large blocks of land from the

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48 R. L. Adams and W. Smith, Farm Tenancy in California (Berkeley: University of California Agricultural Experimental Station Bulletin Number 655 [1941]), p. 30.

49 Interview with Merwyn Voth, Wasco, California, 24 July 1973.

50 Ron Harley, "Kern County," Farm Quarterly (Summer 1970): 44.
Southern Pacific Railroad, as well as tracts obtained under the Swamp and Desert Land Acts, the company acquired water rights, and its subsidiary canal companies sold water to its tenants and to other landholders. By 1939, the company controlled 413,000 acres in Kern County.  

Today the company farms portions of its own land, but the great bulk of it is leased. In 1968, it farmed 21,000 acres of alfalfa, 17,000 acres of cotton, 20,000 acres of barley, and approximately 2,600 acres of citrus and deciduous fruits and nuts. It has a large leasing operation, which in 1968 totalled 168 lessees, the largest of which farmed 3,500 acres, the smallest forty acres. In 1969, it succumbed to the trend toward conglomerates and became a division of Tenneco Corporation.  

Examples of farm organization may be seen in Figures 55, 56, and 57. Figure 55 diagrams the organization of a relatively small operation, consisting of 435 acres, in three separate tracts. The primary tract is of 270 acres, and includes the residence and headquarters of the grower. A block of 155 acres lies seven miles to the west of the headquarters, while a small 10 acre block lies several miles to the east. The operation has 415 acres

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Figure 55: Spatial organization of 435 acre cotton-field crop operation, Southern San Joaquin Valley, 1973.

Source.—Fieldwork by author.
Figure 56: Spatial organization of 3,016 acre cotton-field crop operation, Southern San Joaquin Valley, 1973.

Source.--Fieldwork by author.
Figure 57: Spatial organization of the Kings County operation of J. G. Boswell Corporation, 1973.

Source.—Fieldwork by author.
under cultivation, with 54 percent in cotton, 20 percent in sugar beets, nine percent each in grapes and alfalfa, six percent in potatoes, and two percent in wheat.

Equipment includes six tractors of various sizes, and several trucks and trailers, as well as various pieces of plowing, spraying, and cutting equipment. This equipment takes care of all necessary cultivation with the exception of custom harvesting which is employed for cotton, alfalfa, and wheat. There are two regular employees in addition to the family, with a sharp rise in seasonal employment for the harvesting of grapes (75-100 workers for 6-7 days), and potatoes (50-100 workers for 1-2 days).

Figure 56 outlines the organization of a grower who operates a unit of 3,016 acres in northern Kern County, 2,780 acres of which is in crops. The operation consists of four blocks, and has a diametric distance of twenty-nine miles. Fifty percent of the area in crops is devoted to cotton, twenty-one percent to alfalfa, fifteen percent to wheat, ten percent to barley, and four percent to potatoes. The remaining area is used for the headquarters area, roads, irrigation canals and pumps. Approximately one-third of the land is leased from Tenneco Corporation (formerly Kern County Land Company), and Standard Oil. Equipment

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consists of about 25 pieces, including three crawler tractors, a number of wheeled tractors, several large tractor-trailer trucks, and three mechanical cotton pickers. Except for cotton, harvesting is done by custom operators. There are eighteen permanent employees, with a surge of temporary help at harvest time.54

Figure 57 outlines the Kings County operation of the J. G. Boswell Corporation. Boswell is one of the nation's largest "agri-business" firms and holds land in Arizona and Australia as well as California, with operations in the state located in Fresno and Kern Counties as well as Kings County.

The Kings County operation encompasses over 96,000 acres, approximately twelve percent of which is leased. The main headquarters, two gins, oil mill complex, and large stockyard are located in Corcoran. There are separate locations for the large shop and equipment yard, ranch operations headquarters, and three gins.

The Boswell-Kings County operation specializes in cotton and small grains, alfalfa, and safflour. About 36,000 acres are presently in cotton, with the remaining acreage planted to the subsidiary crops. The rotation schedule is generally two years cotton, then a year in one of the other crops. Cotton is rarely planted more than two years because of the possibility of wilt in the third year.

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54 Interview with Merwyn Voth, Wasco, California, 24 July 1973.
About two hundred permanent personnel are employed in the farming operation, with an additional twenty percent being employed between October and December. Among the equipment owned and operated by this enterprise are 90 mechanical cotton pickers, 35 combines, 35 D-7 and D-8 Caterpillar tractors, several large earth movers, 50 radio equipped cars and pickups, and four aircraft, including a helicopter (Figure 58). Various pieces of specialized equipment, such as earthmovers, are contracted when needed. As opposed to many west side operations, much of the irrigation water is carried via huge canals from the Kings River, which flows from the Sierra Nevada. Wells are maintained, but well water is used only as supplementary supply.

To a large extent Boswell's is an integrated operation. Harvested cotton is taken to one of the five Boswell gins for processing. After ginning the seed is collected, and taken to the Boswell oil mill for pressing. Cottonseed hulls and meal are fed to cattle in the Boswell stockyard, as is alfalfa and some small grains grown on the operation (Figure 59). The oil mill also extracts oil from the safflower grown, and the oils, as well as processed cotton, are transported out of the region.55

55 Interview with Audy Bell, Farm Operations Manager, J. G. Boswell Corporation, Corcoran, California, 12 July 1973.
Figure 58: Equipment yard of J. G. Boswell Corporation, Corcoran, California, showing partial inventory of mechanical cotton pickers.

Source.—Photo by author, June 1973.
Figure 59: Ginning and seed-crushing complex at headquarters of J. G. Boswell Corporation, Corcoran, California. Seed from safflour as well as cotton is crushed in the complex.

Source.—Photo by author, July 1973.
Transport and Processing

Modern gins have a somewhat different appearance than those of the pre-World War II period. Probably the most noticeable is an increase in length and width, due in large part to the increase in the amount of ginning equipment. Prominent additions have been more saws per gin stand and enlarged saw diameter. By 1960 one hundred saw stands were common, and the diameter of saws had increased from twelve to sixteen inches or more. New machinery to remove trash from machine picked cotton had been installed, and seed cotton driers had also been added. The parking area for trailers adjacent to the gin had also been enlarged. During the period when most cotton was hand picked, the harvest was longer, and the cotton moved from field to gin at a low rate. With the widespread use of mechanical pickers though, harvesting is accomplished in a shorter time, and the increased volume for short periods called for a greater area for cotton storage.

A common feature of the agricultural landscape is two, three, or even four gins in one location. Although most gins built since World War II in the Valley can produce nine to fifteen bales of cotton per hour, many gins have not been able to process the added volume of cotton initiated with machine picking. Consequently, it has been necessary to increase capacity, and one popular method has been to build a second gin to supplement the
output of the first, rather than tear down the original and build a new one of higher capacity.

Gins in the San Joaquin Valley are operated in one of three ways. The first is the company gin, associated with financing and processing organizations such as Producers Cotton Oil or San Joaquin Cotton Oil Company. The second is the cooperative gin, and the third is the independent gin.

Stabilization of the San Joaquin Valley as a cotton producing region was aided by the introduction of processing and financing organizations such as Producers Cotton Oil Company and the San Joaquin Cotton Oil Company, a division of the Texas based Anderson-Clayton corporation. Although cotton seemed well suited to the area, many banks were dismayed by the number of farm bankruptcies during the 1920s and 1930s, and refused to make loans to cotton farmers. These two organizations were instrumental in filling the void left by the banks and many growers sought operating capital from these organizations' gins. Together the grower and gin manager estimate growing costs and arrange a loan for that amount. The grower draws it in monthly installments, and pays five percent interest. A second loan might be made during the ginning to meet the costs of harvesting. To secure these loans the company takes both a crop and chattel mortgage and in return the grower agrees to gin his cotton with the company and sell

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them his cottonseed for processing.\textsuperscript{56}

In recent years these company, or "line" gins as they are called, have declined in influence, particularly in Kern County. One of the most important reasons has been the resurgence of the cooperative gins since World War II. Members of cooperatives have their cotton processed in the gin, which then usually sells the cotton seed to a cooperative seed company. In some cases the cost of ginning comes out of a service charge per bale, in other cases the sale of the grower's seed covers processing charges. After a period of years a certain payment is made to the grower through the gin's revolving fund which has accumulated through gin profits. A great incentive to cooperative ginning has been a loosening of credit by banks, and the more stable position of many farmers, which has reduced the reliance on the "line" gin.\textsuperscript{57}

A third type of gin is the independent gin. In some cases independent gins are set up by large growers to handle their own crops, but in others they are truly independent and simply handle the cotton of other growers for a charge.\textsuperscript{58}

\begin{thebibliography}{9}
\bibitem{Agricultural Council of California} Agricultural Council of California, Exploring Farmer Cooperatives (Sacramento: W. G. Clark, n.d.), p. 27.
\end{thebibliography}

\textsuperscript{57}Agricultural Council of California, Exploring Farmer Cooperatives (Sacramento: W. G. Clark, n.d.), p. 27.
\textsuperscript{58}Interviews with the managers of each of the ninety-four active gins in the region were attempted. Managers associated with forty-four gins were interviewed, a total of forty-seven percent of the gins in the area. Data obtained from these interviews with gin managers
The relative unimportance of the company gin is obvious from the data in Figure 60. It should be borne in mind that a relatively small number of company gin managers were interviewed, thus presumably biasing the data; but other information reinforced the general opinion that line gins had declined in importance in recent years, particularly in the southern part of the region. The service areas ranged from three to ten miles, although about two-thirds of the gins had service areas of less than six miles. The number of gin patrons varied from three to fifteen, with an average of eight patrons per gin. The amount of cotton ginned was also limited, no gin processed cotton from more than 3,800 acres (Figure 61).

The size and extent of cooperative ginning operations was much greater. The service areas ranged from eight to thirty miles, with over half the gins serving an area of ten to twelve miles. While the least popular coop had a membership of nine, and the most popular had a membership of 180, these were extremes, sixty-eight percent of the coop gins had memberships of between forty and eighty. Acreages served also showed divergence, ranging from 4,000 to 13,000 acres. Almost half the coop gins though, served acreages ranging from 6,000 to 10,000 acres (Figure 62).

Illustrates the position of the three gin types in the organization of cotton ginning in the Valley.
Figure 60: Gin service areas, Southern San Joaquin Valley, 1973.

Source.—Fieldwork by author.
Figure 61: Service areas, company gins, Southern Joaquin Valley, 1973.

Source.—Fieldwork by author.
Figure 62: Service areas, cooperative gins, Southern San Joaquin Valley, 1973.

Source.—Fieldwork by author.
Independent gins showed the greatest variety of all types. Service areas varied from twelve to sixty-five miles, and gins processed cotton from acreages ranging from 1,500 to 50,000 (Figure 63). Gin patronage tended to be small, averaging 16 growers per gin. Some independent gins actively seek additional business to increase gin volume, but those handling large volume do not. One large organization discouraged new business because of their own large volume, although they handle ginning for growers with whom they have had a long association.59

Considering the new acreage being brought into production on the west side of the Valley there are few gins in the area. This is perhaps not unexpected; with the cost of a modern gin ranging between 650,000 and 1.5 million dollars, and an annual usage of eight to twelve weeks, there is little incentive to increase the number of gins when most of the cotton can be efficiently transported to established gins (Figure 64).60

A problem that arises when new cotton districts are opened, but gin facilities are minimal, is the proper storage of cotton until it can be transported to the gin. One recent storage innovation that is becoming increasingly popular, particularly in the new west side districts, is

59 Interview with Audy Bell, Corcoran, California, 12 July 1973.

60 Interview with Robert Norris, Field Representative, Calcot, Limited, Bakersfield, California, 10 July 1973.

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Figure 63: Service areas, independent gins, Southern San Joaquin Valley, 1973.

Source.—Fieldwork by author.
Figure 64: Cotton districts and active cotton gins, Southern San Joaquin Valley, 1973.

Source.—Field maps from U.S.D.A., Bakersfield, California; and fieldwork by author.
that of "ricking." By this procedure cotton is loaded from a mechanical picker into a trailer-like bin where it is compressed by a hydraulic ram. This mobile bin is then pulled forward, and a compressed stack of cotton, 80-120 feet long, 10 feet wide, and 10-12 feet high is left in the field. This field stored cotton is then covered with sheets of plastic to prevent the infusion of moisture into the cotton. The cotton is left in the field until trailers are available and the gin is ready to receive the cotton. In the 1972-1973 harvest in the San Joaquin Valley approximately 70,000 bales were handled in this way, much of it on the west side (Figures 65 and 66). 61

Marketing

Once the cotton has been ginned it is stored in cotton warehouses located at Fresno, Bakersfield, Tulare, and Corcoran, until it is shipped from the Valley. California regained its Oriental markets after World War II, and now sends most of its crop to Japan, Korea, Indonesia, and recently to China.

The marketing of California cotton is controlled by several large organizations. The largest is Calcot, Limited, a cooperative marketing concern headquartered in Bakersfield. It markets the cotton crops of over 2,000 growers, and in 1973 marketed 41 percent of the San Joaquin

Figure 65: Photograph of a rick compacter in operation. This method of field storage for cotton is becoming increasingly popular in the Southern San Joaquin Valley, particularly in recently opened west side areas.

Source.—Cotton Incorporated photo.
Figure 66: Specially constructed tandem trailer for hauling cotton, Tulare County. Used in conjunction with ricking. Each set of trailers has a capacity of twenty-five bales of cotton.

Source.--Photo by author, August 1973.
cotton crop. The same year the two processing and financing companies, Anderson-Clayton (San Joaquin Cotton Oil), and Producers Cotton Oil marketed thirty-five percent of the crop between them, while the J. G. Boswell Corporation disposed of ten percent of the crop. The remaining seventeen percent of the 1973 crop was marketed by a number of small independent concerns.  

Cottonseed is sent from the cooperative gins and some of the independent gins to Ranchers Cotton Oil mills at either Fresno or Bakersfield. This is also a cooperative concern which crushes approximately half the seed in the Valley. Seed from the San Joaquin Cotton Oil gins goes to Chowchilla, thirty miles north of Fresno. Producer's gins send cotton seed to their plant in Fresno, while the Boswell Corporation operates its own mill in Corcoran.

After World War II, cotton acreage underwent a tremendous expansion, but was sharply curtailed by government restrictions in the early 1950s. The reduction in acreage was followed by a reduction in the number of farms, although the size of the farms increased substantially. The regional expansion of cotton is also a noticeable factor, with alkali tolerance, irrigation technology, the ability to farm large areas with mechanization, and available land, often owned by large landowners, being

instrumental in the westward movement of the industry. Farms are also noted for fragmentation, with most operations spread over several miles.

Cotton processing has shown an enlargement of gin capacity, and often the addition of gins per location. The westward movement of gins has not kept up with the westward movement of cotton acreage, as the expense involved in gin construction overrides the need for gin for short periods. Cotton growers have a choice of three types of ginning concerns to deal with. Recently, the cooperative gins have been very influential, overshadowing both the "line" or company gins and commercial gins in total number of gins, and, particularly, the number of patrons.

Cotton marketing is, for the most part, in the hands of several large concerns, who ship the majority of the state's cotton to overseas markets, with the Orient maintaining its customer dominance.

Summary

Cotton adapted itself well to the physical background of the southern San Joaquin Valley, as the aridity, hot summer temperatures, and irrigation supplies were extremely beneficial for prolific growth.

Farms during the early era were small, in 1930 two-thirds of all cotton operations were less than 100 acres in size. A heavy reliance was placed on mechanization, which was well suited to the flat topography of the region.
Cotton was usually grown in rotation with other field crops, and the land was extensively used.

Journeys from field to gin in the pre-World War II era were usually limited to ten miles or less. Cotton gins of this period had the same basic organization as gins today, focusing on a gin stand-saw complex which was used for fiber separation. During this period a high percentage of cotton ginning and marketing was in the hands of ginning-finance companies which entered the region during the 1920s and 1930s, and who helped to stabilize the industry. Since textile mills in the United States discriminated against California cotton a large portion of the market was overseas, mainly the Orient.

Since World War II the cotton region has expanded due to the feasibility of irrigating and operating formerly barren land, and movement has been onto the west side of the Valley. There have been tremendous acreage fluctuations, brought about in large part by government intervention. The contemporary cotton operation has increased in size from that of the pre-World War II era, with many operations farming more than five hundred acres, and a substantial number farming over one thousand acres. Gins have continued to increase in size and volume, and in some cases the number of gins per location has risen. Although today many growers still haul less than fifteen miles to the gin, new innovations such as ricking have increased service areas to as much as sixty-five miles.
Gin organization has recently felt the influence of the cooperative processor, and their share of area production in growing greater. Marketing is concentrated in the hands of several large concerns, and the majority of California cotton continues to be shipped overseas.
CHAPTER VI

SUMMARY AND CONCLUSION

The preceding chapters have traced the development of several agricultural systems in the southern San Joaquin Valley, illustrating variations within the systems, at different levels and at different times. A comparison of structure among the systems, focusing on several components, will demonstrate the importance of these variables (Tables 7, 8, and 9).

Characteristics of the region's climate have affected all commodities under investigation, both in terms of commodity production and intra-regional variation, although there are differences among the three. The long growing season, warm temperature regime, and low humidity provide excellent conditions for plant growth; as many as six or more alfalfa cuttings per year are possible; some of the highest cotton yields in the United States are found in the region, and the maturity of valuable citrus commodities is expedited. Aridity has acted as an impediment to diseases affecting cotton and alfalfa, and helped prevent troublesome weed growth.
The Physical Environment
Region has low precipitation and humidity, which prevents acid soils and diseases which adversely affect alfalfa. Warm temperature regime and long growing season permits prolific alfalfa growth. Suitable soils and water for irrigation. Mild temperatures permit year-round use of open for cattle, precludes need for large storage barns.

The Dairy
1910
One to twelve cows in herd. Primarily Durham cattle, some mixed with range cattle.

The Farm
1940
Usually fewer than twenty cows per herd when dairying combined with row or field crops. On specialized "Class A" dairies herds of forty or more. Most herds Holstein, some Guernsey and Jersey.

1973
Herds average about 300, with many dairies having 800 or more dairy cows. Most cattle Holstein.

Feed
Pasture, alfalfa grown on farm. Stock watered from wells, canals or streams.

Pasture, alfalfa grown on farm, as well as some oats and barley. Stock watered from wells, canals or streams.

On some dairies alfalfa grown, as well as corn and oats. Many dairies import all feed. Stock watered from wells.

Table 7
Dairying Organization, Southern San Joaquin Valley, 1910-1973

(Cont'd. on next page.)
### Table 7 (Cont'd.)

#### The Farm

<table>
<thead>
<tr>
<th>Year</th>
<th>Labor</th>
<th>Irrigation</th>
<th>Cultivation Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1910</td>
<td>Hand milking, cream separated on farm. Labor for alfalfa, tree and vine crops combined with dairying.</td>
<td>Gravity flow from streams and canals, some use of wells. Alfalfa irrigated by check or seepage, other crops by furrow method.</td>
<td>Fields prepared for alfalfa, plowed, irrigation systems laid. Usually required every five to six years.</td>
</tr>
<tr>
<td>1940</td>
<td>Use of milking machines becoming widespread, whole milk sent to processing plants. Labor for row and field crops often combined with dairy labor.</td>
<td>Gravity flow from streams and canals, some use of wells. Alfalfa irrigated by checks or seepage, other crops by furrow method.</td>
<td>Fields prepared for alfalfa, plowed, irrigation systems laid. Usually required every five to six years. Annual cultivation cycle for row crops. Increasing use of tractor.</td>
</tr>
<tr>
<td>1973</td>
<td>Milking highly automated, through milking barn-milk house complex. Labor focuses on herd maintenance, on some dairies crops as well.</td>
<td>Although some water from streams or canals most from wells. Alfalfa irrigated by check, seepage, and, increasingly by sprinkler. Row crops by furrow method or sprinkler.</td>
<td>Annual cycle of cultivation practices for row crops, same as earlier periods for alfalfa.</td>
</tr>
</tbody>
</table>

(Cont'd. on next page.)
Table 7 (Cont'd.)

The Farm

<table>
<thead>
<tr>
<th>Year</th>
<th>1910</th>
<th>1940</th>
<th>1973</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Building materials and structure location governed by state regulation on specialized &quot;Class A&quot; dairies.</td>
<td>Building materials and structure location governed by state regulation, size of herd indirectly controlled by milk allotment.</td>
<td>Building materials and structure location governed by state regulation, size of herd indirectly controlled by milk allotment.</td>
</tr>
<tr>
<td>Farm Structure</td>
<td>Farm consisted of residence, barn, corrals, pumphouse and storage sheds. Pasture, alfalfa, and orchards and vineyards in adjacent fields.</td>
<td>Farm consisted of residence, barn, corrals, and equipment storage to serve needs of both dairying and crops. Some dairies also included silos as well as milking barn-corral complex to meet state regulations.</td>
<td>Structure consisted of residence, milking barn-milkhouse complex. Intensive use of small area for quartering herd and corral-walkway complex. Some small pastures, some dairies have area devoted to crops.</td>
</tr>
</tbody>
</table>

Processing, Linkages and Markets

<table>
<thead>
<tr>
<th>Year</th>
<th>1910</th>
<th>1940</th>
<th>1973</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm to Processor Linkage</td>
<td>Cream hauled to processor by wagon. Few journeys more than six miles.</td>
<td>Whole milk transported to processor by truck. Some journeys of fifteen to twenty miles.</td>
<td>Whole milk transported to processor by tank truck. Some journeys up to thirty miles.</td>
</tr>
</tbody>
</table>
### Table 7 (Cont'd.)

#### Processing, Linkages and Markets

<table>
<thead>
<tr>
<th></th>
<th>1910</th>
<th>1940</th>
<th>1973</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing Organization</td>
<td>Small dairy processing factories, both cooperative and independent firms.</td>
<td>Processing plants increasingly complex, turning out variety of products. Independent and cooperative firms.</td>
<td>Plants produce a great variety of dairy products. Plant capacities greater than earlier periods. Most plants independent, two cooperatives.</td>
</tr>
<tr>
<td>Processing Plant Input</td>
<td>Cream</td>
<td>Milk</td>
<td>Milk</td>
</tr>
<tr>
<td>Linkage to Market</td>
<td>Rail to Southern California.</td>
<td>Rail and truck to Southern California.</td>
<td>Primarily truck to markets throughout California, some dried products by rail.</td>
</tr>
<tr>
<td>Markets</td>
<td>Southern California.</td>
<td>Southern California.</td>
<td>Throughout California, primarily urban centers.</td>
</tr>
</tbody>
</table>

Source.—Calculations by author.
Table 8

Citrus Organization, Southern San Joaquin Valley, 1910-1973

The Physical Environment
Citrus belt in region relatively frost-free, has mild winters. Hot summer temperatures expedite citrus growth, particularly navel orange. Water available for irrigation, alkali-free soils.

<table>
<thead>
<tr>
<th>Year</th>
<th>Farm Size</th>
<th>Cultivation Practices and Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1910</td>
<td>Farms rarely more than ten acres in size. Citrus usually the only crop grown.</td>
<td>Annual cycle of cultivation including weeding, spraying, fertilization, pruning, and harvesting. Also frost prevention practices during winter. Use of animal power for many tasks, harvesting of fruit by hand.</td>
</tr>
<tr>
<td>1940</td>
<td>Few changes from earlier period. Farms continued to be small, citrus only crop grown.</td>
<td>Essentially same cycle of cultivation from earlier period. Increasing use of mechanized equipment instead of animal power.</td>
</tr>
<tr>
<td>1973</td>
<td>Farms showed great increase in size from earlier periods, few full-time growers cultivate less than 100 acres. Often citrus combined with other fruit and nut crops.</td>
<td>Increasing use of chemical sprays for weeding, &quot;non-cultivation&quot; with little plowing also widely used. Use of wind machines for frost protection. Fruit harvested by hand. Extensive use of mechanized equipment.</td>
</tr>
</tbody>
</table>

(Cont'd. on next page.)
<table>
<thead>
<tr>
<th>Year</th>
<th>Irrigation</th>
<th>Farm Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1910</td>
<td>Gravity flow from streams, canals, use of wells. Furrow method of irrigation most widely used, basin method in porous soils.</td>
<td>Farmstead consisted of few buildings including residence, barn, implement sheds and pumphouse, adjacent to groves.</td>
</tr>
<tr>
<td>1940</td>
<td>Irrigation practices same as earlier period.</td>
<td>Farmstead essentially that of earlier period, but barn often replaced with the introduction of the tractor.</td>
</tr>
<tr>
<td>1973</td>
<td>Some flow from streams and canals, also use of wells. Furrow method as well as basin method of irrigation practiced, but increasing reliance on sprinkler irrigation.</td>
<td>Farm structure remained simple. Barn replaced except as storage facility. Few implements, farmstead consists usually of a residence and building for equipment storage. Citrus operation often in fragmented parcels, farmstead on largest block.</td>
</tr>
</tbody>
</table>

(Cont'd. on next page.)
<table>
<thead>
<tr>
<th>Farm to Processor Linkage</th>
<th>1910</th>
<th>1940</th>
<th>1973</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fruit hauled from grove to packing house by wagon. Few journeys of more than five miles.</td>
<td>Fruit hauled from grove to packing house primarily by truck. Few journeys of more than ten miles.</td>
<td>Fruit hauled from grove to packing house by truck. Most journeys are less than fifteen miles, but as far as sixty miles.</td>
</tr>
<tr>
<td>Processing Plant Input</td>
<td>Fresh fruit.</td>
<td>Fresh fruit.</td>
<td>Fresh fruit.</td>
</tr>
<tr>
<td>Processing Plant Output</td>
<td>Fresh fruit.</td>
<td>Fresh fruit, sub-standard fruit used for juices.</td>
<td>Fresh fruit, sub-standard fruit used for juices, flavoring, cattle feed, oils.</td>
</tr>
</tbody>
</table>

(Cont'd. on next page.)
Table 8 (Cont'd.)

Processing, Linkages, and Markets

<table>
<thead>
<tr>
<th></th>
<th>1910</th>
<th>1940</th>
<th>1973</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linkage to Markets</td>
<td>Rail to markets throughout North America.</td>
<td>Primarily rail to markets throughout North America, some truck hauling for California markets.</td>
<td>Rail and truck throughout North America, ship to foreign markets.</td>
</tr>
<tr>
<td>Markets</td>
<td>North America</td>
<td>North America</td>
<td>North America, one-third fresh fruit sold in foreign markets.</td>
</tr>
</tbody>
</table>

Source.— Calculations by author.
### The Physical Environment

Long growing season and high temperature regime during the growing season are important in cotton production. Also lack of precipitation permits control of moisture to plants. Aridity keeps out pests such as boll weevil and bollworm. Little chance of precipitation during harvesting permits field storage.

#### The Farm

<table>
<thead>
<tr>
<th></th>
<th>1940</th>
<th>1973</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Farm Size</strong></td>
<td>Prior to World War Two farms tended to be less than 100 acres. Two-thirds less than 100 acres, only five percent more than 500 acres.</td>
<td>Farms noted for large size. Many, particularly in the western part of the region are several thousand acres or more in size. Most larger operations in fragmented parcels, cotton grown in conjunction with other field crops.</td>
</tr>
<tr>
<td><strong>Cultivation Practices and Labor</strong></td>
<td>Annual cycle of cultivation including land clearing, plowing, planting, weeding and harvesting. Use of mechanized equipment for cultivation before World War Two. Hand picking.</td>
<td>Same cycle as before World War Two. Introduction of mechanical cotton picker during 1950s, crop almost totally machine-picked.</td>
</tr>
</tbody>
</table>

(Cont'd. on next page.)
Table 9 (Cont'd.)

The Farm

<table>
<thead>
<tr>
<th>Year</th>
<th>Irrigation</th>
<th>Farm Structure</th>
<th>Government Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940</td>
<td>Gravity flow from streams, some use of wells. Furrow method most widely used.</td>
<td>Early farmstead consisted of residence, barn, pumphouse and equipment storage. Crops in adjacent fields.</td>
<td></td>
</tr>
<tr>
<td>1973</td>
<td>Gravity flow from streams and canals, extensive use of wells. Furrow method still most common method of irrigation, although sprinkler method becoming more widely used, particularly in newer districts.</td>
<td>Newer farmsteads stress buildings for equipment storage, shops for welding, etc. Often several parcels in farm, separated by some distances. Farmstead on largest parcel, sometimes small subsidiary yard on other block.</td>
<td>Acreage restrictions on cotton affects size of operation.</td>
</tr>
</tbody>
</table>

Processing, Linkages and Markets

<table>
<thead>
<tr>
<th>Year</th>
<th>Field to Processor Linkage</th>
<th>1940</th>
<th>1973</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Most trips less than 10 miles, average 5 miles. Movement by cotton trailer.</td>
<td>Most field to gin trips of 10 miles or less, but up to sixty-five miles. Cotton hauled by trailer, some emphasis on field storage.</td>
<td></td>
</tr>
<tr>
<td>Processing Organization</td>
<td>1940</td>
<td>1973</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Processing Organization</td>
<td>Company, independent and cooperative gins, company gins very</td>
<td>Company, independent, and cooperative gins, with cooperatives becoming</td>
<td></td>
</tr>
<tr>
<td></td>
<td>important.</td>
<td>increasingly important.</td>
<td></td>
</tr>
<tr>
<td>Processing Output</td>
<td>Cotton fiber.</td>
<td>Cotton fiber.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cotton seed.</td>
<td>Cotton seed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cattle feed, lard, soaps, oils.</td>
<td>Cattle feed, lard, soaps, oils, paints.</td>
<td></td>
</tr>
<tr>
<td>Linkage to Market</td>
<td>Rail to points in North America, ship to foreign markets.</td>
<td>Rail and truck to points in North America, ship to foreign markets.</td>
<td></td>
</tr>
<tr>
<td>Markets</td>
<td>Textile mills in United States and foreign markets.</td>
<td>Textile mills in United States and foreign markets.</td>
<td></td>
</tr>
</tbody>
</table>

Source.-- Calculations by author.
The mild climate has affected landscape features as well. Large dairy herds can be maintained in open corrals and pasture, precluding the need for large, substantial dairy barns necessary in areas of harsh winter climate, and the storage of large amounts of expensive mechanized equipment in skeletal shelter is a common feature of the area.

The lack of precipitation during the growing season permits precise control of water through irrigation, influencing crop yield. The precipitation regime though, brings benefits to commodities in altogether different manners as well. While cotton harvesting is aided, and lint quality is maintained by the sparse or non-existent autumn rainfall, spring precipitation is extremely important in the solidification of the Washington navel as the most significant citrus crop.

Freezing temperatures are not common in the Valley, but the possibility of occurrence strongly influences the location of the citrus industry, restricting it to the relatively frost free districts along the Valley rim. Although alfalfa and cotton would be adversely affected by cold weather during crucial growth periods, their annual cycle of growth makes this unlikely.

Certainly, the availability of water was a crucial factor in initiating agricultural activity for all the systems, and has remained so to the present. Early crop production was localized on the east side of the Valley,
where stream water was available, canal networks were feasible, and supplemental water from underground sources could be utilized with the then current technology. Advanced irrigation technology, while allowing new methods of watering for all crops, has been influential in the spread of field crops, especially cotton. The introduction of deep well drilling for instance, was instrumental in the noticeable eruption of westward movement for field crops within the area.

Soils are not the paramount factor to consider when locating any of the crops under investigation, although citrus might be adversely affected by alkali deposits. All crops will grow on a variety of soils, although doing best on soils of medium texture. The tolerance of alkali is a beneficial aspect of both cotton and alfalfa cultivation, as these crops will tolerate moderate amounts of this substance, which allows them to grow in areas barred to more sensitive plants.

While the physical characteristics of the region, combined with the availability of transport and market demand have given a basis to the systems, citrus and dairying have been given an added impetus because of the Valley's location in relation to the heavily urbanized area of Southern California. The population pressures in that area have caused an exodus of dairymen and citrus growers, many of whom have chosen the southern portion of the Valley for relocation. Their reasons for locational choice though,
are diverse: for citrus the temperature regime and lack of frosts, combined with an already established industry and land for development played an important role in choice, while for dairymen the space for expansion, the proximity of feed, and the availability of rapid transport for their highly perishable commodities were the instrumental factors.

One of the most important components of the agricultural system, upon which much activity focuses, is the farm unit itself. Although the various commodities have always had their own cultivation practices, there was a similarity in the early farmstead appearance, characterized by a relatively homogeneous set of buildings, consisting of a house, sheds, a barn and corral complex, and the ubiquitous pumphouse. Through time though, the diminishing in the need for animal power negated the need for a barn, and the increasingly specialized nature of the different systems brought about an evolution into distinct farmstead styles.

The dairy, with its increasing emphasis on specialized milk production, has undergone alterations to provide efficient milk production in sanitary surroundings, utilizing the product from large herds. Structural changes include specialized milk houses and milking barns, containing innovations to expedite milking and the movement and storage of milk. The herds are much larger than in previous periods, and, due to the availability of large quantities of feed that can be transported economically
from as far as Utah, can be quartered in relatively small spaces. Economic factors are not the only aspects to consider in dairy organization. Government regulation dictates building location and materials, and, indirectly, the size of the operation through milk allotments.

While the modern dairy, with its intense use of a highly developed area, is noted for a number of striking components, the citrus farmstead has almost a spartan appearance, due, in large part, to the nature of cultivation activities which call for a limited implement inventory. Once the initial land clearing and planting is completed, the permanent nature of citrus agriculture, the increasingly simplified cultivation practices, and the harvesting crews provided by outside sources all contribute to farmstead simplification.

The third type of agricultural system under discussion has a different set of cultivation practices, different equipment needs, and, consequently, presents a different arrangement and landscape appearance. The cycle of land preparation, cultivation, and harvesting of cotton and its associated field crops calls for heavy expenditures of mechanical labor, and as a result the cotton operation is noted for an array of equipment sheds, storage yards, and shops for mechanical repair. While older operations are noted for some vestiges of former operational structure, the more modern farmsteads are composed of strictly
utilitarian buildings, often no more than frames and a roof.

While the farmstead components have shown diversity through the years, the size and distribution of holdings have also shown change. The size of the unit has shown an increase for all commodities, and, particularly for cotton and citrus, a noticeable fragmentation of holdings. Perhaps the most striking aspect is the differences in scale between the two. While citrus operations rarely exceed five miles in diameter, and most are contained within two miles, the cotton-field crop operation is noted for a much wider range as well as a much larger size. The cotton farm has expanded because of technology which brought formerly barren land into production, large scale mechanization which made the cultivation of large acreages possible, and available land for farming which could be bought or leased, often from large landholders.

Government regulation has influenced the cotton operation as it has the dairy. Acreage allotments affect the amount of acreage planted to cotton, the rotation schedule of crops, and the implement inventory. If acreage restrictions were to be lifted the impact on the San Joaquin Valley cotton districts could well be dramatic, with a shift of acreage from the Southeast to the irrigated regions of the West where efficient, high yield irrigated farming is well established.
When one considers processing facilities, certainly a prominent feature has been the recent reduction in the numbers of primary processing facilities. Large capital outlays were needed for modernization and increased capacity of facilities, and those least able to afford such renovations and additions were forced out of business.

The need for rail transport has dictated the location of processing facilities for citrus and dairying. On the other hand, cotton gins have not been anchored by this factor, and until recently have migrated with the expanding cotton districts. The heavy capital outlay for new gins, combined with recent innovations in cotton transport, have made the use of older, established gins more economically practical than the construction of gins in the new west side cotton districts.

The movement of commodities from farm to processor has been, as other aspects of the system, altered by far reaching technical change. The shift to truck from the horse and wagon, with its restricted range, small capacity, and slow rate of travel, provided the farmer with new economic advantages including a wider choice of processing facilities, a freedom from long, arduous journeys, and the ability to move larger quantities of produce in a shorter period of time.

Although the change to truck was probably the most significant development in farm-processor relations, the friction of distance has been made increasingly less
discernible during recent periods. Considering commodity region, the varied locations of plants, the wide overlap of plant service areas, and new commodity moving techniques such as bin trucks, bulk tankers and ricking, one must conclude that barriers of intra-regional space plays a very small role in commodity transfer, and that producer choice has much more import.

Linkages between the processor and the market have undergone changes as well. The advantages of increased speed and mobility possessed by the modern high-powered, refrigerated truck has drastically diminished the reliance on rail, particularly for the movement of dairy products and citrus. For cotton and overseas shipments of citrus though, the ship, with its large capacity and cheap rates has remained the primary means of movement.

The marketing structure of the three agricultural commodities is oligopolistic, particularly for citrus and cotton. Over three-quarters of all citrus marketing is handled by one firm, while over eighty percent of the San Joaquin Valley cotton crop is marketed by only four concerns. While dairying is not as concentrated, there has been a reduction in processors during the recent past, and all are associated with large retail firms.

The dominance of the large marketing organizations, particularly for commodities such as cotton and dairying with widespread markets distant from the producing area, is not unexpected. The needs for product promotion, the
maintenance of consumer contacts, the search for new markets, the ability to maintain product quality control, and bargaining power for transport, demand a well coordinated, far reaching organization. The inability of a small concern, unless extremely well financed, to execute the above named duties is understandable.

From the standpoint of organization, the influence of the vertically integrated firm is very apparent. Perhaps the most striking example is the power exerted by the Sunkist cooperative, although both cotton, with the influence of a few cooperative and commercial ginning-marketing firms, and dairying, with its nine processor-retail companies, demonstrate the economic power consolidated into a few units. No chronological period has been of importance for all systems. Sunkist has proved the most influential throughout all periods of citrus development in the Valley. The consolidation of power for the other systems has been more recent, with vertical integration in the dairying industry beginning in the 1930s and expanding after World War II, and although the ginning-financing companies of the cotton industry heavily controlled ginning and marketing during the 1930s and 1940s, they have been successfully challenged by the rise of cooperative organizations in recent years. Regardless of industry though, the close links between processing and marketing provide increased communication, the streamlining
of functions, and better coordination for the final utilization of the product.

The strength of cooperative organization is also noticeable. Growers are offered a choice in all systems, and at both the levels of processing and marketing, between cooperative and commercial outlets, and the desire of the farmer to participate in his economic activities is seen by the large numbers of patrons for cooperative enterprises, particularly in citrus and cotton.

All systems then, are noted for relatively few marketing concerns, often connected with processing activities. Those early cooperatives which survived, such as Sunkist and the remaining dairy coops in the region, were noted for initiative in extending activities and maintaining communications with markets. Those firms which became influential during later periods, such as dairy processor-retailers, cotton ginning and financing companies, and, more recently, cotton cooperatives, have had access to capital for facilities and expansion.

Conclusion

This dissertation demonstrates that all-embracing statements concerning agricultural development and organization must be carefully scrutinized. Although certain components, such as transportation development have affected agriculture in the region in general, each of the systems studied manifested peculiarities of
development, size, and distribution of elements within each system. These have been due to the nature of the commodities, the adaptability of technology to the systems at different times, and the markets served. Comparison among the systems at any particular period shows contrasts in size of farm operation, processing service areas, and market areas and means of commodity transport. Certain similarities do exist. All systems are noted for grower choice in the means of processing and marketing. There are close links in all systems between processors and marketing firms, and the marketing of goods is controlled by relatively few organizations.
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Olsen, W. C. Secretary, California Milk Producers Association, Tulare, California, 2 July 1973.
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Communications


# APPENDIX A

ACREAGE UTILIZATION, 20 DAIRIES, SOUTHERN SAN JOAQUIN VALLEY, 1973

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<th>Size of dairy herd (all cows)</th>
<th>Size of farm unit</th>
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### APPENDIX B

**ACREAGE UTILIZATION: NINE CITRUS OPERATIONS, SOUTHERN SAN JOAQUIN VALLEY, 1973**

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*Top figure represents acreage while bottom figure represents number of parcels.
VITA

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Natural Resources
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World Regional Geography
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Candidate: Steven John Zimrick

Major Field: Geography

Title of Thesis: THE CHANGING ORGANIZATION OF AGRICULTURE IN THE SOUTHERN SAN JOAQUIN VALLEY, CALIFORNIA

Approved:

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

November 17, 1975

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