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Common roots of a new industry: the introduction and expansion of cotton farming in the American West

by

Cameron Lee Saffell

A dissertation submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Agricultural History and Rural Studies

Program of Study Committee:
Pamela Riney-Kehrberg, Major Professor
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Iowa State University

Ames, Iowa

2007

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Several people contributed immeasurably to this work. To them I owe very personal and professional debts, and I am pleased to publicly recognize their efforts.

First are the several faculty that oversaw my studies, which extended over several years. Dr. R. Douglas Hurt, former director of the Agricultural History and Rural Studies (AHRS) Program and former editor of Agricultural History, was the original chair of my committee and directed my studies while I was in residence at Iowa State University. With my earlier graduate studies at Texas Tech University having been in museum science, I learned much of the craft of being a professional historian and writer from him. After Hurt's departure from the department, Dr. Pamela Riney-Kehrberg, his successor and current director of the AHRS Program, stepped in to advise me from several hundred miles away. To both I owe a debt of gratitude for helping mold the historian inside and pushing me to complete this endeavor.

Several faculty members in the History Department at Iowa State University aided my advancement and, at times, served on my committee. Those who I recall with fondness and who made suggestions toward research papers and material that I incorporated in this work include Alan I Marcus, Dennis M. P. McCarthy, James Whitaker, Jerry Garcia, Amy Bix, Hamilton Cravens, and Joseph Taylor III. It was most gratifying that the collective faculty thought enough of me and my work to award me the Garst Dissertation Fellowship in Spring 2005, even though I had not been in residence for several years. I also want to express thanks to my classmates in the several seminars I completed while at Iowa State University, who offered their comments and criticisms on my work.

As I completed my coursework and began studying for my comprehensive exams, I had the extraordinary opportunity to become the first agricultural historian for the New Mexico Farm & Ranch Heritage Museum, a curatorial position in my chosen career field. I have been blessed to have extraordinary support from the administration and my colleagues. Former director Mac Harris and my immediate supervisor, Chief Curator Toni Laumbach, who graciously consented to my taking a part-time leave for the semester when I held the Garst Fellowship. I am personally appreciative of Laumbach's words of encouragement and understanding, particularly in the final push to complete this project. Several co-workers and

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friends at the Museum were also inspirational and persuaded me to carry on with my doctoral studies on the "nights and weekends" plan. Notable among them were Robert Hart, Leslie Bergloff, Holly Radke, and several of our wonderful volunteers. The professionalism and success of a relatively new museum is due in large part to the staff, which have become my family away from home. I am grateful that I have been able to secure such a wonderful and rewarding position as my first career job.

My finishing this project would not have been possible without the aid of many people in various institutions from Iowa to Arizona. This includes the staff of the Lubbock County Historical Collection (now part of the American Museum of Agriculture in Lubbock, Texas), the Southwest Collection at Texas Tech University, and the librarians and archivists at Iowa State University, Texas A&M University, Arizona State University, and New Mexico State University. Their contributions of knowledge and know-how were useful in securing resources and materials for this dissertation.

Many thanks must go to family and friends who supported me even at a distance, whether I was in Ames or Las Cruces. The most thanks go to my parents, Julia and Ted (who works for a cotton module truck company), for their weekly phone calls and encouragement. I also very much appreciate my brother Justin, his wife Mary, and my niece Isabelle for their interest and support. I have also benefited from the support of many friends, including Deborah Bigness, Leslie Bergloff, Christine Carl, and Ellen Atkinson Stump, who always said that I would get through this one way or another.

My interest in this subject began with my thesis research at Texas Tech University in the 1990s. In developing a material culture/technology history of cotton farming on the Texas South Plains, I reconnected to my own family heritage. I am the grandson of two West Texas farm families, J. C. and Helen Flournoy of Crosbyton and Leon and Ruby Saffell of Meadow. Although my grandfather Saffell died when I was young, the rest of my grandparents passed away during the years I worked on this project. I have always felt their presence and believe they would be pleased to know that I am honoring them among the numerous families who are the farmers of the Cotton West. I dedicate this dissertation to their memory.

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ABSTRACT

During the early twentieth century American cotton-producing areas rapidly expanded beyond the "Old South" cotton belt, an area extending from Virginia to East Texas. By the 1920s farmers had plowed fields and established new cotton centers in western Oklahoma, the High Plains of Texas, and among the large irrigated farms of California, Arizona, and New Mexico. By the 1940s the dominant areas of American cotton production were California and West Texas.

While historians have examined many aspects of cotton production in the South, the same cannot be said of the western cotton belt. This study profiles the newer cotton farming areas from Central Texas to California and their evolutionary development into the "Cotton West."

Several conditions influenced the establishment and expansion of the Cotton West. Water and irrigation were key ingredients. New settlers in many areas produced relatively little until the federal government built a major irrigation system through the reclamation program; other farmers depended on underground water to sustain their crops.

Central players in the development of the western cotton industry were the researchers and scientists of the U.S. Department of Agriculture (USDA) and their partners in state land-grant colleges and agricultural experiment stations. The USDA was particularly eager to establish a new cotton industry in the West—one that would supplement instead of duplicate that of the South. Researchers sought and improved varieties of long-staple and Acala cottons, which they bred to suit each region of the Cotton West.

With appropriate varieties of cotton available to farmers, the march toward mechanization became the next important area of study for farmers and researchers alike. Changes in technology and the available labor force were constant challenges for western cotton producers needing seasonal, sometimes migratory, labor at particular times of the year. Federal immigration policy affected which ethnic groups were available. The shift to mechanical harvesting after World War II marked a significant step toward completing mechanization and shifting the labor needs for cotton growing. Once the Cotton West became well established, the contrasts between the West and the South began to disappear.

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CHAPTER I
INTRODUCTION AND METHODOLOGY

The cotton-producing areas of the United States rapidly expanded in the early twentieth century. Up to that time cotton was produced only in the "Old South" cotton belt from Virginia to East Texas. By 1900 farmers were quickly crossing toward the 100th meridian in Texas, and over the next twenty years they established the beginnings of new cotton centers in western Oklahoma, the Southern Plains of Texas, and large irrigated farms in California, Arizona, and New Mexico. By the end of World War II the dominant areas of American cotton production were California and West Texas.

While the ins and outs of the Southern cotton belt have been thoroughly examined from many perspectives, the same cannot be said of the newer Western cotton belt. Many short articles and a few theses and dissertations have offered regional glimpses into this area. Unfortunately, to date no one has considered the common development and similarities of the region as a whole—unlike the cotton industry itself, which has met in the Western Cotton Production Conference and other similar gatherings since 1951. This monograph corrects that oversight—to study and profile the newer cotton farming areas from Central Texas and Oklahoma to California and their evolutionary development as the "Cotton West."

The Cotton West

What constitutes the cotton growing areas of the West and the South? Where does one leave the South and enter the West? The potential answers can be quite complex but are critical in differentiating how newer cotton production in the West differs so much from the older areas of the South.[1] To define the "Cotton West," one should first determine what is the "Cotton South."

[1] The author first developed the definitions of the Cotton West and Cotton South for a 1999 presentation at the Agricultural History Society symposium, which was subsequently developed for publication. Much of the material in this section comes from that work. Cameron L. Saffell, "When Did King Cotton Move His Throne (And Has It Moved Back)?", Agricultural History 74(2) (Spring 2000): 293-308.

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The Bureau of the Census defines the South as the states of Alabama, Arkansas, Delaware, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, Georgia, Florida, South Carolina, Tennessee, Texas, Virginia, and West Virginia (fig. 1).[2] Most historians refer to this as the "Census South." This definition functions fairly well, although it includes several non-cotton-producing states.

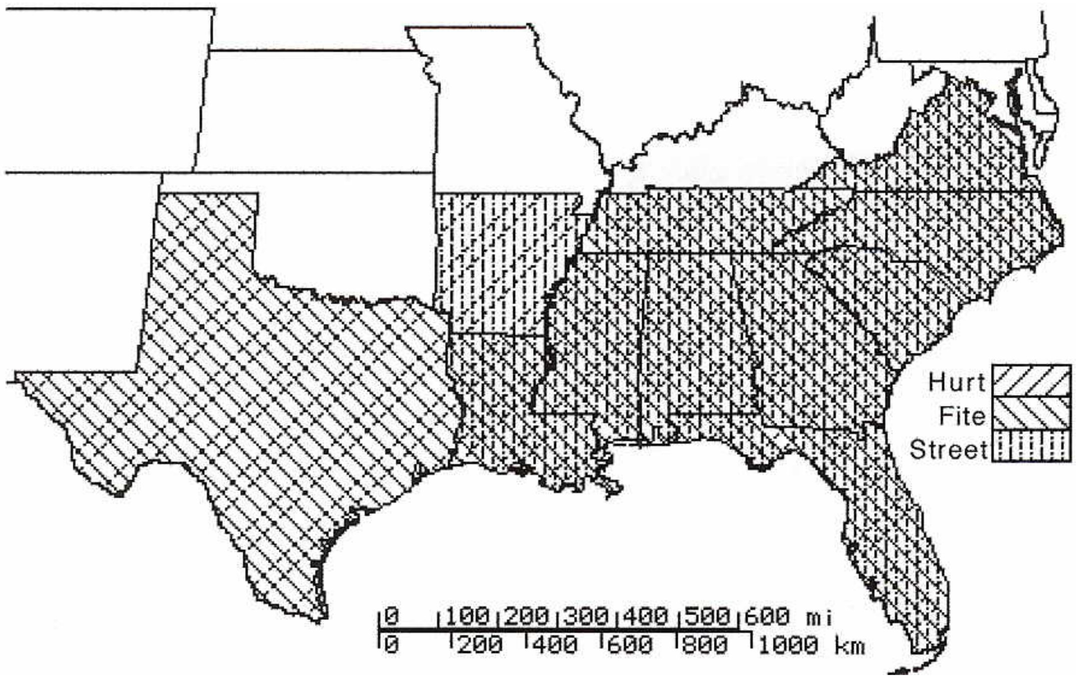

Figure 1. Definitions of the South
Source: Compiled by the author.

R. Douglas Hurt, in the most recent history of American agriculture, defines the "Cotton Kingdom" South as running from "Virginia and North Carolina to Texas [and] from Tennessee to Louisiana and Florida," as depicted in figure 1. Gilbert Fite, in his comprehensive study of southern agriculture, Cotton Fields No More, "arbitrarily" defines the South as the eleven states of the Confederacy from the American Civil War. This, he admits, leaves out some critical cotton areas in Kentucky, Oklahoma, and southern Missouri. The latter two are significant cotton-producing regions in the twentieth century. James

[2] As an example see the geographic map divisions for "Cotton—Acreage, By States: 1909," in U.S. Bureau of the Census, Thirteenth Census of the United States Taken in the Year 1910, Volume V: Agriculture (Washington, D.C.: GPO, 1913), 683.

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Street, in The New Revolution in the Cotton Economy, defines the South three ways, including a "Southeast" grouping similar to Fite's minus Oklahoma and Texas.[3] All of these definitions of the Cotton South (by states) are fairly suitable as long as one is considering production prior to 1900. Up to that time American cotton farming extended across the region defined by Hurt plus southern and eastern Oklahoma.

In the twentieth century cotton farming expanded into the American West. Through most of the nineteenth century cotton farming did not extend west of the Blackland Prairies that range across Central Texas. Growth followed the line of furthest Anglo settlement as the pioneers slowly advanced toward West Texas and into Oklahoma. Farmers in these recent agricultural additions did not raise more than small experimental plots of cotton until the 1910s, when experiment station researchers developed varieties and growing methods adapted to the semi-arid environment and when producers built the first cotton gins on the High Plains.[4]

The first two decades of the twentieth century also saw the establishment of cotton farming in the American Southwest. The irrigation canals of public and private water projects opened previously dry lands to farming for the first time. USDA researchers experimented with long-staple cotton varieties that produced greater fiber yields in the longer growing season.[5] They also met their goal of establishing an alternative, domestic source of long-staple Egyptian cotton for American mills. Further, these areas were free of the dreaded boll weevil that was then sweeping across the Cotton South. Production began in the Imperial Valley of California and in nearby Arizona. As successful growing methods and varieties were determined, production expanded to the San Joaquin Valley of California and

[3] R. Douglas Hurt, American Agriculture: A Brief History (Ames: Iowa State University Press, 1994), 120-21; Gilbert C. Fite, Cotton Fields No More: Southern Agriculture, 1865-1980 (Lexington: University Press of Kentucky, 1984), xi; James H. Street, The New Revolution in the Cotton Economy: Mechanization and Its Consequences (Chapel Hill: University of North Carolina Press, 1957), viii.

[4] Cameron Lee Saffell, "Working in the Cotton Fields of the South Plains [of Texas], 1910-1990" (Master's thesis, Texas Tech University, 1996), 24-28.

[5] Many observers describe cotton—specifically the varieties or types being grown—by its staple length. The fiber length of cotton is the key trait to buyers. Generally the longer the fiber, the more desirable it is for spinning and weaving into fabric. Cotton is usually either short-staple (fibers less than 1 1/2 inches in length) or long-staple (fibers longer than 1 1/2 inches).

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the river valleys of Arizona and southern New Mexico. These areas and the new sections of western Oklahoma and Texas may be said to constitute the Cotton West.[6]

The westward expansion of cotton production poses some problems for trying to define the West from the South simply by states. Logically, cotton grown in western Oklahoma and Texas cannot be included as part of the South because it is in a new and climatically different region from the rest of the traditional Cotton Belt. Somewhere in between, a finer line must be drawn for where the Cotton West begins.

Several sources offer possible delineation lines (fig. 2). The first is simply a line west of the 1899 production areas, as reported in the 1900 decennial census. Many of these areas are in the Blackland Prairie of Central Texas, depicted in figure 2 based on a map in Rebecca Sharpless' 1999 book profiling farm women of that region. Another definition comes from a 1933 Census Bureau report that suggests the western boundary of cotton growing runs along the 20 to 23 inch annual rainfall line in "western Texas." That boundary falls between the 98th and 100th meridians in Texas. An additional defining landmark is physical geography. Across Texas and into Oklahoma, moving from south to northwest the land changes from the coastal Gulf-Atlantic Plain to the Rolling Plains and then to the High Plains. Each of these regions is marked by relatively sharp changes in elevation. The transition from coastal plain to interior plains (the Rolling Plains) occurs at approximately one thousand feet above sea level. All four differently defined lines fall in the same area across almost the entire state of Texas.[7]

These lines are not as congruent as they cross into Oklahoma. The boundary between Indian and Oklahoma Territories prior to statehood in 1907, however, provides a convenient and consistent line across the state, as areas to the west developed similarly to the Texas

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[6] John Turner, White Gold Comes to California (Bakersfield: California Planting Cotton Seed Distributors, 1981), 29-40.

[7] U.S. Bureau of the Census, Twelfth Census of the United States, Taken in the Year 1900 Volume VI: Agriculture (Washington, D.C.: GPO, 1902), 412-14; Rebecca Sharpless, Fertile Ground, Narrow Choices: Women on Texas Cotton Farms, 1900-1940 (Chapel Hill: University of North Carolina Press, 1999), 5; Foster F. Elliott, Fifteenth Census of the United States. Census of Agriculture: Types of Farming in the United States (Washington, D.C.: GPO, 1933), 152; "Average Annual Precipitation (Inches)," in U.S. Department of Agriculture, Climate and Man: Yearbook of Agriculture, 1941 (Washington, D.C.: GPO, 1941); Goode's World Atlas, 18th ed., s.v. "United States and Canada: Physiography," "Central U.S.A.," and "Western Gulf Region of U.S.A. and Part of Mexico," 62-63, 104-7. Note that the 100th meridian (100^{o}W) includes the north-south border between Oklahoma and the Texas Panhandle (fig. 2).

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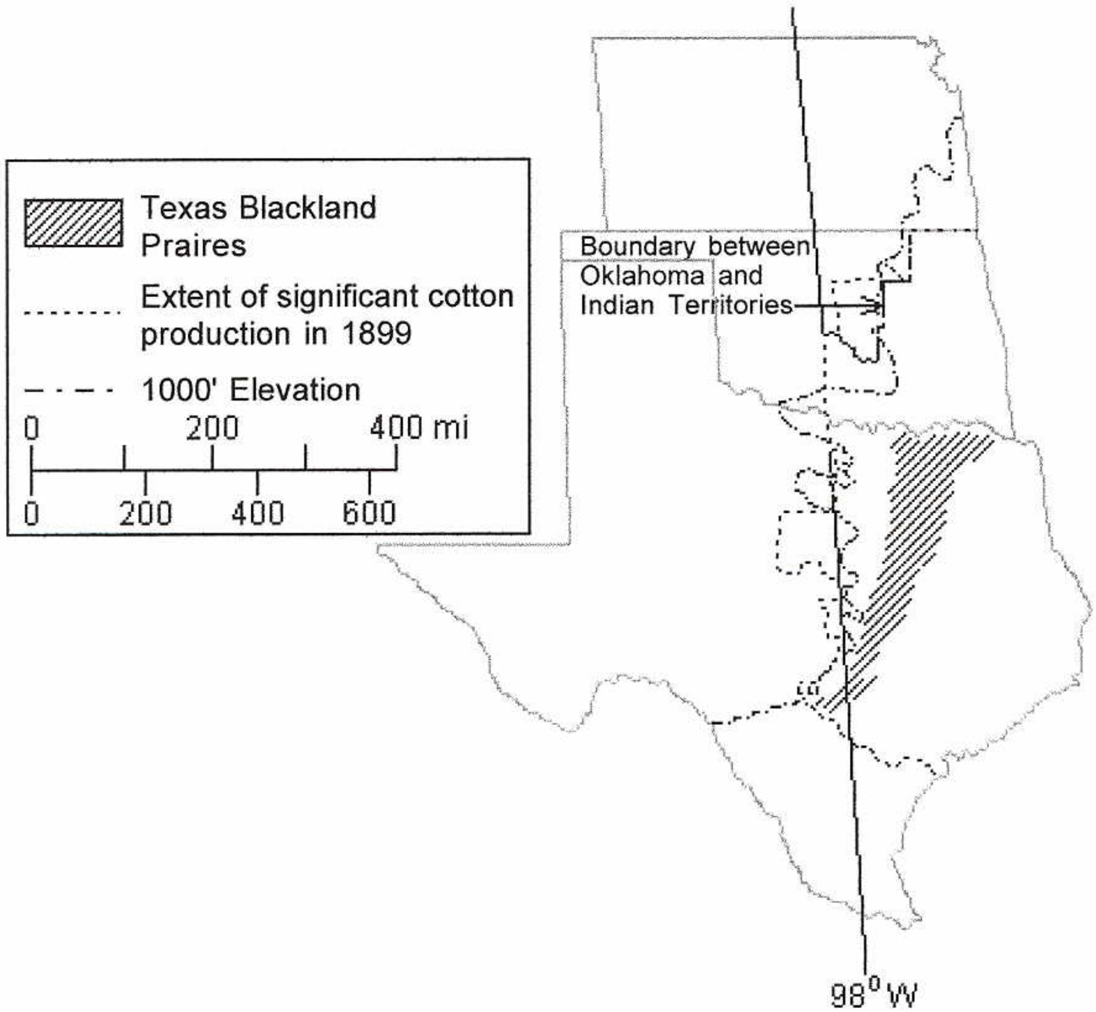

Figure 2. Where Does the South End and the West Begin?
Source: Compiled by the author using data from sources listed in footnote 7.

High Plains. Together, from the Rio Grande Valley to south central Kansas, these lines denote the approximate boundary between the Cotton South and the Cotton West.

While this study focuses on the common features and development of the Cotton West as a whole, it is helpful for one to understand the major cotton producing regions within the Cotton West. Figure 3 indicates a breakdown of these broad regions. Their borders were determined after extensive consultation of experiment station publications, trade magazines, soil surveys, and topographic and county maps. There are no exact and definite boundaries in reality; these are approximations with which most people, in and out of the cotton industry, would concur.

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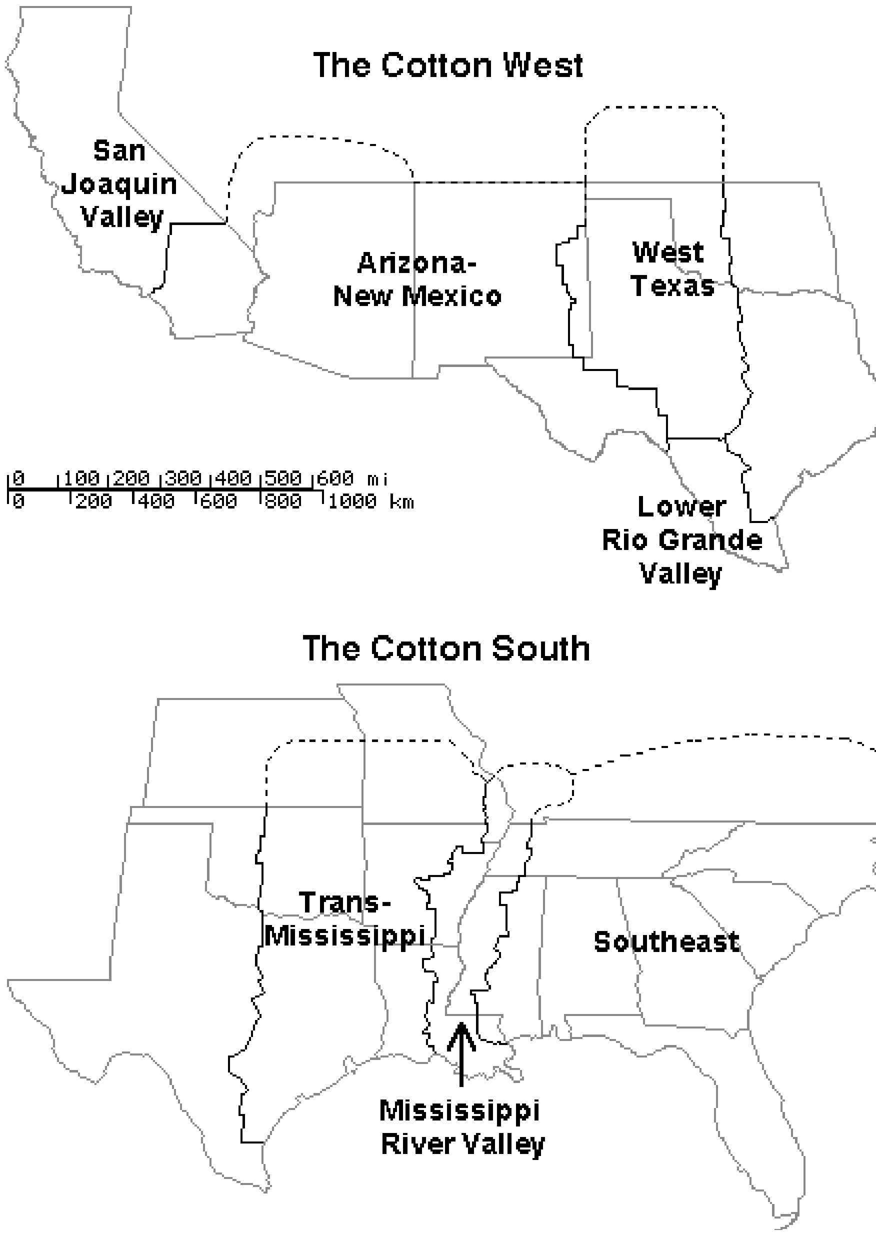

Figure 3. Cotton-Producing Regions of the United States in the Twentieth Century
Source: Compiled by the author.

The West contains four major production regions. The West Texas region runs from the boundary with the Cotton South to the western edge of the High Plains, just short of the Pecos River. On the other side are the irrigated farms in New Mexico (Rio Grande and Pecos Rivers) and Arizona and California (Colorado River and tributaries). The San Joaquin River region of California's Central Valley is in the Far West. The final region, the Lower Rio

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Grande Valley (including the Winter Garden area), fits within the rainfall definition but not the elevation definition in Texas. However, the Lower Rio Grande Valley clearly falls in the West because of its use of irrigation similar to that of the southwestern regions. More details about these regions and their development appear in Chapter Two.

Brief Overview of Cotton Farming in the West and the South

The period between 1899 and 1944 was a critical period for American cotton production. The era saw the beginning of cotton production in the West, the ravages of the boll weevil across the South, and increased production associated with two world wars. The greatest output came in the 1920s "golden age" before the Great Depression struck both the South and the West in 1934.

Cotton production in the West got off to a slow start. Except for a period of prosperity in West Texas in the 1920s, production remained relatively flat and small with only slow gains. The lack of a mid-1910s census leaves us to speculate how much of an impact American-Egyptian long-staple cotton production had in Arizona during World War I. Remarkably, the Great Depression had little impact in the West, as cotton production stayed level in all the regions except in West Texas, which gave back its gains of its first two decades during the drought of the 1934 census year. Only West Texas increased its production during World War II while the other regions, including the large farms of California, actually saw slight declines. A shortage of labor for hand harvesting crops as men went to war and women took factory jobs explains the latter drop.[8]

The post-war period saw major changes in cotton production in the United States. In the five years after the end of World War II, cotton production in the West sharply increased, in large part due to the use of mechanized cotton harvesters. Having used tractors for plowing, planting, and cultivating since almost the beginning of western cotton farming, producers found that adding a harvester in a large operation was not only easy, it was desirable. With cotton growing and harvesting mechanized, western farmers quickly

[8] One probably would expect all production to have declined during the Great Depression because of drought and financial difficulties. One would then expect a recovery during World War II as production resumed to supply the war effort.

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expanded their acreage to take advantage of the profits. By mid-century much of the Cotton West had become firmly established and fairly stable.[9]

But while the early twentieth century marked a period of industry building for the Cotton West, it was a period of industry instability and transition for the producers of the Cotton South. Historians have extensively examined every facet of southern cotton production, rural life, and the economy. One article goes so far as to suggest that "the agricultural history of the South has been worked and reworked so that the subject is nearly as worn as the region's tired soils."[10]

Farming in the South changed little from the 1870s to the 1930s. The region lagged behind the rest of the nation in mechanizing, adopting improved methods of cultivation, applying science to agricultural production, and utilizing capital in farm operations. The act of farming itself was labor intensive. Both black and white farmers became embroiled in sharecropping, the crop-lien system, and other kinds of tenancy, virtually committing themselves to produce the only thing that brought in cash—cotton—and trapping them in an unending cycle of debt. Raising cotton without crop rotations depleted the soil of nutrients, and farmers put even marginal lands into production to try to break out of debt. Thus cotton acreage and output continued to increase, despite low (and dropping) market prices, poor financial returns to growers, and even the invasion of the Mexican boll weevil after 1892. Little went to the hundreds of thousands of white and black tenants and sharecroppers, who barely lived at the subsistence level. Absentee landowners, gin owners, and market operators in the community fared much better than the average southern cotton farmer.[11]

As cotton production expanded and the market economy intensified after 1870, outsiders and government officials began calling for the diversification of southern agriculture and the introduction of science and efficiency in farming. Proponents argued that the cotton farmer came out on the short end if he concentrated on raising cotton and then went to buy all his meat and commodities at the store—a practice of credit debt that kept him

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[9] Gilbert C. Fite, "Mechanization of Cotton Production Since World War II," Agricultural History 54(1) (January 1980): 194-203.

[10] Moses S. Musoke and Alan L. Olmstead, "The Rise of the Cotton Industry in California: A Comparative Perspective," Journal of Economic History 42(2) (June 1982): 385.

[11] Gilbert C. Fite, "Southern Agriculture Since the Civil War: An Overview," Agricultural History 53(1) (January 1979): 4-8.

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constantly at the behest of merchants and landlords. Diversified farming would rebuild soils, helping to improve production and ease the transition into other crops and markets. Advocates of change also called upon farmers to apply the benefits of science and technology to improve their methods of production and begin to utilize equipment to extend workers' productivity, thus lowering the net costs of labor. Farming could be more efficient, they argued. With the growth of land-grant colleges and scientific research, a new chorus of state agriculture college and experiment station researchers joined in the calls to change. They offered information and advice to farmers in farm journal articles, extension bulletins, and farmers' institutes. The USDA joined the efforts when it sent Seaman Knapp to show southern farmers how to increase their income by adopting better production methods, which he endeavored to show through demonstration farms operated by cooperating farmers. Some proponents believed that the spread of the boll weevil would force cotton farmers to diversify and improve their practices. Despite all these efforts, though, by the eve of World War I southern agriculture still looked very much the same as it had forty years earlier.[12]

Since the problems continued, diversification advocates kept pushing for changes. After about 1909 the USDA and state experiment stations made a concerted effort to develop a beef cattle industry in the South. The spreading damage caused by the boll weevil was one major justification for shifting their research and publicity efforts. In the mid-1910s a shift in labor caused more problems for farmers and landowners. With low cotton prices and depressed economic conditions, southern sharecroppers, tenant farmers, and unemployed laborers (particularly African Americans) began moving north to work in industrial jobs in Midwestern cities, jobs no longer being filled by European immigrants who had been coming to the U.S. prior to World War I. Alarmed at the problems of southern agriculture and their inability to influence changes, the USDA and state experiment stations began economic studies to identify what was going on, including the relationships between farm size, ownership, productivity, and low incomes. Not surprisingly, they found that rural poverty was closely associated with "uneconomic farm units." Most farmers, though, had no alternative but to continue raising cotton the way they always had. They were still in no

[12] Fite, Cotton Fields No More, 68-82.

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position to diversify production or take advantage of the scientific and management advice coming from the USDA, agriculture colleges, and experiment stations.[13]

Meanwhile, the expansion and changes to the cotton industry in the West began showing their influence in the South. The 1920s experiments on the Texas High Plains with primitive cotton sled harvesters caught the attention of one Mississippi planter. In 1927 he wrote Dean A. H. Leidigh of Texas Technological College and declared, "It looks as if you fellows are going to make us produce cheap cotton or no cotton at all." Farm and political leaders in the South decided that if they could not change the farm, perhaps they could change the market. They concluded that farmer cooperatives, with financial backing from the federal government, could help raise prices and maybe break the cycle. While this may have helped stabilize markets, the lack of reliable and nearby places to sell other farm products—vegetables, fruits, poultry, and dairy products—did little to help advocates encourage diversification away from cotton farming. Government researchers continued their study of the economy and rural life, but were successful only in painting a clear picture of what farm life was like and why farmers continued to be stuck in poverty. Only a handful of farmers did well and enjoyed a relatively good living, largely because they took advantage of information coming from the colleges, experiment stations, and the USDA. By 1930 southern cotton farming was still stuck in its unending cycles.[14]

With the onset of the Great Depression, the meager standard of living of so many southern cotton farmers dropped even further. The worst features of the tenant and sharecropping systems intensified. Despite some of the lowest market prices ever for cotton, farmers continued to plant as much acreage as they previously had. "At least cotton would bring in some money [cash]. It always had." Even the thought of diversifying was not palatable, as all crop and livestock prices were very low. With the onset of President Franklin D. Roosevelt's administration came some relief. The Agricultural Adjustment Act and parity pricing tried to reduce cotton surpluses, raise market prices, and pay landowners not to grow cotton. The Soil Erosion Service tried to help rebuild soil fertility and take

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[13] Ibid., 96-101.

[14] Ibid., 109-119. The letter to Dean Leidigh is quoted in Donald E. Green, Fifty Years of Service to West Texas Agriculture: A History of Texas Tech University's College of Agricultural Sciences, 1925-1975 (Lubbock: Texas Tech Press, 1977), 30.

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marginal lands out of production. Congress established the Tennessee Valley Authority as a broad-based approach to remaking agriculture and rural life along the Tennessee and Cumberland rivers. Its goals included soil conservation, flood control, improvement of agricultural practices, and the expansion of low-cost electricity. It became evident, however, that only large farmers and landowners would benefit from New Deal agricultural legislation. Not everything trickled down to tenants and sharecroppers, many of whom became unemployed; some began leaving agriculture and the region. These programs did begin to shake apart the foundations of cotton farming and how it had been done in the South for decades.[15]

Those that stayed in cotton farming and agriculture in general took the first tentative steps toward mechanization and improved labor practices. With a large supply of cheap labor, no one had an incentive to purchase machinery. In addition, most southern farms had been too small and too irregular to use a tractor effectively. Once again the USDA encouraged producers to reduce their costs and improve efficiency by improving their machinery. Mechanization reorganized farm operations, changed the relationship between land and people, and employed better management and business skills. It also meant that small family farms and more sharecroppers and day laborers were displaced, but advocates said the changes had to occur. With better and more stable cash flow because of New Deal programs and federal farm capital programs, those farmers who wanted to modernize and mechanize found they could do so. Soon the South began mirroring the decreasing numbers of farms and increasing average farm sizes economists were seeing in other parts of the country. The old system of southern farming began to change.[16]

The circumstances surrounding World War II heavily influenced the final transition of cotton farming in the South. Demand from American textile mills increased substantially, as did market prices for cotton. Other crops and livestock became more profitable as well, helping to encourage more producers to diversify. Soybeans and peanuts became popular as southern farmers tried to meet the calls by wartime agencies for oil-producing crops. As with

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[15] Fite, Cotton Fields No More, 120-139, 148-149.

[16] Ibid., 149-161. Some examples of monographs on displaced laborers include Donald Holley, The Second Great Emancipation: The Mechanical Cotton Picker, Black Migration, and How They Shaped the Modern South (Fayetteville: University of Arkansas Press, 2000); and Alferdteen Harrison, ed., Black Exodus: The Great Migration from the American South (Jackson: University Press of Mississippi, 1991).

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other parts of the country, agricultural labor shortages began to increase, but women, children, and urban residents helped fill in as cotton harvesters. At the same time farmers began utilizing machines to help with their growing cotton. With more opportunities for non-farm work, even for those supplementing their livelihood on a farm, the cycle of sharecroppers and tenant farmers finally eased, as did rural poverty. The economic and industrial recovery of the World War II extended into the postwar years. Although the changes came, they had come slowly but surely. Even though in the immediate post-World War II period the Cotton South had not caught up with the Cotton West, it was well on its way. By then the problems for one were usually the problems for all in the cotton industry.[17]

Historiography Review

In American agricultural history, there is a firm and well-established literature regarding the Cotton South both before and after the American Civil War. Numerous aspects of cotton agriculture have been examined, both on a regional level and as a whole, and for narrow and broad time ranges.[18] Perhaps the best overview of the post-Civil War Cotton South is Gilbert Fite's Cotton Fields No More (1984). In his introduction, Fite states that "no general history of southern farming since the end of slavery" had been written. He suggests that the economic pressures, the evolution of rural poverty, tenancy, and sharecropping, the

[17] Fite, Cotton Fields No More, 164-179. While changes came to how cotton was farmed in the South, the price was what Fite called the "farmers left behind," the group of mostly poor, displaced residents who knew no other way of making a living and lacked the education or skills to change their lives as the cotton fields had changed around them.

[18] These include L. C. Gray and Esther Katherine Thompson, History of Agriculture in the Southern United States to 1860 (Washington, D.C.: Carnegie Institution of Washington, 1933); John Hebron Moore, The Emergence of the Cotton Kingdom of the Old Southwest: Mississippi, 1770-1860 (Baton Rouge: Louisiana State University Press, 1988); Theodore Rosengarten, Thomas Benjamin Chaplin, and Susan W. Walker, Tombee: Portrait of a Cotton Planter (New York: Morrow, 1986); C. Allan Jones, Texas Roots: Agriculture and Rural Life Before the Civil War (College Station: Texas A&M University Press, 2005); Harold D. Woodman, King Cotton and His Retainers: Financing and Marketing the Cotton Crop of the South, 1800-1925 (Lexington: University of Kentucky Press, 1968); Charles S. Aiken, The Cotton Plantation South Since the Civil War (Baltimore, Md.: Johns Hopkins University Press, 1998); Robert L. Brandfon, Cotton Kingdom of the New South: A History of the Yazoo Mississippi Delta from Reconstruction to the Twentieth Century (Cambridge, Mass.: Harvard University Press, 1967); Pete Daniel, Breaking the Land: The Transformation of Cotton, Tobacco, and Rice Cultures Since 1880 (Urbana: University of Illinois Press, 1985); and Thad Sitton and Dan K. Utley, From Can See to Can't: Texas Cotton Farmers on the Southern Prairies (Austin: University of Texas Press, 1997).

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devastation of the boll weevil and other infestations, and overall conditions uniformly affected the Cotton South and could be described in a unified context. Fite's history examines southern agriculture mostly from economic or commercial perspectives. However, his general description of the Cotton South provides a good overview from which one can compare it to the Cotton West.[19]

Unfortunately, there is little in the existing literature to make this comparison. No historian has assembled a comprehensive monograph of the Cotton West, even though a great many of the factors that shaped the evolutionary development of the region—land and water issues, cotton seed varieties, mechanization, and labor—are common to almost every producer who began growing cotton in the West. Such an overview would bring a historiographical unity to a subject that interpretation to date has not recognized. It also provides numerous points to expand existing analyses of major issues in the development of the American West.

The literature of the South has been quite thorough, perhaps because of its focal nature of North versus South in the traditional history of the United States. Thus, as Fite demonstrated in Cotton Fields No More and in other literature since, there are overwhelming numbers of articles, theses, and monographs on almost every aspect of cotton farming and rural life in the South. To this point, however, the same has not been true for the Cotton West. While several historians and economists have authored short studies—mostly articles and a handful of theses—they can be characterized as being very specific in topic and/or geography. Taken together, one can begin to assemble a loose picture of the Cotton West, but it is a historiography that is full of holes.

Several students have written theses and dissertations about agriculture and cotton in West Texas from the center of that producing area—Texas Tech University (formerly Texas Technological College). These works have examined everything from particular machine components to entire industries and economies. Students from several disciplines have written on South Plains cotton, including researchers in business, agricultural economics, home economics, engineering, and atmospheric science.[20] Not surprisingly the most material

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[19] Fite, Cotton Fields No More, xi-xii.

[20] Examples include Wilton Royce Bodkin, "The Effect of Mechanization on the High Plains Cotton Farm: 1920-1960" (Master's thesis, Texas Technological College, 1965); Richard Scott Prentice, "Pollution

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has originated in the Tech history department. The broadest examination is Delmar Hayter's "South Plains Agriculture: 1880-1950." He focuses not only on cotton but also on other early commodities of the area and provides insight into the early settlement of the region and the development of the regional economy.[21] A good follow-up is Joseph Gordon's dissertation, "The History and Development of Irrigated Cotton on the High Plains of Texas," which provides an in-depth analysis of the development of irrigation technology and methods and its introduction in cotton farming practices in the region.[22] Leota Matthews provides an excellent history of the Texas Agricultural Experiment Station's Lubbock Substation. This institutional study discusses the station's research on grain sorghum, cotton, mechanization, and irrigation from its opening to the 1950s.[23] A complement to the Matthews history is Richard Arnold's thesis on cotton varieties. The development of storm-proof cotton varieties involved not only the Lubbock Substation but also local farmers and seed companies who tested and bred strains of cotton best suited to the area. The evolution of storm-proof cotton was a key ingredient to creating mechanized cotton farming on the South Plains, especially for mechanical harvesting.[24] Taken as a whole, the theses of South Plains agriculture create a good description of cotton growing in that region, but all lack any reference or connection to the shared issues of the Cotton West.

Moving beyond West Texas, perhaps one of the most significant histories assembled on cotton varieties is Joseph McGowan's "History of Extra-Long Staple Cottons." McGowan contends that the historical relationship of Pima cotton and foreign long-staple cottons is so close that a full account of both had to be written concurrently. Thus, he spends

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Reduction of Cotton Yarn Dyeing" (Master's thesis, Texas Tech University, 1974); and William Wallace Brown, "A Study of Yearly Average Qualities of Texas South Plains Cotton in Comparison with Mill Average Qualities of Cotton Used in the Production of Specified Fabrics" (Master's thesis, Texas Technological College, 1957).

[21] Delmar Hayter, "South Plains Agriculture: 1880-1950" (Master's thesis, Texas Tech University, 1981).

[22] Joseph F. Gordon, "The History and Development of Irrigated Cotton on the High Plains of Texas" (Ph.D. diss., Texas Technological College, 1961).

[23] Leota Lightfoot Matthews, "The History of the Lubbock Experiment Station, Substation No. 8" (Master's thesis, Texas Technological College, 1959).

[24] Richard Willson Arnold, "The History of Adaptation of Cotton to the High Plains of Texas, 1890-1974" (Master's thesis, Texas Tech University, 1975).

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as much time profiling the international demand for long-staple cotton as he does the subsequent results of the USDA establishing the present Pima cotton industry in Arizona.[25]

Although there are a couple of short articles and theses, only one comprehensive study has been done of the Arizona cotton industry.[26] Erik-Anders Shapiro's 1989 thesis, "Cotton in Arizona: A Historical Geography," examines the expansion and distribution of cotton production in the region, from prehistoric Hohokam cotton farms to late twentieth century agribusiness enterprises. Shapiro considers cultural, biological, and physical factors in commercial cotton production, including the interrelated business linkages between banks, farm implement and chemical dealers, and ginners and cottonseed producers. His holistic approach results in a comprehensive view of the entire cotton production process—not just the "on the farm" issues involved. However, while it fulfills Shapiro's important goals for the study itself, it fails to link any of those developments or issues to those shared by the cotton producers of the neighboring areas of the Cotton West.[27]

As with the Texas South Plains, several monographs and theses have been compiled on the California cotton industry. Two come from key participants. Retired cotton breeder John Turner spent nineteen years directing the U.S. Cotton Research Station at Shafter, where California's official certified Acala variety was bred. In White Gold Comes to California (1981), he provides a general overview of technical developments—such as the introduction of a particular cotton variety or the establishment of a producer association—that make up the basis of cotton production in the Central Valley. However, his scientific background

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[25] Joseph C. McGowan, "History of Extra-Long Staple Cottons" (Master's thesis, University of Arizona, 1960). The work was seen as significant enough, probably by regional long-staple cotton producers, that it was published "as is" as a soft-cover book by Hill Printing Company of El Paso, Tex., in 1961. (Subsequent citations will refer to the latter version.) Extra-long staple cottons such as American Pima are a derivative of Egyptian and American-Egyptian cotton, long-staple varieties with fiber lengths of 1 1/2 to 1 5/8 inches long.

[26] Thomas H. Orton, "The New Water Management Era and the Return of Southwest Cotton to the Old South," Agricultural History 66(2) (Spring 1992): 307-30; Melissa Kane, "Cotton and Figs: The Great Depression in the Casa Grande Valley," Journal of Arizona History 32(3) (Autumn 1991): 267-90; and Marsha L. Weisiger, "Mythic Fields of Plenty: The Plight of Depression-Era Oklahoma Migrants in Arizona," Journal of Arizona History 32(3) (Autumn 1991): 241-66. Theses include Yaaqov Goldschmidt, "Economic Use of Limited Water and Land Resources in Cotton Production" (Master's thesis, University of Arizona, 1959); and Thomas Gordon Carr, "Agricultural Response to Changing Water Prices in Arizona," (Master's thesis, University of Arizona, 1977).

[27] Erik-Anders Shapiro, "Cotton in Arizona: A Historical Geography" (Master's thesis, University of Arizona, 1989), 12.

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leaves his book lacking a historical analysis of factors influencing California cotton production, including irrigation, mechanization, and labor issues, much less placing them in the broader context of issues and developments in the rest of the Cotton West.[28]

A similarly well-placed observer of an earlier period of the California cotton industry was Wofford B. Camp. Camp began his career as a U.S. Department of Agriculture (USDA) cotton breeder, eventually helping to establish California's One-Variety Cotton Law in the mid-1920s. Camp's biography and observations have been published in two large works. First, Camp granted a series of interviews with the University of California-Berkeley's Bancroft Library Regional Oral History Office, which published a lengthy transcript in 1971 titled Cotton, Irrigation, and the AAA. Later William Briggs and Henry Cauthen compiled a biography, The Cotton Man: Notes on the Life and Times of Wofford B. ("Bill") Camp (1983). Like Turner's White Gold, both works are essential in understanding the timeline of developments and first-hand observations of a key player in California cotton farming, but both lack any analysis or connections to other parts of the Cotton West, other than those offered directly by Camp himself in his comments.[29]

The most recent and most comprehensive examination of the California cotton industry is Mark Stemen's environmental history of the plant, "Genetic Dreams." Stemen examines some of the same areas that this dissertation will consider—particularly the development of new cotton varieties bred specifically for California at the behest of the U.S. Department of Agriculture. However, he looks at a similar set of facts through a slightly different lens: the interactions between the land and the people. Stemen reaches a similar conclusion as I will suggest—the federal government played a critical role in establishing a cotton economy, much as it has in other aspects of the American West such as reclamation water projects. Stemen also considers the role of irrigation, in part for its social impacts and in part for its presence—or lack thereof—as a genetic consideration in breeding cotton varieties.[30]

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[28] John Turner, White Gold Comes to California (Bakersfield: California Cotton Planting Cotton Seed Distributors, 1981).

[29] Wofford B. Camp and Willa K. Baum, Cotton, Irrigation, and the AAA (Berkeley: University of California Bancroft Library, Regional Oral History Office, 1971); William J. Briggs and Henry Cauthen, The Cotton Man: Notes on the Life and Times of Wofford B. ("Bill") Camp (Columbia: University of South Carolina Press, 1983).

[30] Mark L. Stemen, "Genetic Dreams: An Environmental History of the California Cotton Industry, 1902-1953" (Ph.D. diss., University of Iowa, 1999): 1-3.

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"Genetic Dreams" does much to explain the importance of the cotton plant to California and, to a lesser extent, to the very early Arizona industry and how it evolved into the state's major agribusiness of the 1950s. To be completely comprehensive, it would require an examination of labor matters, mechanization, and a deeper look at irrigation issues. Further, Stemen does not take the next step to link all of these issues to the common and parallel developments— frequently along similar lines—as what was taking place in Arizona, New Mexico, West Texas, and western Oklahoma. My dissertation will build on his significant work for California and expand similar arguments, plus others, into a consideration of the whole Cotton West and how it relates to the historiography of the American West.[31]

While the western cotton industry itself has seen limited study, many other key subject areas in the American West have been examined. In many of these studies, cotton is only a background player in the assessment or argument being presented. These studies, however, provide key linkages in connecting a study of the Cotton West with the general research of the American West.

One of these topical areas is technological history. My 1996 master's thesis, "Working in the Cotton Fields of the South Plains, 1910-1990," a material-culture study of cotton farming implements of West Texas, is a rare assemblage of the history and evolution of cotton farming in a region based on its machinery. Through a detailed technological overview of cotton farming, one can gain insight into the mechanization of the Cotton West. The type of implements and scale of farming seen on the South Plains are very similar to that found in other areas of the Cotton West. Another regional technological history is Farmers, Workers and Machines (1965), which examines technology developments and their social

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[31] To this point, one might note that little has been said about references from two states included in this study—Oklahoma and New Mexico. In both cases, much of the available material from these two states derives from the primary research publications of the respective state agricultural systems. Only a couple of secondary articles have been compiled on western cotton culture for these two states, though several have been done on Eastern Oklahoma's contributions to the southern cotton industry. For example, see Leo Kelley, "'I Should Have Been a Mule': Cotton Pickin' Blues in Southwestern Oklahoma," Chronicles of Oklahoma 76(2) (Summer 1998): 160-71; and William Douglas Blachly, "The Labor and Power Requirements for Producing Cotton in Southwest Oklahoma" (Master's thesis, Oklahoma Agricultural and Mechanical College, 1931). This study will not overlook these areas—indeed New Mexico's agricultural experiment stations and land-grant college did significant, groundbreaking work in developing a western-suited Acala cotton variety. They merely lack the depth of historical research that California, Texas, and Arizona have had over the years.

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impacts in the Arizona citrus, lettuce, and cotton industries. The authors examine several aspects of labor types, needs, and machinery to assess the impact of technological change. This policy study, published at the end of the Bracero Program-era, suggests how technology and immediate issues of farm labor should be shaped in the immediate future. The value of this study in researching the Cotton West is understanding the impact and ripple effects of mechanization in the industry and to its workers. A near-contemporary technological history focuses on the mechanization of the entire American cotton industry. In The New Revolution in the Cotton Economy (1957), James Street uses the cotton industry as an example of the overall process of mechanization of any industry. His observations, however, prove useful in balancing the technical and economic designs of mechanization with labor issues and economies of scale that are common throughout the Cotton West.[32]

Many farm labor studies allude to the cotton industry. Only a few focus specifically on it, and most of those relate to union efforts in California.[33] One of the best is Devra Weber's

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[32] Cameron Lee Saffell, "Working in the Cotton Fields of the South Plains, 1900-1990" (Master's thesis, Texas Tech University, 1996); Harland Padfield and William E. Martin, Farmers, Workers and Machines: Technological and Social Change in Farm Industries of Arizona (Tucson: University of Arizona Press, 1965), iv-viii, 1; James H. Street, The New Revolution in the Cotton Economy: Mechanization and Its Consequences (Chapel Hill: University of North Carolina Press, 1957). Another thesis on technological matters is Moses S. Musoke, "Technical Change in Cotton Production in the United States, 1925-60" (Ph.D. thesis, University of Wisconsin-Madison, 1976).

[33] Linda C. Majka and Theo J. Majka, Farm Workers, Agribusiness, and the State (Philadelphia, Pa.: Temple University Press, 1982); several articles in J. C. Foster, ed., American Labor in the Southwest: The First One Hundred Years (Tucson: University of Arizona Press, 1982); Philip G. Olson, "Agricultural Laborers: A Study of a Minority Group in a Small Arizona Community" (Master's thesis, University of Arizona, 1956); Geta LeSeur, Not All Okies Are White: The Lives of Black Cotton Pickers in Arizona (Columbia: University of Missouri Press, 2000); Cletus E. Daniel, Bitter Harvest: A History of California Farmworkers, 1870-1941 (Ithaca, N.Y.: Cornell University Press, 1981); Ernesto Galarza, Farm Workers and Agri-Business in California, 1947-1960 (Notre Dame, Ind.: University of Notre Dame Press, 1977); Edwin Charles Pendleton, "History of Labor in Arizona Irrigated Agriculture" (Ph.D. diss, University of California, Berkeley, 1950); Herbert B. Peterson, "A Twentieth Century Journey to Cíbola: Tragedy of the Bracero in Maricopa County, Arizona, 1917-21" (Master's thesis, Arizona State University, 1975). Several recent, critically acclaimed books help frame the discussion of cotton labor; both are tangential to this study, as they both deal mainly with farming in the Texas Blackland Prairie region, the outer edge of the Cotton South. They are Rebecca Sharpless, Fertile Ground, Narrow Choices; Neil Foley, The White Scourge: Mexicans, Blacks, and Poor Whites in Texas Cotton Culture (Berkeley: University of California Press, 1997); Richard Steven Street, Beasts of the Field: A Narrative History of California Farmworkers (Stanford, Calif.: Stanford University Press, 2004); Emilio Zamora, The World of the Mexican Worker in Texas (College Station: Texas A&M University Press, 1993); Harry Schwartz, Seasonal Farm Labor in the United States: With Special Reference to Hired Workers in Fruit and Vegetable and Sugar-Beet Production (New York: Columbia University Press, 1945); Juan L. Gonzales Jr., Mexican and

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Dark Sweat, White Gold (1994), a comprehensive examination of the relationships between cotton growers, processors, investors, laborers, unions, and government officials in the formative period from 1919 to 1939 just prior to the start of contract labor programs like the Bracero program.[34] One of the most recognized is Carey McWilliams Factories in the Field (1939), a frequently republished account by a newspaper writer recounting efforts to unionize Mexican cotton pickers in the Central Valley.[35] McWilliams subsequently went on to write several more books and numerous articles about Mexican immigrants, Braceros, and migrant labor in the Southwest. These monographs, coupled with general studies of Mexican labor and repatriation efforts of the early 1930s, such as Francisco Balderrama's and Raymond Rodríguez's Decade of Betrayal (1995), are important in establishing the labor needs, market, and workers of the Cotton West from the establishment of production to the Great Depression period.[36]

The economic crisis of the 1930s and the shift from Mexican to American migrant labor marks a common, major change in the labor supply for the Cotton West. In 1995 historian Marsha Weisiger published Land of Plenty, a study of displaced Oklahoma farmers—so-called "Okies"—who migrated to and harvested cotton in Arizona during the Great Depression. She concludes that socioeconomic class, rather than race, was key to the exploitation of agricultural workers and that the Arizona cotton industry played a major role

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Mexican American Farm Workers: The California Agricultural Industry (New York: Praeger, 1985); and Wayne D. Rasmussen, A History of the Emergency Farm Labor Supply Program, USDA Bureau of Agricultural Economics Agriculture Monograph No. 13 (1951). Among those rare exceptions of cotton labor examinations are Ruth Alice Allen, "The Labor of Women in the Production of Cotton", University of Texas Bulletin No. 3134 (Austin: University of Texas, 1931; reprint, New York: Arno Press, 1975); and Charles E. Gibbons and Clara B. Armentrout, Child Labor Among Cotton Growers of Texas: A Study of Children Living in Rural Communities in Six Counties in Texas (New York: National Child Labor Committee, 1925).

[34] Devra Weber, Dark Sweat, White Gold: California Farm Workers, Cotton, and the New Deal (Berkeley: University of California Press, 1994).

[35] Carey McWilliams, Factories in the Field: The Story of Migratory Farm Labor in California (Boston, Mass.: Little, Brown and Company, 1939; latest reprint, Berkeley: University of California Press, 2000).

[36] Francisco E. Balderrama and Raymond Rodríguez, Decade of Betrayal: Mexican Repatriation in the 1930s (Albuquerque: University of New Mexico Press, 1995). Other books of a similar vein include Mark Reisler, By the Sweat of Their Brow: Mexican Immigrant Labor in the United States, 1900-1940 (Westport, Conn.: Greenwood Press, 1976); Padfield and Martin, Farmers, Workers and Machines; Camille Guerin-Gonzales, Mexican Workers and American Dreams: Immigration, Repatriation, and California Farm Labor, 1900-1939 (New Brunswick, N.J.: Rutgers University Press, 1994); and David Montejano, Anglos and Mexicans in the Making of Texas, 1836-1986 (Austin: University of Texas Press, 1987).

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in enticing Oklahomans westward. Weisiger builds her study in part on the earlier work of James Gregory in American Exodus (1989), which critically examines the Dust Bowl migration and transference of Okie culture to California. Taken together, along with New Deal and other contemporary labor studies of the period, like Paul Taylor's On the Ground in the Thirties, these works help frame the discussion and common labor issues of the Cotton West in the 1930s in the post-Mexican repatriation period.[37]

The "gathering clouds of war" marks yet another shift in the labor issues for western cotton producers in the late 1930s. Surprisingly, while a great deal has been written about the disappearance of rural labor to urban factories and the subsequent emergence of the Bracero Program—which was at first tied to the Emergency Farm Labor Program during World War II—few historians or researchers have explored the relationship of Braceros and cotton production. Outside of the Anglo migrant experience, the continuity of labor needs and use in the Cotton West has yet to be examined in great detail or placed in a greater context.[38]

Water issues in the American West have been widely studied, but, on this subject in particular, the presence or role of cotton farming is rarely brought out. Historian Donald Pisani has done the most extensive work, with a focus on the developments leading to and ramifications of the federal Reclamation Act of 1906. It is featured in his trilogy monographs—To Reclaim a Divided West (1992), Water, Land, and Law in the West (1997), and Water and the Government (2002)—as well as in numerous articles like "Reclamation and Social Engineering the Progressive Era" and his first book, From the Family Farm to

[37] Marsha L. Weisiger, Land of Plenty: Oklahomans in the Cotton Fields of Arizona, 1933-1942 (Norman: University of Oklahoma Press, 1995); James N. Gregory, American Exodus: The Dust Bowl Migration and Okie Culture in California (New York: Oxford University Press, 1989). Paul Taylor concluded his career by assembling several of his articles and government reports, compiled from his first-hand research in the 1930s, into a single monograph: On the Ground in the Thirties (Salt Lake City, Utah: Peregrine Smith Books, 1983). Some of the other publications include Charles J. Shindo, Dust Bowl Migrants in the American Imagination (Lawrence: University Press of Kansas, 1997); Walter J. Stein, "The 'Okie' as Farm Laborer," Agricultural History 49(1) (January 1975): 202-15; and Helen Dunlap Packard, "The Social Welfare Problems of Migratory Workers in the Cotton Industry of the Southern San Joaquin Valley during the 1937 and 1938 Seasons" (Master's thesis, University of Southern California, 1939).

[38] Wayne A. Grove, "The Mexican Farm Labor Program, 1942-1964: Government-Administered Labor Market Insurance for Farmers," Agricultural History 70(2) (Spring 1996): 302-20.

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Agribusiness (1984).[39] Through these works, Pisani has charted the evolution of public policy, irrigation, and large water projects in the West. Other writers like Marc Reisner (Cadillac Desert, 1986) and Donald Worster (Rivers of Empire, 1985) profile the critical place of water, its management, and its conservation in the social development of the American West.[40] None of these books give any insight into the Cotton West per se, but provide the evolutionary backdrop against which many of the developments of the Cotton West occurred. Without the shifts in American public policy and the examination of issues of water management, no cotton farming could effectively take place in much of the Cotton West.

While most of the water issue pertains to federal reclamation policy or developments, some areas had similar problems through a different source—underground aquifers. For example, Donald Green discusses in Land of the Underground Rain (1973) how the development of irrigation sources is key to the settlement of the Texas High Plains and surrounding areas and its implementation of a farming economy.[41]

As with the spotty patchwork of cotton history narratives, all these topical areas fail to relate much detail with regard to the cotton industry or place their issues and concerns into a greater agricultural context. Rather than simply retelling or expanding on any one of these, this dissertation seeks to assemble a comprehensive view of the establishment and evolution

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[39] Donald J. Pisani, To Reclaim a Divided West: Water, Law, and Public Policy, 1848-1902 (Albuquerque: University of New Mexico Press, 1992); Donald J. Pisani, Water, Land, and Law in the West: The Limits of Public Policy, 1850-1920 (Lawrence: University Press of Kansas, 1997); Donald J. Pisani, Water and American Government: The Reclamation Bureau, National Water Policy, and the West, 1902-1935 (Berkeley: University of California Press, 2002); Donald J. Pisani, "Reclamation and Social Engineering in the Progressive Era," Agricultural History 57(1) (January 1983): 46-63; and Donald J. Pisani, From the Family Farm to Agribusiness: The Irrigation Crusade in California and the West, 1850-1931 (Berkeley: University of California Press, 1984).

[40] Marc Reisner, Cadillac Desert: The American West and Its Disappearing Water (New York: Viking Books, 1986); Donald Worster, Rivers of Empire: Water, Aridity, and the Growth of the American West (New York: Oxford University Press, 1985).

[41] Donald E. Green, Land of the Underground Rain: Irrigation on the Texas High Plains, 1910-1970 (Austin: University of Texas Press, 1973). While numerous other works examine ecological and social issues surrounding the Ogallala Aquifer beneath much of West Texas, Eastern New Mexico, and Western Oklahoma, as with other studies of Western water they help inform and connect to the development of the Cotton West as a major farming belt. For example, see John Opie, Ogallala: Water for a Dry Land (Lincoln: University of Nebraska Press, 1993); David E. Kromm and Stephen E. White, Groundwater Exploitation in the High Plains (Lawrence: University Press of Kansas, 1992); and Morton W. Bittinger and Elizabeth B. Green, You Never Miss the Water Till …: The Ogallala Story (Fort Collins, Colo.: Resource Consultants, 1980).

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of farming in the Cotton West, using many of the same secondary sources and incorporating additional information from first-hand accounts, extension publications, and government reports.

A very important source of primary information is the bulletins and reports of the state agricultural experiment stations. Each state system played an influential role in the development of cotton farming in its regions. For example, the Texas Agricultural Experiment Station (TAES) was instrumental in developing nearly every facet of cotton farming on the High Plains and in West Texas—from the development of storm-proof cotton varieties to the stripper harvester and several planter mechanisms (including the shallow-furrow planter).[42] Their bulletins include excellent descriptions of equipment, variety, and planting tests and the relevant findings. Similarly, the Arizona Agricultural Experiment Station did extensive work developing cotton varieties that grew very well in the different arid, irrigated farm areas around Phoenix, Tucson, Yuma, and Southeastern Arizona.

Similarly important was the research work of the federal experiment stations. Federal scientists at several Texas posts helped select the initial outgrowths of the Mexican Acala cotton that became a genetic basis for much of the western cotton industry. The federal station at Shafter, California, was for many years responsible by state law for producing and improving the officially certified Acala variety for the Central Valley under California's one-variety laws. Federal scientists frequently reported their research results were frequently reported in USDA bulletins, circulars, and special publications of the Bureau of Plant Industry and other USDA agencies. Federal researchers from other agencies also explored mechanization, economic, and labor issues, which increased substantially during the New Deal period. Taken as a whole, these state and federal agricultural publications, the station farms, and their demonstration work were undoubtedly valuable to ascertaining and spreading knowledge among farmers as the western cotton culture developed.

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[42] Throughout this dissertation I will frequently use the initials AES to refer to the USDA's counterpart researchers at the state level, as in the Texas AES or TAES. This generally means the state's Agricultural Experiment Station or Agricultural Experiment System. Some states used the same initials to mean their agricultural extension system. This is sometimes, but not always, synonymous with the agricultural experiment station. In most states, it was the extension system that dispersed the information produced by the researchers from the experiment station.

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Earlier I discussed the published recollections of scientist-farmer Wofford Camp. His name is one among the many government researchers who were principal players in developing the Cotton West. A small group of these men are each responsible for publishing a few dozen extension bulletins, circulars, or articles which, as a body, constitute a major resource for this study. One of the first and probably most important of these men was O. F. Cook of the USDA Bureau of Plant Industry. Originating his career in the late 1880s and coming up through the USDA Bureau of Entomology, Cook first became involved with cotton research while seeking plants resistant to the boll weevil, including his early 1900s trips to Guatemala and southern Mexico. By the 1910s he was one of Plant Industry's prolific proponents of western cotton breeding and production, including the advocating of one-variety communities throughout the cotton belt—West and South. A 1950 bibliography indicates that Cook published well over one hundred times on matters relating to cotton, making him one of the "front men" in federal efforts to establish a western cotton industry.[43]

One of Cook's key partners was Thomas Kearney, a Bureau of Plant Industry researcher working in Arizona. Kearney was the first scientist performing cotton experiments there in the early 1900s. His initial successes helped convince the USDA to expand the effort and led to the extensive federal involvement in establishing an Arizona cotton industry. Kearney's background was in alkali soils and drought resistant plants, the subject area in which Kearney first began collecting long-staple cotton varieties from Egypt in 1902. Like Cook, Kearney became a frequent author of agricultural bulletins and circulars on the development of cotton varieties in Arizona.[44]

The work of Cook, Kearney, their colleagues in the Bureau of Plant Industry, and other federal researchers like Wofford Camp was critical—even groundbreaking—in their scientific breeding work. Their presence was most noticeable in California and Arizona, but their methods and their breeding material had far reaching impacts on scientists in state experimental stations nationwide. Though several dozen men published in the Cotton West in the first half of the twentieth century, a handful of them were particularly important and prolific, as Cook and Kearney were at the federal level. E. D. Tetreau of the University of

[43] W. Andrew Archer, Bibliography of O. F. Cook (Beltsville, Md.: U.S. National Arboretum Plant Industry Station, 1950).

[44] Stemen, "Genetic Dreams," 20-21, 39-42.

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Arizona Agricultural Experiment Station did extensive research on labor issues and requirements for cotton and other irrigated crops during the critical 1930s period when migratory labor patterns shifted so much.[45] Don L. Jones, superintendent of the TAES's Lubbock substation from 1925 to 1957, was a leading researcher on cotton variety development and responsible for helping establish West Texas' stormproof varieties and later versions adapted to stripper harvesters. Jones authored or co-wrote over forty articles on these subjects. Jones worked frequently with Texas A&M professor and TAES researcher H. P. Smith, whose research focused on mechanizing cotton production and harvesting. His book Farm Machinery and Equipment was likely the authoritative book on the subject, judging by its being published in five editions.[46] As will be shown, regional partners such as Tetreau, Jones, and Smith played as important a role as the federal scientists in developing and improving the Cotton West.[47]

This Study

This dissertation fills a large void in the history of the American cotton industry and contributes to interpretations of several topical areas of western history. To this point no one has assembled a comprehensive monograph on the introduction and spread of cotton farming in the American West. There have only been, as noted above, sporadic regional accounts that do not link to each other or the larger history of the industry. Further, many of the subject-based histories of the West fail to seek or establish connections between one area and another. As will be seen in this study, some of these are necessarily dependent links. Without development of cotton breeding, for example, no farms need manual laborers. Or if there were no cotton farming efforts some of the West's irrigation projects would have been failures.

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[45] Shapiro, "Cotton in Arizona," 355-56, itemizes several of Tetreau's most important publications in his bibliography.

[46] Saffell, "Working in the Cotton Fields," 127-28, 194-95; Matthews, "History of the Lubbock Experiment Station," 15; Harris Pearson Smith, Farm Machinery and Equipment, 5th ed. (New York: McGraw-Hill, 1965).

[47] All of these men built upon the agricultural science work of the generation before them. Alan I Marcus describes many of the basic concepts and principles—of science and of their purpose in society—in Agricultural Science and the Quest for Legitimacy: Farmers, Agricultural Colleges, and Experiment Stations, 1870-1890 (Ames: Iowa State University Press, 1985).

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In the subsequent chapters of this study, the reader will discern a couple of basic premises behind understanding the Cotton West. At the heart of this is, regardless of where one was in the West, most cotton producers dealt with the same sets of common problems—having water to irrigate fields, planting a particular variety of cotton, creating economies of scale and mechanization, and finding laborers to work in those fields, particularly prior to the development of the mechanical harvester. This study demonstrates that western farmers broached these problems and found solutions—often ones that were common or similar from one region of the Cotton West to another.

Ultimately all these developments occurring concurrently in the West contrast to what was going on in the traditional Cotton South. Faced with his own problems and stuck in longtime patterns of farming culture, one does not see more uniformity in the experiences of an American, rather than a Southern or Western, cotton farmer until after World War II.

In addition, this study will repeatedly point to the significant role played by federal and state researchers in the evolutionary development of the Cotton West. Their motivations and suggestions largely influenced the course that farmers followed, whether it is in establishing a one-variety community for the Central Valley of California or the significant base of Mexican Acala cotton in the genetic makeup of varieties in every state. Further, as many historians have already demonstrated in showing the federal role in reclamation projects and western irrigation, the federal influence is just as strong and significant in cotton farming. In similar fashion, one can point to parallel interpretations in the existing literature of other western fields within the development of the Cotton West.

This dissertation will be presented largely in topical fashion. It begins with a profile of how the cotton growing areas of the West first developed and became irrigated. Then, building from the plant itself and the evolution of many cotton varieties used across the Cotton West, subsequent chapters will add layers examining cotton mechanization, cultural practices, and labor. By the time the reader reaches the concluding chapter, a complete picture of the history of the Cotton West will be assembled, whereupon one can offer some final comparisons to the history of the Cotton South and the connections to the historiography of the Cotton West.

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CHAPTER II
SETTLEMENT AND IRRIGATION OF THE COTTON WEST

In the last chapter, I briefly defined the Cotton West as being made up of four major production regions: West Texas; the irrigated river areas of Southern California, Arizona, New Mexico, and Far West Texas; the San Joaquin Valley of Central California; and the Lower Rio Grande Valley. These are the generalized production regions, larger groupings that the cotton industry has used. Each larger region contains several smaller, more specific sub-regions. This chapter will delve deeper into these sub-regions, briefly outlining the historical settlement and evolution of irrigated cotton farming and providing the context for discussions in subsequent chapters.

A 1930 USDA bulletin generally described the characteristics of the Southwest farm regions. The population was sparse and spread out. Annual rainfall was low. Overall, only a small percentage of land could be tilled and irrigated, but that which could tended to be very fertile. While most of the Southwest could be called arid or semi-arid, the climatic conditions at any one place varied widely. Annual rainfall ranged from three inches in the Imperial Valley of Southern California to seven inches in the Salt River Valley near Phoenix, with summer temperatures that could reach above 110°F. The mountainous parts of Arizona, New Mexico, and Far West Texas with their long, winding river valleys tended to be more moderate, with precipitation between ten and twenty inches a year, but sometimes had shorter growing seasons due to the elevation. In West Texas the precipitation levels increased above twenty inches a year, but the temperature extremes through the year ranged from subzero to above 100°F, with only the Lower Rio Grande Valley of Texas having a reliable twelve-month growing season. In short, summer temperatures were high and the crop-growing season was generally long, but in these arid lands farmers had to irrigate.[1]

Irrigation was not new to the Greater American Southwest. USDA scientists noted that the Pueblo Indians and Spanish colonists had long recognized the value of water to nourish crops and constructed systems to bring water to their fields. The arrival of federal water projects after about 1899, however, quickly transformed irrigation practices and reclaimed

[1] Samuel Fortier, Irrigation Requirements of the Arid and Semiarid Lands of the Southwest, USDA Technical Bulletin No. 185 (1930), 2-11.

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significant expanses of desert lands for farming. "The most striking advantages of irrigation agriculture are to be expected in the Southwest because of the climatic conditions that enable crops to be grown through the whole 12 months of the year," said cotton scientist O. F. Cook in 1913. Commenting on the first decade of reclamation work in the Southwest, Cook noted that "Irrigation facilities have been provided largely with a view to other crops that have been considered more profitable than cotton. The present indications are that cotton will be recognized eventually as the chief agricultural resource of many enterprises" because cotton was a more dependable source of income compared to the speculative nature of specialty truck or fruit crops. Cook added that the dry southwestern climate "affords protection against the boll weevil and many other insect enemies and diseases that often reduce or destroy the cotton crop in the East." The drier late fall and winter weather during harvest time also left cotton to be gathered and marketed in better condition as compared to southern cotton farms. By 1928 USDA officials proclaimed that "cotton is now one of the leading irrigated crops of the United States and is responsible for the present prosperity of many farmers in the irrigated sections of California, Arizona, New Mexico, and Texas" (fig. 4).[2]

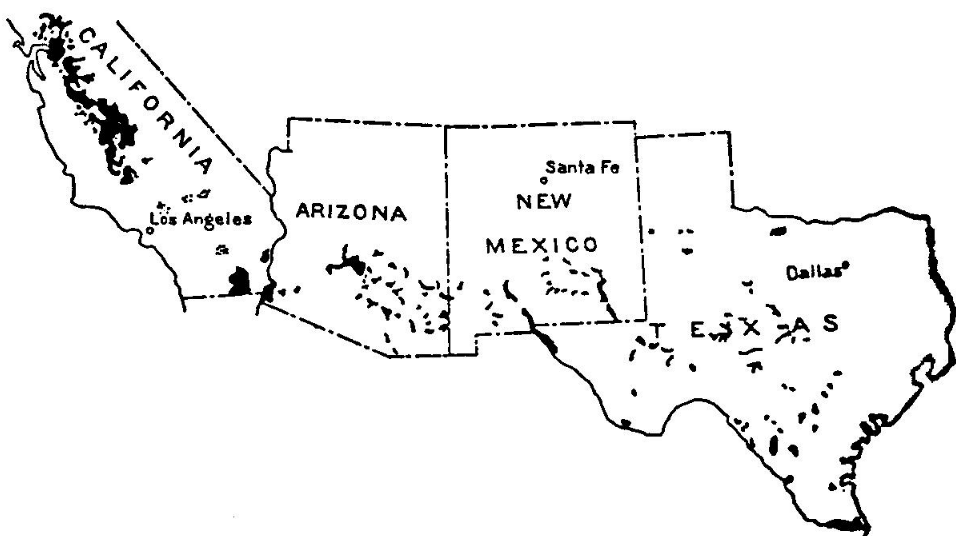

Figure 4. USDA Map of Irrigated Cotton-Growing Areas of the Southwest in the 1920s
Source: Marr and Hemphill, Irrigation of Cotton, 2.
Note: This map does not include those areas of West Texas just starting to use underground water for irrigation and dryland farmers of western Texas and Oklahoma that are part of the Cotton West.

[2] Ibid., 17-18; O. F. Cook, "Cotton Farming in the Southwest," in Miscellaneous Papers, USDA Bureau of Plant Industry Circular No. 132 (1913), 10-17; James C. Marr and Robert G. Hemphill, Irrigation of Cotton, USDA Technical Bulletin No. 72 (1928), 1-2.

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West Texas and Oklahoma

A 1913 USDA Bureau of Plant Industry observed that "So new is the agriculture of the great Southwest, including western Oklahoma and Texas, that the amount of reliable data on the best agricultural practices for this region is relatively small." Its Field Instructions for Farmers' Cooperative Demonstration Work further described the target audience as those farmers in areas where annual rainfall was thirty inches or less: "As we go west conservation of moisture becomes of more and more importance. Whenever we reach a territory where the conservation of moisture becomes the primary object of farm practices we may say that we have reached a semiarid section."[3]

This general publication also described the eastern edge of this semiarid territory. Author Bradford Knapp said the boundary in Oklahoma was west of the 98th meridian, running through Oklahoma City. From there it cut south to near Wichita Falls and thence toward Austin. While Knapp described their line as generally the thirty-inch rainfall line, he cited examples from across the region that most of the area had rainfall of just above twenty inches. This varied greatly from year to year, he noted, with some areas averaging closer to fifteen inches and dry years of as little as ten inches. Knapp noted, "All of these facts have a very important bearing on the kind of farming to be undertaken, the character of the crops to be grown, and especially upon the farm practices to be pursued."[4]

Against this backdrop, federal and state extension agencies began setting up field research stations across western Oklahoma, the Texas High Plains and South Plains, and the Rolling Plains off the Caprock of Northwest Texas and Southwestern Oklahoma (fig. 5). The USDA Division of Dry Land Agriculture established a station at Lawton, Oklahoma, in 1915. Located near the eastern edge of the Rolling Plains, station officials suggested that Lawton was representative of a fairly large area of southwestern Oklahoma and northern Texas. "No other extensive area in the Great Plains is directly comparable or similar to that in which the Lawton station is located." The average annual precipitation of thirty-one inches was more

[3] Bradford Knapp, Field Instructions for Farmers' Cooperative Demonstration Work in Western Texas and Oklahoma, USDA Bureau of Plant Industry unnumbered circular (Washington, D.C.: GPO, 1913), 1-2.

[4] Ibid., 2-3.

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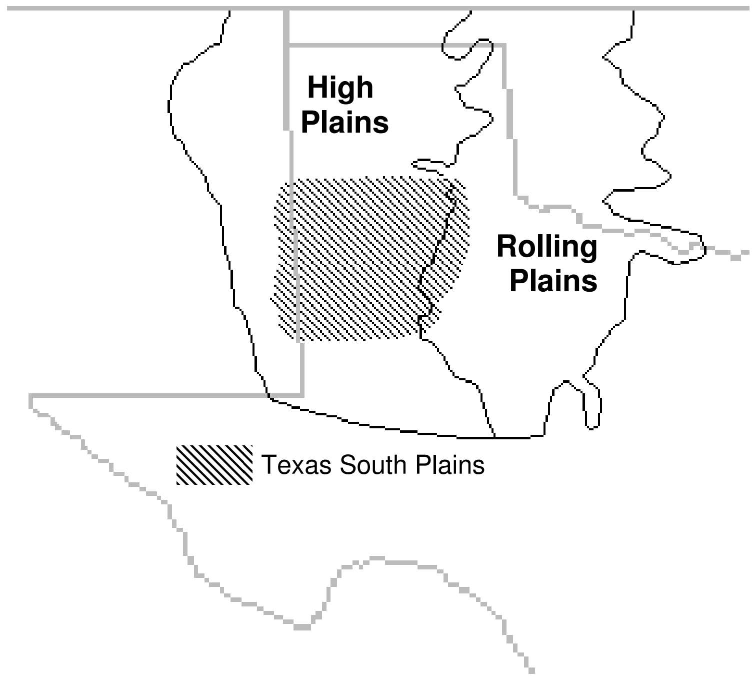

Figure 5. Map of the High Plains, Rolling Plains, and Texas South Plains
Source: Compiled by the author.

irregular than sub-humid areas further east, thus sharing characteristics more common to the semiarid areas to the west.[5]

This region soon became a small but important cotton-producing area; farmers became dependent on the annual crop for much of their income. "Although cotton production is widely distributed over central, southeastern, southern, and western Oklahoma, a group of 13 counties in the southwestern part of the State produced an average of approximately 43 per cent of the total State crop from 1916 to 1930." In cooperation with the Oklahoma Agricultural Experiment Station, the Lawton Field Station conducted continuous cotton field tests for two decades. Their researchers examined every aspect of production, from varieties planted and planting dates to spacing tests and crop rotation patterns. They also noted that in only one year was the cotton crop damaged seriously by insects—grasshoppers in 1924—though there were occasional occurrences of the cotton-leaf worm, the bollworm, and webworm. As farming practices and knowledge improved, the region began to take on many

[5] W. M. Osborn, Rotation and Tillage Experiments at the Lawton (Okla.) Field Station, 1917-1930, USDA Technical Bulletin No. 330 (1932), 1-2.

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of the characteristics of its neighbors further west on the Texas South Plains. This eventually included the use of sled harvesters in the 1920s and the use of stripper-varieties of cotton, which I will discuss in greater detail in later chapters. Thus in the end, southwestern Oklahoma and the immediately neighboring areas of North Texas fell into the general practices and classifications of the greater West Texas/High Plains region of cotton farming.[6]

The High Plains of Texas was the last region of the state to be permanently settled by Anglo Americans. After the U.S. cavalry defeated the last American Indian bands in the region in the mid-1870s, the Texas Legislature created the final fifty-four counties of the state on the northwest frontier, which included all of the South Plains, and offered public lands for sale or lease. The coming of the railroad to the South Plains after 1907 opened the region to major development. Although large expanses had been part of cattle ranches, the railroads brought new settlers to the region responding to advertising, boosterism, and cheap land. By the 1910s farmers replaced ranchers as the major agricultural producers. Most early farms practiced subsistence farming, but after some experimenting farmers focused on cotton as their major cash crop.[7]

The first cotton experiments in the region began in the 1880s on the Spur Ranch, on the Rolling Plains of Texas. Successful growers were unable to market their cotton locally, however, and had to haul it by wagon to the Dallas area to sell it. Thus, cotton farming did not become more widespread until local transportation improved and a local market developed. As more farmers reached the region, they realized cotton's potential in the area as a cash crop. Many farmers came from the cotton regions of the South or East Texas and were eager to see cotton do well on the South Plains. Observers described average yields of the early crops as "very satisfactory," and farmers showed interest in experimenting with different seed varieties.[8]

The Texas Agricultural Experiment Station opened two substations in the region in 1909. Substation Number 7 at Spur examined farming issues for the Rolling Plains, while

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[6] W. M. Osborn, Cotton Experiments at the Lawton (Oklahoma) Field Station, 1916-1931, Oklahoma AES Bulletin No. 209 (1933), 5-31; Osborn, Rotation and Tillage Experiments, 21-24; J. O. Ellsworth and F. F. Elliott, Types-of-Farming in Oklahoma, Oklahoma AES Bulletin No. 181 (1929), 52.

[7] Cameron Lee Saffell, "Working in the Cotton Fields of the South Plains, 1910-1990" (Master's thesis, Texas Tech University, 1996), 24-27.

[8] Ibid., 27-28.

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Substation Number 8 at Lubbock did the same for the South Plains. Both stations immediately started extensive reviews in their first five years of forty-six cotton varieties, as well as began tracking issues surrounding the growing season and the shortage of water. The growing season between the first and last freeze was barely long enough to permit most cotton varieties to fully develop. Thus, any problem that postponed planting or required replanting might mean that the crop did not reach full maturity. Scientists and settlers also found that the annual rainfall, ranging from almost twenty inches in the Rolling Plains of Texas to about twelve in Eastern New Mexico, was less than what they were used to. Irrigating from underground with windmills was not practical, so most farmers simply learned to best utilize moisture when it was available. Fortunately, most of the rainfall came between April and June, the best time to give cotton seedlings a good start before the hot summer months ensued.[9]

Before 1920 early speculators and farmers experimented with pump irrigation on the High Plains. High expense and inexperience with irrigation techniques and early internal-combustion engines hindered any early acceptance of the concept. Further, a variety of factors combined to make pump irrigation economically unfavorable for a number of years.[10]

West Texas and southwestern Oklahoma were well suited for power machinery and large implements. Land was fertile and farm plots were relatively large, both factors conducive to large-scale farming. Being settled relatively recently, the region was not mired in long established customs. Instead, it fostered the "progressive nature of a pioneering type of farmer," one who was young and very interested in laborsaving mechanical devices. Farm organizations and business methods to sell tractors and power equipment were new in the area, whereas they had to be reinvented in other established areas of the country.[11] Farmers were interested in tractors and tractor-drawn equipment in the late 1920s and 1930s, though not all could afford it. While the Great Depression slowed the transition from horse-drawn to mechanized equipment, the situation eased and the shift to tractors quickly took place by

[9] Ibid., 28.

[10] Donald E. Green, Land of the Underground Rain: Irrigation on the Texas High Plains, 1910-1970 (Austin: University of Texas Press, 1973), 118.

[11] Saffell, "Working in the Cotton Fields," 55; P. H. Stephens, "Mechanization of Cotton Farms," Journal of Farm Economics 13(1) (January 1931): 29-33.

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World War II. Once able to obtain these new technologies, farmers applied them to larger farms and increased overall production.[12]

To complete the transition from subsistence to commercial farming, producers had to employ large-volume pumps capable of lifting water from deep wells sunk into the Ogallala Aquifer hundreds of feet below. The drought associated with the Dust Bowl, along with new developments in irrigation technology, combined to make irrigation more favorable to producers. The number of wells on the Texas High Plains blossomed from only 170 in 1930 to over 2,100 ten years later. In the 1940s and early 1950s, irrigation expanded outward from the old "shallow-water" area to encompass much of the region. By 1948 over 7,500 farmers irrigated 1.4 million acres of cotton, wheat, and grain-sorghum crop fields. As with many other residents of the West, most High Plains producers thought of their underground aquifer as a never-ending source of water.[13]

The development of large-scale irrigation began to seriously deplete these underground oases. By World War II the increasing problems of High Plains and Winter Garden region (along the Lower Rio Grande Valley) producers encouraged state administrators to believe that additional administrative controls of groundwater were needed. A groundswell of concern brought legislative proposals to the forefront in 1947.[14]

Many irrigation interests in West Texas opposed any state control or regulation of groundwater. Some feared that new regulations would favor industries and municipalities. Others saw no need for controls on underground water, citing a recent rise in the water table in some areas. High Plains farmers and businessmen began lobbying against any such legislation. If regulation were absolutely necessary, the group supported vesting authority in a local entity rather than in some state water agency. The strong opposition was enough to help defeat the proposed legislation in 1947, but the controversy continued.[15]

Concerned that "certain industrial and conservation groups" were preparing new groundwater control legislation for the 1949 session, High Plains irrigators began work on a

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[12] Saffell, "Working in the Cotton Fields," 55-57, 83.

[13] Green, Land of the Underground Rain, 43, 143-57; Stephen C. Head, "A History of Conservation in Texas, 1860-1963" (Ph.D. diss., Texas Tech University, 1982), 137-38.

[14] Head, "History of Conservation in Texas," 138; N. P. Turner Jr., The Need for Administrative Control of Water in Texas (Austin: Texas Planning Board, 1938), 12-13.

[15] Head, "History of Conservation in Texas," 229-30; Green, Land of the Underground Rain, 173-74.

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countermeasure. They crafted a measure calling for organization of groundwater districts to promote conservation, provide information to farmers, and prevent water waste. The districts would issue permits for new wells in order to regulate the placement of wells and the size of well pumps. They could also have authority to regulate the pumping of groundwater if the supply reached a critical level.[16]

Not everyone in the state agreed with this approach. The Texas Water Conservation Association advocated a bill that would do away with the concept of private ownership of groundwater, issuing well permits through the state engineer's office and prioritizing groundwater for municipalities and manufacturers over groundwater for irrigators. Just before the legislature convened, West Texans and the Texas Water Conservation Association met and negotiated a compromise, manifested in the subsequently adopted Texas Underground Water Law (1949). Through this legislation, the state implemented a groundwater policy that did not require its direct supervision and included most of the provisions desired by West Texas agricultural producers.[17]

Following the procedures outlined in the Underground Water Law, farmers from West Texas formed one of the state's first underground water conservation districts. Covering all of the Ogallala Aquifer south of the Canadian River—which included the entire South Plains cotton production area—the High Plains Underground Water Conservation District (HPUWCD) quickly established itself as a significant player in West Texas water use and development. The organization pursued legal actions on behalf of farmers with the federal Internal Revenue Service to establish its groundwater as a depletable natural resource, similar to mining, eligible for federal income tax deductions. The HPUWCD also called attention to the fact that farmers were rapidly lowering underground water levels. Through educational campaigns and institution of water-conservation farming techniques and irrigation equipment, the HPUWCD worked to slow and even reverse the drop in the Ogallala Aquifer. Some of their innovations included the introduction of center-pivot irrigation systems, to limit the amount of water routed through open ditches to where it was needed, and the subsequent conversion of those systems from open air sprinklers to low-pressure drop lines that deposit water directly between the rows. The HPUWCD also introduced innovations in

[16] Green, Land of the Underground Rain, 175-77.
[17] Ibid., 175-78.

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row-crop equipment to create small dams to retain water in rows, called furrow diking. These changes have materially affected the way many farmers approached and practiced cotton farming in the region, and the water-conservation work of the HPUWCD continues today.[18]

The development of irrigation and large-scale farming in the West Texas region between 1930 and 1950 quickly raised the region to the forefront of national cotton production. According to a review of census figures, western Texas and Oklahoma producers more than quadrupled their output and reached similar figures as the Mississippi River Valley in annual production. Several individual counties from West Texas became regular fixtures on the top one hundred cotton-producing counties in the United States starting in the 1944 census, a trend that has continued to the present.[19]

New Mexico and Far West Texas

Moving across the Cotton West, the next production regions encountered are in New Mexico and Far West Texas. As shown in figure 6, the largest areas of irrigated farming occur in the Pecos Valley, from Roswell, New Mexico, to near Fort Stockton, Texas, and in the Rio Grande Valley, largely on the lands of the Rio Grande Reclamation Project, in the Mesilla and Rincon valleys of New Mexico and the El Paso Valley of Texas. Small areas of irrigated farming also became established near Deming, New Mexico; Balmorhea, Texas; and along the Rio Grande near Presidio, Texas.

The Mesilla Valley of southern New Mexico includes an area of 123,500 acres, varying in width from one-half to five miles. Although American Indians and Spanish colonists traveled through the region along the Camino Real de Tierra Adentro, no one established permanent settlements until the mid-nineteenth century. The residents of several small towns had small irrigation systems based on Spanish *acequias*, but with the extension of railroads through the valley in 1881 came more settlers and increased demand for water for irrigation. A small private irrigation system began about 1908; the Reclamation Bureau subsequently

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[18] Cameron Saffell, "Whose Water Is It, Anyway?: The Formation and Activities of the High Plains Underground Water Conservation District No. 1" (paper presented at the Texas State Historical Association annual meeting, Austin, Tex., 5 March 1998 [from author's research files]).

[19] Cameron L. Saffell, "When Did King Cotton Move His Throne (And Has It Moved Back)?", Agricultural History 74(2) (Spring 2000): 300-305.

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Figure 6. Principal Cotton Growing Areas of New Mexico and Far West Texas
Source: Excerpted from map in Anderson, Clayton & Co., California Acala ([1941]).

took it over as part of one of its first projects in the country. The completion of the Elephant Butte Dam (fig. 6) in 1916 established control over the Rio Grande, eliminating periodic floods, and making agriculture a stable and profitable venture.[20]

Shortly after its creation in 1904, the new federal Reclamation Service drafted the objectives for the Rio Grande Project. The efforts to form a private irrigation district in New Mexico Territory in the 1890s caused much discord with neighboring Texas and Mexico, both of which pressed their water-right claims to the Rio Grande. The Reclamation Service recommended the building of Elephant Butte Dam about seventy miles north of Las Cruces to create a reservoir to provide irrigation water for the Mesilla, El Paso, and Juarez valleys. The United States guaranteed Mexican water claims in the Juarez Valley by treaty in 1906. Farmers on the American side formed water users associations in the 1910s to meet

[20] Edwin J. Foscue, "The Mesilla Valley of New Mexico: A Study in Aridity and Irrigation," Economic Geography 7(1) (January 1931): 1-9.

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requirements of the federal Reclamation Act for water deliveries. The Elephant Butte Irrigation District included farmers in New Mexico, while the El Paso County Water Improvement District No. 1 coordinated irrigation for El Paso Valley farmers in Texas.[21]

In the heart of the Mesilla Valley lies the city of Las Cruces. Today at the southern edge of the town is New Mexico State University and the related railroad siding and community of Mesilla Park. In the early 1900s the New Mexico College of Agriculture and Mechanic Arts was three miles south of Las Cruces, referred to geographically as simply State College, New Mexico.

Being the home of the land-grant college opened in 1889, State College was also the home for the bulk of the staff and research work of the New Mexico Agricultural Experiment Station (NMAES). Scientists there included cotton among their tested crops at State College as early as 1891. They did little in-depth research, though, until the mid-1910s. Up to that point the only successful cotton-growing areas of New Mexico had been in the Carlsbad area along the Pecos Valley.[22]

In 1916 station officials decided to begin comprehensive trails and testing at State College, as well as with some local cooperators in the Roswell area, north of Carlsbad. Researchers determined that the climate and soil of the Pecos and Mesilla valleys are very similar, despite some difference in elevation. This early work by the NMAES established a pattern for cotton testing and development employed for several decades—the central, major experiments at State College with a separate set of tests near Roswell to customize the Mesilla Valley results for Pecos Valley producers.[23]

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[21] Bärbel Hannelore Schönfeld LaMar, "Water and Land in the Mesilla Valley, New Mexico: Reclamation and Its Effects on Property Ownership and Agricultural Land Use" (Ph.D. diss., University of Oregon, 1984), 35-38.

[22] The development of irrigation in the Pecos Valley is a complicated story of private irrigation companies, the entry of the Reclamation Service, and its takeover of the Carlsbad Project (successful) and the Hondo Project (a spectacular failure) that cannot be examined in any detail here. Two books that examine these developments in depth are Stephen Bogener, Ditches Across the Desert: Irrigation in the Lower Pecos Valley (Lubbock: Texas Tech University Press, 2003); and Ira Clark, Water in New Mexico: A History of Its Management and Use (Albuquerque: University of New Mexico Press, 1987).

[23] Rupert L. Stewart, Cotton Growing, New Mexico AES Bulletin No. 120 (1919), 3-12. An example of reporting of these inter-valley experiments can be found in G. N. Stroman, Improved Strains of Acala Cotton for New Mexico, New Mexico AES Bulletin No. 256 (1938). This bulletin also reported on the records lost to a fire at State College in 1937, which destroyed the first two decades of research records but had little impact on breeding stock because plants were already in the field that year.

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Much of the development of cotton farming knowledge for these areas came from New Mexico scientists. The Texans, however, established an agricultural experiment substation at Pecos during their research expansion in 1909-10. The Pecos station's purpose was to investigate varieties of several field crops. In one of their first major reports, researchers reported that cotton was one of the most successful crops tested at the Pecos Substation. "The late spring in no way favors the crop, but it seems peculiarly suited to the extreme heat of the summer," they reported. They also noted that the large amount of work and irrigation needed to raise cotton paid off in the end.[24]

As cotton growing and research began in earnest in the 1910s, some USDA officials expressed concern about fields in the Rio Grande Valley—specifically the possibilities of a similar cotton culture emerging across the river in Mexico, where regulations were much more lax. Government officials thought that Mexican farmers might plant cotton infested with the pink bollworm in the Juarez Valley, thus creating a bridge of sorts to infest American fields that could then spread both west and east to other cotton-growing sections of the United States. This would have been similar to how the boll weevil spread northward from Mexico near Brownsville, Texas, and subsequently moved across the Cotton South. "The [U.S.] Department of Agriculture feels justified in discouraging cotton growing in the Rio Grande Valley. It is believed that farmers in that region, realizing the risk not only to themselves but to the entire cotton industry of the country, will not make an effort to develop a cotton industry there." Even if it was made with some frequency, the suggestion fell on deaf ears. No doubt the relative proximity of the New Mexico A&M College and its extensive cotton tests gave plenty of reasons why Rio Grande Valley farmers thought they could make a go of cotton farming in this area in the long run.[25]

The impact of the Rio Grande Reclamation Project on agriculture in the region cannot be understated. Cotton fields occupied only 0.4 percent of the total crop acreage in 1919, shortly after completion of the Elephant Butte Dam. By 1927 it had expanded to 59 percent. Geographer Edwin Foscue noted that the rapid rise of cotton acreage caused "more

[24] J. W. Jackson, Progress Report, Substation No. 9, Pecos, Texas, Texas AES Bulletin No. 221 (1917), 7-11.

[25] "Making the Southwest Safe for Cotton," Reclamation Record 8(11) (November 1917): 517-18. The article's subheading elaborated: "Some precautions which may be urged in dealing with a booming industry."

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conservative farmers" to fear that the Mesilla Valley would evolve into a one-crop area. Farmers saw cotton as a more stable source of income as compared to other possible crops. A 1928 study reported that cotton averaged $29 profit per acre, but there was some risk involved; the costs of production were almost twelve cents per pound of ginned cotton at a time when market prices fluctuated between ten and twenty-five cents per pound.[26]

Geographer Bärbel Schönfeld LaMar conducted an in-depth assessment of the changes in landownership and water development and use in the Mesilla Valley in her 1984 dissertation. Shortly after the railroad arrived, an influx of Anglo-American settlers came to the area, purchasing Hispanic community grant properties with rights to the local irrigation system or homesteading available public lands. The latter were frequently complete quarter-sections of land (160 acres) that were too large to be cleared, leveled, and irrigated by one family, at least until word of the pending Rio Grande Reclamation Project began to spread in 1905. "The mere prospect of improved water supply conditions attracted new people and stimulated land transactions." At that point in time, Schönfeld LaMar states that virtually all Mesilla Valley farmers were generally subsistent, growing small amounts of alfalfa, wheat, or corn for sale or barter. With the completion of Elephant Butte Dam and improved canal delivery systems, farmers shifted from fields of alfalfa to cotton.[27]

Schönfeld LaMar separates the relative newcomers from the longer established landowners. Newcomers, being more financially strapped because of their investment in high-priced land, were more determined to plant cotton, often plowing up existing alfalfa, orchards, or vineyards. The longtime local farmers usually owned their property outright and had more long-term investments like orchards, dairies, and vineyards. Thus they were slower to make the transition to cotton farming. Nonetheless, Schönfeld LaMar's research indicates that by 1930 almost 90 percent of Mesilla Valley farmers grew at least some cotton and over 75 percent derived most of their income from cotton. Cotton was both a blessing and a curse. While it was a good cash crop that covered the high production costs, it also encouraged the emergence of a monocrop farm culture that was susceptible to dramatic fluctuations in market prices. This instability resulted in cotton acreage shrinking to 51 percent of the total

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[26] L. H. Hauter, Economics of Crop Production on the Elephant Butte Irrigation District, New Mexico AES Extension Circular No. 97 (1928), 7-37; Foscue, "Mesilla Valley of New Mexico," 16.

[27] Schönfeld LaMar, "Water and Land in the Mesilla Valley," 269-84.

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cultivated lands in 1935. The federal cotton acreage control programs during the New Deal became a lasting influence on how much land was planted to cotton in any given year.[28]

By World War II the cotton-producing areas of New Mexico had become fairly stabilized. Of the approximate 133,000 acres of cotton in the state, about 54,000 acres were in the Pecos Valley and fifty-nine thousand were in the Rio Grande Valley. Although New Mexico cotton acreage expanded to over 200,000 acres in the 1950s, even with the additional acreage in the Pecos and El Paso/Rio Grande valleys in Texas, the production of the New Mexico/Far West Texas region was relatively small compared to the rest of the Cotton West. The region has proven to be far more influential for its development of the Acala 1517 cotton variety (see more in Chapter Three).[29]

Arizona

Cotton growing in present-day Arizona goes back the farthest of any of the regions of the Cotton West. Archaeological evidence suggests that several pre-Columbian American Indian cultures—the Hakataya, Mogollon, Anasazi, and Hohokam—all raised a type of Old World cotton called Gossypium hirsutum. The Hohokam Indians were the largest producers, having settled in the Salt and Gila river valleys about 300 B.C. Archaeological evidence shows they were raising cotton by A.D. 500 with small dams and canals, followed by larger irrigation canal systems around A.D. 800. Spanish explorers in the sixteenth and seventeenth centuries noted cultivated cotton plants in numerous Arizona river valleys; Spanish Jesuit missionaries first noted production in Pima Indian villages, as did later Anglo visitors in the mid-nineteenth century. Pima cotton raising declined sharply after Arizona became part of the United States and virtually ended by 1900.[30]

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[28] Ibid., 247, 283-87.

[29] P. W. Cockerill, Labor Needs for Seasonal Operations on New Mexico Farms, New Mexico AES Bulletin No. 299 (1943), 6; Harry Bates Brown and Jacob Osborn Ware, Cotton, 3rd ed. (New York: McGraw-Hill Book Company, Inc., 1958), 55-56. The remaining 20,000 acres in 1942 were scattered in areas of the Gila River Valley of far southwestern New Mexico, the Mimbres River area near Deming, and farms on the Eastern Plains that fall within the West Texas region of the Cotton West.

[30] Erik-Anders Shapiro, "Cotton in Arizona: A Historical Geography" (Master's thesis, University of Arizona, 1989), 23-29. The G. hirsutum that the Pima Indians raised for more than a thousand years is unrelated to the modern Pima variety cotton, a type of G. barbadense, developed in central Arizona. I will discuss this Pima cotton more in the next chapter.

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Experiments with modern cotton production began during Arizona's territorial period. Settlers test-planted several varieties of cotton brought from the southeastern U.S. in the 1860s and 1870s in the Salt River Valley. Mormon colonists from Utah also produced cotton in their new settlements in the Salt and Upper Gila regions, following official church decrees. Significant production, however, was not feasible because there was no way to export the crop to outside markets. Thus there was no commercial cotton farming until the completion of the Salt River Reclamation Project and the introduction of long-staple cotton varieties about 1910.[31]

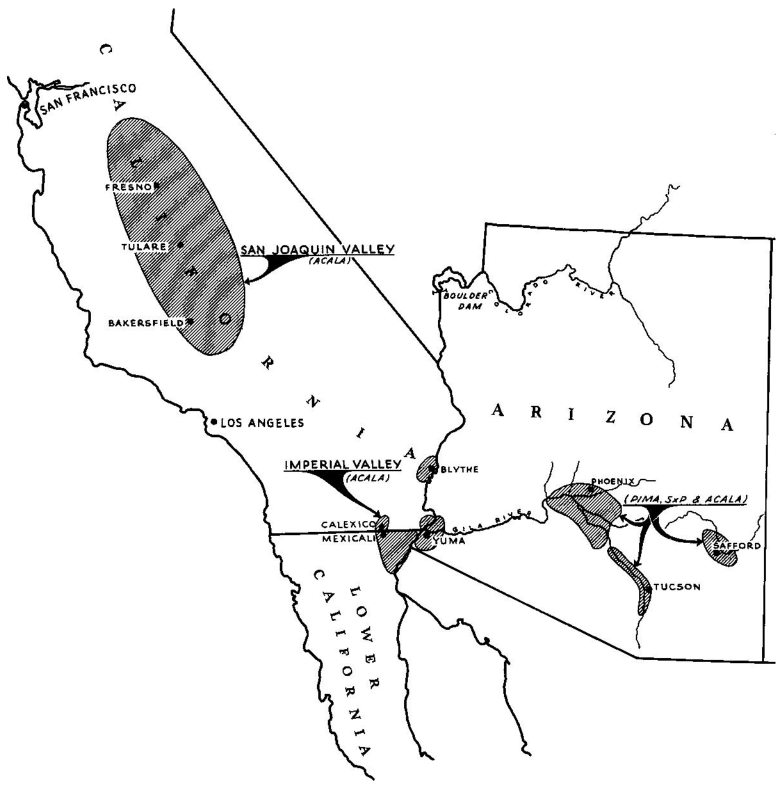

Figure 7. Principal Cotton Growing Areas of Arizona and California
Source: Excerpted from map in Anderson, Clayton & Co., California Acala ([1941]).

The most significant cotton farming areas in twentieth century Arizona (fig. 7) are the Salt River Valley in Maricopa County south of Phoenix, portions of the Gila River in the Tucson area, and the lower Gila River where it empties into the Colorado River at the southwestern corner of the state. The latter is discussed below in conjunction with the

[31] Ibid., 37-44.

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Imperial Valley and Southern California. According to 1930 census figures, only 0.8 percent of the land area of Arizona was irrigated. This represented about 575,000 acres, with an estimated potential addition of about 250,000 acres. Of these amounts, 87 percent of the irrigated areas were along the Gila River (or its tributaries) and 10 percent came directly from the Colorado River. Farmers were raising cotton on 204,000 acres, representing about 1 percent of the total U.S. crop, but contributing 40 percent of the state's agricultural income.[32]

Geographer Erik-Anders Shapiro suggested in his 1989 thesis that Arizona producers became locked into a system that "almost demands" the growing of cotton. Since it generated the most cash, producers raised cotton to recapture the costs of reclamation projects and to generate capital to pay rent and borrowed loans. Shapiro believed that this was not necessarily planned. "Reclamation often proceeds independently and cotton gets planted as a necessary consequence." He identified several factors that influenced the spread of cotton farming. These included the depth to available groundwater (for areas outside of active reclamation projects), the distance to market (usually by railroad), and climate and elevation. Groundwater pumping became a small, but significant, addition to the major cotton growing areas of Arizona, such as in Pinal County (described below in the discussion of the Casa Grande Valley and the San Carlos Project).[33]

The core area of the Salt River Valley lies in central Arizona, an area about fifty miles long and twenty miles wide that encompasses much of the modern Phoenix metropolitan area. Before the extensive urbanization of the area, the Salt River Valley included more than 200,000 acres of lands irrigated through the reclamation project. Average rainfall of just over seven inches a year falls during a short period in the summer and another in the winter.[34]

Researchers suggested the "modern development" of the valley began with the construction of the Swilling Ditch in 1867, which became a development model for about a dozen other canals in the 1870s and 1880s. The early associations behind each project were more cooperative than communal, often preempting the doctrine of prior appropriation ("first

[32] The Staff, Present-Day Agriculture in Arizona, Arizona AES Bulletin No. 141 (1932), 7-11.

[33] Shapiro, "Cotton in Arizona," 60-61, 80-81.

[34] R. W. Clothier, Farm Organization in the Irrigated Valleys of Southern Arizona, USDA Bulletin No. 654 (1918), 4-5.

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in time, first in right") and eventually leading in the 1890s to many lawsuits about water rights of Salt River Valley residents. Meanwhile, much of the irrigation infrastructure was more temporary than engineered, often resulting in washouts and destruction during annual floods. Some organization came about when several of the canal systems on the north side of the Salt River incorporated as the Arizona Water Company in 1898, which eventually passed to the Salt River Valley Water Users' Association after the reclamation project began.[35]

Members of Arizona's congressional delegation and Salt River Valley residents lobbied Congress extensively during the debates that led to the passage of the Reclamation Act in 1902. The newly formed Reclamation Service quickly identified the Salt River as an early project for their new mission. It labeled the articles of incorporation of the Salt River Valley Water Users' Association, completed in early 1903, as a model for other reclamation projects to follow. The Secretary of the Interior authorized the Salt River Project later that year, as well as the construction of Roosevelt Dam to hold irrigation water for project users. In 1910 builders completed the dam, the first large-scale irrigation engineering project for the Reclamation Service. With the accompanying hydroelectric development, farming expanded by several thousands of acres—both within the project boundaries and outside it, where cheap electricity powered underground water pumping for surface irrigation.[36]

The Pima Indians had practiced irrigation in the Casa Grande Valley south of Phoenix along the Gila River in prehistoric times. When they arrived, Anglo settlers began irrigating in modern canal systems, not unlike the developments of the Salt River Valley. However, in the 1890s the water supply became inadequate for the growing populace of residents. This led to the sinking of wells to pump irrigation water for area farms. Farmers formed electrical districts to obtain cheaper power for their pumping efforts. The farms, however, were little more than subsistent until the construction of Coolidge Dam by the federal government in 1929 as part of the San Carlos Project. Built as much to support Indian reservations as white settlers, the San Carlos Project brought a total of 100,000 acres of desert land into the

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[35] Karen L. Smith, <u>The Magnificent Experiment: Building the Salt River Reclamation Project, 1890-1917</u> (Tucson: University of Arizona Press, 1986), 3-7; Clothier, <u>Farm Organization in the Irrigated Valleys</u>, 5-6. Smith goes into much greater detail about the activities of the various canal associations and their mergers and acquisitions.

[36] Smith, <u>The Magnificent Experiment</u>, 34-70, 157; Clothier, <u>Farm Organization in the Irrigated Valleys</u>, 6-7.

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irrigation system—split evenly between Indians and non-Indians. Only about 65 to 70 percent of the land, however, was actually irrigated due to lack of available water. Farmers outside the San Carlos Project remained dependent on groundwater to irrigate their crops.[37]

The first federal research facility in the area was the United States Field Station at Sacaton, Arizona, in 1907. The station began as a cooperative venture between the federal Office of Indian Affairs and the USDA Bureau of Plant Industry. Its main function was to study agricultural problems of the Southwest, giving particular attention to crops that might be of value to the Pima Indians of the nearby Gila River Reservation. While testing a broad range of crops, the Sacaton Field Station also assisted with questions or problems of agriculture in neighboring valleys. This included the early Pima cotton industry in the Salt River Valley. As I will discuss in the next chapter, early cotton testing at Sacaton yielded the Pima variety of cotton in the early 1910s.

Sacaton Field Station also maintained a separate farm for the purpose of providing pure seed of crop plants developed there for distribution to Indians on the reservation and, in lesser amounts, to local growers and seed dealers for multiplication for other Arizona farmers. This became particularly important after the completion of the Coolidge Dam, which transformed Indian agriculture. Sacaton researchers conducted extensive testing of Pima, new upland Acala varieties, and the older American-Egyptian varieties as central Arizona producers shifted from raising only one type of cotton to growing all three. Scientists also identified and began testing on several diseases and insects that could harm cotton, including a native-Arizona weevil similar to the Mexican boll weevil that had ravaged the Cotton South in the first three decades of the century.[38]

The University of Arizona is the designated land-grant school for the state. Its scientists collaborated with USDA facilities for cotton research and testing through the Arizona Agricultural Experiment Station (AAES). The state operated experiment farms in the Salt River Valley, the Yuma Valley, and the "home base" in Tucson, as well as

[37] An Economic Survey of Pinal County Agriculture, Arizona AES Circular No. 64 (1931), 9-14; George W. Campbell Jr., Pinal County Agriculture, Arizona AES Circular No. 269 (1959), 5-7.

[38] C. J. King and A. R. Leding, Agricultural Investigations at the United States Field Station, Sacaton, Ariz., 1922, 1923, and 1924, USDA Department Circular No. 372 (1926), 1-7; C. J. King and H. F. Loomis, Agricultural Investigations at the United States Field Station, Sacaton, Ariz., 1925-1930, USDA Circular No. 206 (1932), 1-2, 8-12, 24-29, 41-43, 63.

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cooperative farms in Greenlee and Maricopa counties. Based on the state's publications, the AAES seemed mostly content to follow Sacaton Field Station's lead and focused much of their program on crop practices and variety tests for each specific locale up to about World War II. After that and the closure of the Sacaton Field Station, Arizona researchers shifted their attention to labor and mechanization issues in cotton farming. I will examine several of those issues in subsequent chapters.[39]

By the 1950s non-Indian farmers were growing cotton on nearly every farm in Pinal County. Not including reservation farmland, the average farm size was about four hundred acres, and farms exceeding one thousand acres not uncommon. Statewide production peaked at around 400,000 acres. Arizona cotton production declined steadily after that until it bottomed out in 1967. Long able to avoid most insect infestations based on strict state and federal quarantine policies, the pink bollworm escaped and surged across the state in 1965, helping to bring cotton production to a virtual standstill. The modern Arizona cotton industry, rebuilt in large part by the popularity of fine, long-staple Pima cotton, as promoted by the SuPima Association of America, has produced cotton at the same consistent amounts since World War II.[40]

Western Arizona and Southern California

The Yuma Valley of Arizona, along the Colorado River, and the Imperial Valley of California, on an expanse of Colorado River delta (fig. 7), share much of a common climate and history. Even though they often appeared separately in state and federal research project reports, the two valleys are linked from the earliest experiments with long-staple cotton. In one of the first comprehensive reports on Egyptian cotton and the prospects for growing it in the United States in 1908, researchers Thomas Kearney and William Peterson compared

[39] R. S. Hawkins, Field Experiments with Cotton, Arizona AES Bulletin No. 135 (1930), 553-81. Some examples of the shift in research focus include W. I. Thomas, E. R. Holekamp, and K. R. Frost, Cotton Planting, Arizona AES Bulletin No. 233 (1951); E. D. Tetreau, Hired Labor Requirements on Arizona Irrigated Farms, Arizona AES Bulletin No. 160 (1938); and Pick Quality Cotton: A Manual on Mechanical Cotton Pickers, Arizona AES Circular No. 246 (1956).

[40] Campbell Jr., Pinal County Agriculture, 17; Shapiro, "Cotton in Arizona," 192-200; Joseph C. McGowan, History of Extra-Long Staple Cottons (El Paso, Tex.: Hill Printing Company, 1961), 42-47. Production figures for all the regions in this chapter through the twentieth century are described in comparison to the traditional cotton belt in Saffell, "When Did King Cotton Move," 293-308.

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traditional Egyptian cotton-growing regions to the Southwest. They determined that Egyptian cotton varieties were best adapted for irrigated farming in areas where there is practically no rainfall during the growing season. After analyzing the Southwest for these similar conditions, they concluded "that the greatest success with Egyptian cotton is to be expected in southern Arizona and southeastern California." They also noted that it was more desirable to introduce a distinctive cotton as compared to that grown in the traditional southern cotton belt. Thus, in conjunction with the Office of Western Agricultural Extension Investigations, the USDA began its first cotton experiments in the Yuma and Imperial valleys about 1902.[41]

The natural conditions in this area of the country are very rugged. Average rainfall was less than four inches annually, an amount that one report labeled as "not a factor in crop production." Summer temperatures regularly peaked above 110^{o}F, and the winters were mild. The growing season between the last and first killing frosts of winter averaged over 259 days. In its favor, though, the area was free of any cotton pests. Protecting this was a particular concern of USDA officials. In the early experimental period, researchers said that "Planters in the region are urged to consider the question carefully before committing themselves to growing Upland varieties [from the Cotton South]…. The introduction of the cotton boll weevil would be ruinous to the industry at the very outset."[42]

The settlement and development of irrigation in the Yuma and Imperial valleys is a fascinating contrast in methodology and evolution. The Yuma Valley is relatively small, approximately 55,000 acres bounded on the north and west by the Colorado River and on the east by a bench terrace referred to locally as the "Yuma Mesa," all lying between the community of Yuma, Arizona, and the Mexican border. Prior to the arrival of Anglo settlers in the valley, American Indians customarily planted melons, squash, beans, and corn in certain areas following the annual spring floods. Between 1886 and 1907 new settlers and several private irrigation companies began constructing ditches to convey water from the banks of the Colorado River to their nearby fields. These efforts were of mixed success

[41] Thomas H. Kearney and William A. Peterson, Egyptian Cotton in the Southwestern United States, USDA Bureau of Plant Industry Bulletin No. 128 (1908), 28, 37.

[42] Stephen H. Hastings and Edward G. Noble, Pima Egyptian Cotton in Irrigated Rotations at the Yuma Field Station, Bard, Calif., USDA Technical Bulletin No. 369 (1933), 4; Kearney and Peterson, Egyptian Cotton, 9-10, 29.

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because of the lack of a dam to control water elevation in the river, the silty character of the soil, and problems maintaining the ditches.[43]

With the passage of the National Reclamation Act in 1902, federal officials began examining conditions in the Yuma Valley concurrent to their analysis of the Salt River Valley. The Secretary of the Interior created the Yuma Project in 1904; the next year the Reclamation Service began constructing the Laguna Dam. The Reclamation Service also purchased the existing pumping plants and canals, which they operated through 1912 when gravity-flow water became available to Arizona farmers from the Laguna Dam. Whereas before no more than 2,500 acres of farmland were under irrigation, the completed Yuma Project immediately supplied water to more than 27,000 acres. Engineers thought it could be expanded to as much as 130,000 acres, including land in California outside the Yuma Valley.[44]

Several miles across the Colorado River from Yuma lies the Imperial Valley of California, a portion of the river delta about thirty miles wide and forty-five miles long that extends south into Mexico. Technically a desert because of the low annual rainfall, the Imperial Valley had very good alluvial soil capable of supporting agriculture, provided someone could supply irrigation water. Campaigns to raise financing for an Imperial Valley irrigation canal from the Colorado River date back as far as the 1850s, but it was mostly talk until a couple of companies formed in the 1890s to undertake the effort. About 1900 promoters began selling water certificates to settlers who filed homestead claims. With this funding, the California Development Company (CDC) constructed the first main canal artery in 1901. It ran for several miles parallel to the Colorado River, crossed over into Mexico, then came back up a dry riverbed formerly known as the Alamo River. By 1906 settlers had transformed over 130,000 acres of valley land into fields of crops.[45]

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[43] Clothier, Farm Organization in the Irrigated Valleys, 11-13; An Economic Survey of Yuma Valley and Yuma Mesa Agriculture, Arizona AES Extension Circular No. 72 (1932), 5.

[44] Economic Survey of Yuma Valley, 5; Clothier, Farm Organization in the Irrigated Valleys, 11-13. While Laguna Dam was completed in 1909, it was a couple of more years until a siphon tube was constructed that goes underneath the Colorado River from the California side to supply water to Arizona farms. The Yuma Project has three divisions, the Valley Division (for Arizona farms), the Reservation Division (for California farms, including the Yuma Indian Reservation), and the Mesa Division (for farms on the bench terrace lands on the Arizona side).

[45] Robert G. Schonfeld, "The Early Development of California's Imperial Valley: Part I," The Historical Society of California 50(3) (September 1968): 279-92.

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The irrigation canal was not without its problems. The silt-laden Colorado River began building up sediment in the canals and slowed the flow from the intake canal. When the river level dropped in 1904, the CDC had to suspend water deliveries several times. Instead of dredging the main canal, company officials ordered a cutoff be built from the river to bypass the clogged section of canal. With the winter floods later that year, Mother Nature intervened. The Colorado River shifted its course and began running back through the cutoff and the canal system, flooding much of the Imperial Valley and creating the Salton Sea at the low north end of the valley. The CDC mounted several efforts to dam the river and restore it to its normal course. It took until February 1907 before their efforts were successful. The costs were great—$1.6 million dollars to redivert the river and at least that much in lawsuit awards against the CDC. The flood proved beneficial in one aspect, however. Before, irrigation water had nowhere to drain out, so salinity levels were rising in farm fields. The flood flow widened and deepened shallow stream channels, which farmers used to create drainage outlets for their fields. Thus, the salinity of the soil began to fall as the salty water gathered in the Salton Sea.[46]

In the wake of the Salton Sea disaster, federal officials stepped in to provide as much assistance as they could, encouraging further colonization and investment in the Imperial Valley. Farmers organized their own Imperial Irrigation District and took over the assets of the California Development Company, putting control of their farms in their hands without the influence of speculators and water developers. The Reclamation Service came in and agreed to build a new canal entirely on the U.S. side of the border—the All-American Canal—to serve the new irrigation district. In the end, like other parts of the American West, the Imperial Valley had a publicly owned and operated irrigation system—though a local one instead of a federal project.[47]

[46] Robert G. Schonfeld, "The Early Development of California's Imperial Valley: Part II," The Historical Society of California 50(4) (December 1968): 395-417; Mark L. Stemen, "Genetic Dreams: An Environmental History of the California Cotton Industry, 1902-1953" (Ph.D. diss., University of Iowa, 1999), 92-94.

[47] Stemen, "Genetic Dreams," 94-96; Schonfeld, "Early Development: Part II," 417-22. Schonfeld's articles paint quite the picture of conspiracy of the Reclamation Service's attempts to take over the CDC irrigation system, one that Stemen alludes to but downplays. Whatever the details, various ideas or efforts to incorporate the Imperial Valley into the Yuma Reclamation Project were largely dashed by the floods.

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Against the backdrop of the settlement and irrigation development of the Yuma and Imperial valleys, USDA officials began their cotton experiments. Research scientists had a significant presence in the Yuma Valley from the beginning. Arizona Territory had a small experiment station and worked with area farmers for a couple of years prior to 1902, the year of the first cooperative testing by the USDA Bureau of Plant Industry. A short time later the USDA opened its first Yuma Field Station on the Arizona side near Somerton in conjunction with the Reclamation Service. With the opening of Yuma Reclamation Project lands on the California side in 1910, the USDA relocated to a 160-acre tract adjacent to Bard in the northeastern portion of the Yuma Valley. Researchers variously referred to this facility as the Yuma Reclamation Project Experiment Farm or the United States Yuma Field Station. Although it investigated many kinds of irrigated crops, much of the Yuma Fields Station's work was on varieties, irrigation, and production practices for cotton farmers. It was here that researchers developed the short-lived Yuma variety of long-staple cotton, which is discussed in greater detail in the next chapter.[48]

Station researchers published an almost annual series of "Work of the Yuma Reclamation Project Experiment Farm" reports in the 1910s and early 1920s. Cotton was a featured part of every report. "There is needed in the Yuma Valley a crop that will bring in a large cash return per acre and that can be grown in rotation with alfalfa," wrote the Committee on Southwestern Cotton Culture in 1913. It strongly encouraged farmers to consider adding cotton to their fields, and farmers took to the suggestion. By 1920 they had 69 percent of their cultivated acreage in cotton. Despite encouragement to focus on only one variety, Yuma Valley farmers planted a mix of Upland, American-Egyptian, and Pima varieties of cotton.[49]

When the USDA Bureau of Plant Industry began cotton-growing experiments in 1902, they were mostly cooperative ventures with local farmers or at small research facilities in the

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[48] Kearney and Peterson, Egyptian Cotton, 34; Hastings and Noble, Pima Egyptian Cotton, 1-3; Stemen, "Genetic Dreams," 36-37. Although I have not found any documentation to confirm it, it is easy to assume that the Somerton facility was or became the AAES's Yuma Valley Experimental Farm.

[49] E. G. Noble, The Work of the Yuma Reclamation Project Experiment Farm in 1919 and 1920, USDA Department Circular No. 221 (1922), is one of several examples of these reports. Committee on Southwestern Cotton Culture, Cotton as a Crop for the Yuma Reclamation Project, USDA Bureau of Plant Industry Document No. 1009 (1913), 1-5; Hastings and Noble, Pima Egyptian Cotton, 25-28.

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Yuma Valley and Calexico (in the Imperial Valley). The CDC also operated its own experimental farm at Calexico and co-sponsored many of the early farmers' institutes in the valley. San Diego County established a horticultural district for the Imperial Valley in 1905 (taken over by the newly formed Imperial County in 1907), and the University of California established an experimental farm in Meloland. The USDA opted not to open its own separate research facility for the Imperial Valley, instead relying on the results from the Yuma Field Station to answer the questions of both valleys.[50]

An additional small river valley in Southern California is worth brief mention here. The Coachella Valley lies north of the Salton Sea in Riverside County, some seventy-five miles or so northeast of the Imperial Valley. The area has similar climatic conditions as the Imperial Valley, with desert conditions, hot summers, and lands that generally are below sea level. Farmers in the Coachella Valley pumped their irrigation water from wells rather than from gravity surface flows through canals. The USDA conducted experiments here between 1908 and about 1910, but farmers' initial enthusiasm for cotton growing waned with low prices and problems marketing their crop. A second wave of commercial production began about 1918, again influenced by developments by the USDA at its Experiment Date Garden near Indio. Valley farmers quickly embraced the new Acala cotton in 1920 and formed a one-variety community association, a group dedicated to raising solely Acala variety cotton. This group coalesced with a county one-variety ordinance in 1924, which became a first step towards a statewide one-variety law the next year. These developments will be discussed in greater detail in Chapter Three. This situation becomes a curious point of comparison with the nearby Imperial Valley, where the lack of conformity on a single variety became the basis for its exclusion in the new state law. According to a 1927 bulletin, the Acala variety raised in the Coachella Valley in the early 1920s from the field work at the United States Experiment Date Garden was the seed stock subsequently used to develop the Acala cotton varieties raised throughout the rest of the Southwest with the exception of the San Joaquin Valley. Although the Coachella Valley is less mentioned in the development of cotton

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[50] Argyle McLachlan, Community Production of Durango Cotton in the Imperial Valley, USDA Bulletin No. 324 (1915), 2-3; Stemen, "Genetic Dreams," 97-98.

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farming in the West, particularly as compared to the nearby Yuma, Imperial, and San Joaquin valleys, it does occupy an interesting and noteworthy place in its history.[51]

In the long run cotton did not last in the Imperial Valley. With the region self-exempting itself from California's one-variety law, the lack of local cooperation from farmers led to a quick decline in cotton quality. Insect infestations also were a major concern. The boll weevil and the pink bollworm were both common pests in Mexico. With the Imperial Valley topographically extending into Mexico, it became difficult to quarantine infestations from Mexican fields or keep the pests from blowing in on a strong storm. Tenancy was also higher in the Imperial Valley than in other farm areas of the Southwest, a factor that USDA officials believed discouraged building a long-term commitment toward cotton production. Many farmers shifted from cotton to alfalfa or winter vegetables and fruits. With almost frost-free winters, Imperial Valley farmers could usually count on being the first to market their truck crops nationally. By 1926 lettuce acreage exceeded that of cotton in the Imperial Valley, and the decline continued for several more years. Meanwhile, cotton farming continued its progressive development in the river valleys of Arizona and central California.[52]

San Joaquin Valley

The Central Valley of California is three hundred miles long and forty miles wide. The northern portion around the Sacramento River is the Sacramento Valley. The longer southern section, crossing six counties, is the San Joaquin Valley (figs. 7 & 8). Several rivers traverse the valley, including the Kern, Kaweah, Kings, Merced, and San Joaquin rivers. The climate of the region includes dry, hot summers and limited rainfall, most of which occurs between harvesting and planting times. Average annual precipitation varies from six to eleven inches through the valley. While the rivers carry heavy drainage flows from the

[51] H. G. McKeever, Community Production of Acala Cotton in the Coachella Valley of California, USDA Department Bulletin No. 1467 (1927), 1-43.

[52] Stemen, "Genetic Dreams," 112-16. Cotton did make a small comeback in the Imperial Valley in the 1950s.

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Sierra Nevada range, they flow through a desert land. Thus, irrigation is essential to farming in the San Joaquin Valley.[53]

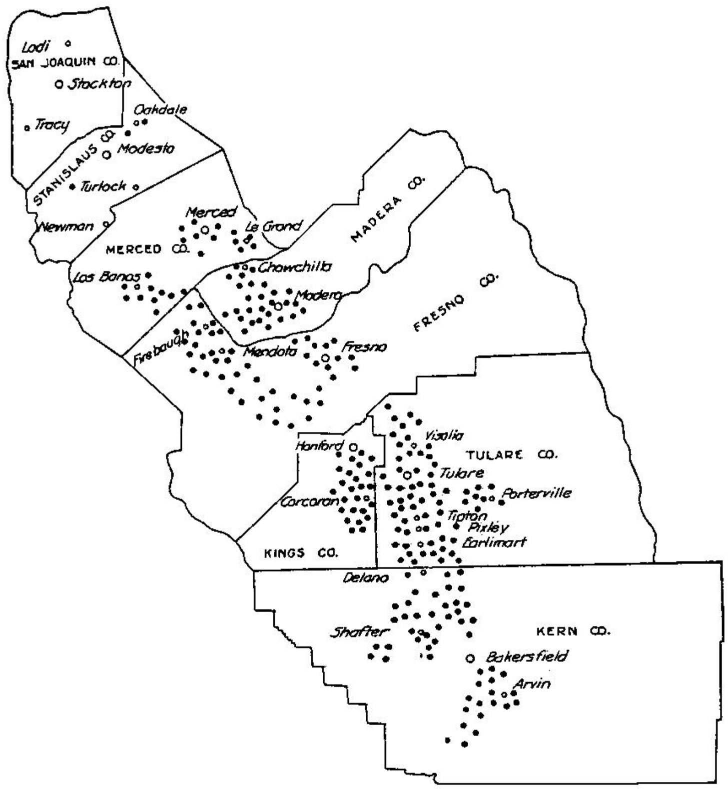

Figure 8. Principal Cotton-Producing Areas of the San Joaquin Valley in 1930
Source: Beckett and Dunshee, Water Requirements of Cotton, 5.

Some of the earliest Anglo cotton production in California occurred in the San Joaquin Valley. Newspaper accounts and census figures indicate that farmers raised small amounts of cotton in the mid-1800s. While state and local officials were optimistic that a cotton industry could be successfully developed, cotton cultivation came to a virtual end by the 1880s because of the continual shortage of labor to harvest the crop, no local market to

[53] Ibid., 119-21; S. H. Beckett and Carroll F. Dunshee, Water Requirements of Cotton on Sandy Loam Soils in Southern San Joaquin Valley, California AES Bulletin No. 537 (1932), 4-7.

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consume it, the lack of knowledge and experience in raising it, and competition from other crops that were more profitable.[54]

With the expansion of the Southern Pacific Railroad through the valley in 1874, a period of canal building by new settlers ensued. Conflicts over water rights during the drought of 1877-78 brought riparian owners and appropriators to state court, climaxing in the famous Lux v. Haggin decision (1886), involving water rights for the two largest landowners in the San Joaquin Valley. The California legislature enacted the Wright Act (1877) to allow local landowners to organize irrigation districts. By 1893 there were fifty districts, but only twelve survived to 1910; most failed because construction and maintenance costs for irrigation systems far exceeded what farm income could support.[55]

The more successful option for most irrigators in the late nineteenth century was pumping underground water. The state's irrigated land increased by more than 500 percent during the 1880s, mostly in the San Joaquin Valley and in Southern California. The increases slowed for a period while technology to pump larger and deeper wells caught up. It was not until these improvements with electric and gasoline engines became more widespread and the introduction of cotton in the valley in the 1920s that cotton farming began to take off. By then one-third to one-half of all valley irrigation came from underground sources. Statewide, the amount of land irrigated from underground increased from 32,539 to 299,841 acres; most of the increase came from land in the San Joaquin Valley. Pumping became so prevalent that state officials became concerned about declining water tables.[56]

Water shortages between 1917 and 1924 sparked a new period of irrigation development in California, as a half-dozen major reservoir projects began. Irrigation districts made a comeback. By 1926 they included 3.6 million acres of land, over twice the acreage of all the federal reclamation projects and small-sized farms throughout the entire American West. This was also the period for the state's first comprehensive water plan proposal, the

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[54] O.F. Cook, Extension of Cotton Production in California, USDA Bulletin No. 533 (1917), 4-6; Colin Campbell Archibald, "A Historical Survey of the California Cotton Industry" (Master's thesis, University of California, 1950), 6-11.

[55] Donald J. Pisani, From the Family Farm to Agribusiness: The Irrigation Crusade in California and the West, 1850-1931 (Berkeley: University of California Press, 1984), 191; Stemen, "Genetic Dreams," 130-31.

[56] Pisani, From the Family Farm to Agribusiness, 285-86, 388; Stemen, "Genetic Dreams," 132-37.

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Marshall Plan of 1919. A geographer and amateur naturalist, Robert Marshall proposed a massive vision for storage reservoirs and canals stretching throughout the Central Valley. If enacted, the Marshall Plan would have reclaimed twelve million acres for agriculture and reduced irrigation costs from as high as $15 an acre to less than a dollar. Although it never was put into motion, the Marshall Plan foreshadowed future state water plans and eventually the Central Valley Project of the 1930s, which had broad ramifications on San Joaquin Valley agriculture.[57]

As developed and put to state voters in 1933, the Central Valley Project and State Water Plan called for building a system to divert San Joaquin River flows to the south (up valley), replacing those waters with a canal flow from the Sacramento River. Federal officials joined the efforts by authorizing the Bureau of Reclamation to help fund and build the project. Small farmers advocated continuing the restriction of a 160-acre maximum to be irrigated under the terms of the 1902 Reclamation Act, while large landowners lobbied to do away with the requirement. In the 1940s nearly half the irrigable land in Madera, Tulare, and Kern counties was owned by less than three percent of all landowners, yet they contained more than half of the total cotton acreage in California. On the other side of the valley, it was unusual for a cotton producer to have less than 640 acres of land. The restriction was not overturned; instead, the Bureau of Reclamation required irrigation users to divest themselves of "surplus" acreage, but enforcement was lax except on the largest of farm operations. This controversy aside, small cotton farmers in the San Joaquin Valley had a sure source of inexpensive water for their fields, while larger operations benefited indirectly as the increased water supply of the Central Valley Project ensured a steady underground water supply for their pump irrigating.[58]

Historian Mark Stemen suggests that the USDA provided the initiative for San Joaquin Valley farmers to try cotton farming again. Experiments with cooperative farmers took place near Bakersfield as early as 1909. The University of California also began conducting variety trails at their facilities in Kearney and Glendale. Trials expanded with the arrival of

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[57] Pisani, From the Family Farm to Agribusiness, 388-96.

[58] Archibald, "Historical Survey of the California Cotton Industry," 68-76; Erwin Cooper, Aqueduct Empire: A Guide to Water in California, Its Turbulent History, and Its Management Today (Glendale, Cal.: Arthur H. Clark Company, 1968), 154-58.

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USDA researcher Wofford Camp in 1916-17 on four acres of land donated to the government in Bakersfield and a number of test plots for Egyptian cotton throughout the region. Although he was officially attached to the USDA facility at Bard (in the Yuma Valley), Camp spent most of his time in the late 1910s in the San Joaquin Valley trying to establish a cotton farming industry. His efforts paid off; by 1920 over 21,000 acres of fields were in cotton. To help gin cotton samples, the USDA and the University of California split the costs to erect a gin at the Kearney Station that year.[59]

In 1919 Camp hedged his bets and began planting small plots of the new Acala 8 variety. The crash of the Egyptian long-staple cotton market and the success of the early Acala plantings led to a quick shift in interest. The continuing support among farmers led the USDA to work out a deal to establish a San Joaquin Valley experiment station for cotton work. In 1922 the U.S. Cotton Research Field Station at Shafter opened. It quickly went to work expanding the research and development of the Acala variety. For the next fifty-five years, the Shafter Station would be the most significant player in the California cotton industry and the home of the state's official Acala cotton variety. The development of California Acala and the role of Shafter Station will be discussed more fully in Chapter Three.[60]

Cotton became California's biggest crop commodity in 1947. The state's largest cotton producer, Russell Giffen, operated three "ranches" covering a total of 86,000 acres—an area about 44 percent larger than the entire Yuma Reclamation Project. The introduction of the mechanical harvester marked the end for small farmers in the valley. Producers needed between one and two hundred acres of cotton to harvest annually to make the large financial investment cost effective. As in West Texas several counties in the San Joaquin Valley began taking regular positions in the top one hundred cotton-producing counties in the United States after World War II. With large farms and mechanization, the San Joaquin Valley surged to become the second or third largest production region in the country, approximately tied with West Texas behind the Mississippi River Valley of the Cotton South.

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[59] John Turner, White Gold Comes to California (Bakersfield: California Planting Cotton Seed Distributors, 1981), 36-40; Stemen, "Genetic Dreams," 139-49. Turner lists some of Camp's California test plot locations as including fields near Shafter, Chico, Arvin, and McFarland.

[60] Turner, White Gold, 40-43; Stemen, "Genetic Dreams," 153.

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Driven by strong growth in the late 1960s and 1970s in the San Joaquin Valley, the Cotton West exceeded cotton production in the South for the final three decades of the twentieth century.[61]

Lower Rio Grande Valley

Statistically the smallest of the Cotton West production areas, the Lower Rio Grande Valley of Texas shares many of the characteristics of western instead of southern cotton agriculture. Cotton farming occurred in the extreme southern end of the valley for many years on a small scale. Here, near Brownsville, the Mexican Cotton Boll Weevil crossed the border about 1892 and began its destructive spread across the southern cotton belt. Once the boll weevil arrived, cotton production in the valley suffered for a great period of time until new weevil-resistant varieties became available.[62]

As far back as the earliest Spanish explorations into the area, settlers in the Lower Rio Grande Valley knew that irrigation was absolutely necessary for successful farming. An early USDA report noted that rainfall is "extremely varied and uncertain"; the maximum annual rainfall was over sixty inches, the minimum just under nine inches, and the mean average about twenty-eight inches. Spanish and Mexican residents had small ditches and acequias, but it was not until the 1890s that irrigation companies began building larger canal systems. Railroads expanding into the valley mounted some ventures, but large-scale land developers initiated later ones, trying to capitalize on increased settlement after 1900. Since the Rio Grande was an international boundary, any reservoir project had to be approved in advance by treaty between the United States and Mexico. Though several inquiries took place, it was not until 1944 that the countries worked out such an agreement, which in part called for the construction of the Falcon Dam, completed in 1953.[63]

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[61] Stemen, "Genetic Dreams," 209-13; Saffell, "When Did King Cotton Move," 301-8.

[62] Saffell, "When Did King Cotton Move," 301-8; W. D. Hunter and W. E. Hinds, The Mexican Cotton Boll Weevil: A Revision and Amplification of Bulletin 45, to Include the Most Important Observations Made in 1904, USDA Bureau of Entomology Bulletin No. 51 (1905), 18; Rex E. Willard, Status of Farming in the Lower Rio Grande Irrigated District of Texas, USDA Bulletin No. 665 (1918), 1-10.

[63] J. Lee Stambaugh and Lillian J. Stambaugh, The Lower Rio Grande Valley of Texas (San Antonio, Tex.: The Naylor Company, 1954), 183-203; L. L. Hidinger, The Drainage Situation in the Lower Rio Grande Valley, Texas, USDA Office of Experiment Stations Circular No. 103 (1911), 13.

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Upstream north of Laredo lies the Winter Garden district. Known chiefly for its production of vegetable and truck crops (and the associated use of Mexican field laborers for harvesting), there are small patches of cotton grown as part of the Lower Rio Grande Valley region, particularly in Frio County. As alluded to earlier in the discussion of underground water use on the High Plains, the Winter Garden district was the other area of Texas that heavily utilized artesian wells and underground pumping for its agriculture.[64]

The Texas Agricultural Experiment Station did not open a research facility for the Lower Rio Grande Valley until 1923. The Weslaco Experiment Station's primary purpose was to research citrus fruit production, but it extended its mission to include research on the adaptability and culture of other crops, including cotton.[65]

The number of farms in the Lower Rio Grande Valley tripled between 1900 and 1930. Irrigated farmland acreage increased from 50,000 to over 536,000 acres between 1900 and 1950. With its close proximity to the border, one might expect that Lower Rio Grande Valley farmers might have been among the last to convert from hand to mechanical harvesting because of the availability of cheap Mexican laborers. Instead, it was among the quickest areas to convert to use of mechanical cotton pickers in the early 1950s. Through the use of irrigation production and advanced mechanization, the Lower Rio Grande Valley continues today to be very advanced in its cotton agriculture and a significant part of the Texas cotton industry and that of the Cotton West.[66]

Summary

The unifying theme of this chapter is the farmer's struggle for water to irrigate his cotton fields. In some places, he redirected surface waters; in others, he pumped water from below the surface. Federal, state, and sometimes local agencies organized water projects to aid and support cotton farming. The laws and concerns differed widely from one region to another. Whatever the specific concern, the water problem was and is a universal concern of

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[64] The New Handbook of Texas, s.v. "Winter Garden Region."

[65] Stambaugh and Stambaugh, Lower Rio Grande Valley, 244.

[66] John P. Tiefenbacher, "A Rio Grande 'Brew': Agriculture, Industry, and Water Quality in the Lower Rio Grande Valley," in Fluid Arguments: Five Centuries of Western Water Conflict, edited by Char Miller (Tucson: University of Arizona Press, 2001), 189-91; Stambaugh and Stambaugh, Lower Rio Grande Valley, 252.

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everyone in the Cotton West. In contrast, the entire Cotton South regularly gets much more rainfall and very rarely has to delve into the realm of irrigation.

Another point of contrast between the West and the South based largely on geography is the lack of cotton pests. The scourge of the South—the Mexican boll weevil—spread eastward from Texas to the Carolinas between 1892 and the 1920s. The lack of natural pests and diseases was a major factor favoring the introduction and spread of cotton in the West. While the West eventually had its own cotton problems—with pink bollworm or verticillium wilt—their emergence several decades later permitted cotton agriculture to become firmly established in the West.

With the West identified as an ideal place to expand American cotton production, the discussion of the evolutionary development of cotton varieties, labor to cultivate and harvest the crop, and progressive mechanization of production will establish a complete picture of the introduction and spread of cotton farming in the production regions of the Cotton West.

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CHAPTER III
COMMON ROOTS

The beginning of the twentieth century marked a critical period of development for the American cotton industry. Farmers, scientists, and government officials saw in the fertile plains and river valleys of the West numerous opportunities to introduce cotton agriculture and expand this vital economic resource. Cotton mills in the eastern United States had increasing needs for all types of cotton, particularly the long-staple Egyptian cotton. At the same time, the quick spread of the boll weevil from Mexico into southern Texas and thence eastward threatened the rural economies that depended on cotton agriculture.

Responding to opportunity and crisis, scientists and an expanding system of experiment stations began intensive research on cotton varieties. Their introduction or "discovery" of either foreign or "new" varieties became the common roots of many modern cotton varieties planted in the United States today. As this chapter will show, many of the western Upland cotton varieties during the period of this study are all related to each other because of the common and shared work of U.S. Department of Agriculture (USDA) and state researchers. Some of the same individuals are responsible for the developments in what becomes Pima long-staple cottons, but in a much smaller area geographically. For both types of cotton, these men's opinions about one-variety communities also influenced the legal and distribution structure of the industry, particularly in California and Arizona. Thus, the underlying story behind the varieties themselves is the role and power of the USDA and local researchers, within a state or region, in establishing the agricultural communities of the Cotton West.[1]

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[1] I will repeatedly refer to two of the four major kinds of cotton in this chapter. American Upland cotton is generally, but not always, short-staple varieties from the United States with fibers between 3/4 and 1 1/16 inches length. The name originally applied to cotton grown in the Carolinas in the "upland," as opposed to the Sea Island type cotton grown along the coast. Egyptian cotton is a category based on plants raised in the country of the same name, but has its genetic origins in South and Central America. It is almost always long-staple cotton around 1 1/2 inches long. Acala cotton, the variety introduced from Mexico, is a short-staple cotton, often crossed with Upland varieties in U.S. breeding efforts, with fiber lengths of 1 1/16 inches. "Glossary of Cotton Terms," in History of Extra-Long Staple Cottons, by Joseph C. McGowan (El Paso, Tex.: Hill Printing Company, 1961), 136-39.

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Making More Cotton Fields

The economic importance and impact of agriculture was a prime consideration of politicians and the leadership of the U.S. Department of Agriculture as the twentieth century began. The annual reports of the Secretary of Agriculture in the 1890s and early 1900s make this clear. James Wilson discussed this at some length in his 1904 report under the heading "Agriculture as a Source of National Wealth." Producing an aggregate wealth of almost $5 billion in 1904, a healthy "farming element of the people" offset an industrial depression and saved the country from "severer conditions that must otherwise have befallen." Wilson's report also discussed the importance of agriculture in foreign trade, farm capital, and the financial health of the banking system. All of the reports for this period describe the extensive research and efforts to protect and expand agriculture in all forms. [2]

The initial emphasis was on production of long-staple cotton varieties, particularly Egyptian types. Manufacturers considered long-staple cotton the most desirable because its longer fiber lengths were easier to spin into thread and were much stronger than shorter staple lengths. At the dawn of the twentieth century, much of the world's long-staple cotton came from Egypt, with lesser amounts coming from the American southeast coast (Sea Island varieties) and a small area of the Mississippi River valley region (long-staple Upland varieties). Egyptian cotton was becoming damaged by disease and cross-contamination in breeding. In addition, rising world tensions that ultimately would lead to World War I threatened to limit or cut off the supply of true Egyptian cotton. The spread of the Mexican boll weevil across the South all but wiped out many cotton-producing areas for several years, including those that grew the long-staple Upland varieties. Thus, the federal government wanted to promote new areas of cultivation of long-staple cotton.[3]

Establishing a Domestic Long-Staple Cotton Industry in the West

Prior to 1861 American Sea Island cotton, grown almost entirely along the East Coast from the Carolinas to Florida, was one of the nation's most exported products, with much of

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[2] Jim Wilson, "Report of the Secretary," in Yearbook of the United States Department of Agriculture: 1904 (Washington, D.C.: GPO, 1905), 9-15. See also the "Report of the Secretary" in other USDA Yearbooks for the period between the early 1890s and the 1920s.

[3] C. S. Scofield et al., Community Production of Egyptian Cotton in the United States, USDA Bulletin No. 332 (1916), 2-5.

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it going to English textile mills. But with the onset of the American Civil War, Great Britain helped Egypt establish and expand its cotton production to fill the void left by the blockade of Confederate cotton. Egypt quickly became recognized for producing a long-staple cotton with high qualities of fineness and strength.[4]

In the aftermath of the Civil War, the newly formed U.S. Department of Agriculture examined this new, high quality Egyptian cotton to help restore a war-torn South. In 1867 and 1871 the USDA conducted more than fifty trials in every cotton-growing state from North Carolina to Texas but found the Egyptian cotton needed a longer growing season than that found in the American South. Over twenty years passed before the USDA tried again to procure seeds for experiment stations and private growers. Again, the results were discouraging and the attempts abandoned.[5]

In the meantime, imports of Egyptian cotton steadily grew. By 1907 the United States was averaging 54 million pounds a year with a market value of over $16 million. With such a strong demand and value not being met by American producers, the USDA renewed its efforts to "develop Egyptian cotton culture in the United States in order to supply our own market with a home-grown product."[6]

The USDA ordered new tests between 1898 and 1902 through the newly organized Office of Foreign Seed and Plant Introduction. Results from humid South Carolina and Texas tests again proved less than encouraging. Another batch of seeds sent to the American Southwest showed much greater promise, especially near the Pecos and Rio Grande rivers in New Mexico and Texas and along the Colorado River valley, whose long, dry summers, irrigation, and deep alluvial soils most closely mimicked Egypt. In 1903 the USDA decided to concentrate its Egyptian tests at its new experiment station at Yuma, Arizona.[7]

As discussed in Chapter Two, southern California and Arizona were climatically similar to Egypt. Both shared characteristics of a long, dry summer, deep alluvial soils, and

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[4] McGowan, History of Extra-Long Staple Cottons, 3, 11.

[5] Lyster H. Dewey, Egyptian Cotton in the United States, USDA Division of Botany Circular No. 26 (1900).

[6] Thomas H. Kearney and William A. Peterson, Egyptian Cotton in the Southwestern United States, USDA Bureau of Plant Industry Bulletin No. 128 (1908), 7.

[7] McGowan, History of Extra-Long Staple Cottons, 51-52; Kearney and Peterson, Egyptian Cotton, 7-8, 31-34.

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controlled irrigation. Further, the region was free of the boll weevil. Writing in 1913, USDA researcher O. F. Cook stated that "There is every reason to expect that long-staple cotton will become one of the chief products of irrigation farming in the Southwest." As a result, the USDA directed a great deal of its efforts into developing long-staple cottons for the region.[8]

According to Thomas Kearney, who directed much of the research on Egyptian cotton in the Southwest between 1902 and 1944, "It was desired from the outset to secure a type of cotton … that would be distinctive" from other cotton-growing areas of the U.S. Of the three Egyptian varieties initially tested in 1902—Mit Afifi, Jannovitch, and Abbasi—Abbasi was believed to too closely resemble Sea Island cotton, which was still being grown along the East Coast. Through experiments and accidents, the Mit Afifi variety became the variety from which scientists drew new selections as they acclimatized and propagated the first American-Egyptian cottons.[9]

As much as the variety itself, USDA researchers looked at every aspect of cotton production in the arid Southwest. One of the major areas was the entire concept of irrigating cotton. Kearney defined the "almost perfect regulation of the water supply" as the principal difference between the Cotton South and the new fields of the arid Southwest. They also reexamined basic growing practices, including different methods of planting and cultivating fields. Kearney indicated that, after a field is leveled to aid in irrigation, "no expensive field machinery is necessary" other than those implements typical on an average irrigated farm.[10]

The improvement of Egyptian cotton proved to be a slow, drawn-out process. It was not until 1908 that Kearney and his colleagues identified and isolated the first three American-Egyptian cotton varieties, all named for the locales where they originated. They discarded Somerton quickly because it matured later and produced excessive foliage. They retained Gila cotton, from a farm on the Gila Indian reservation at Sacaton, Arizona, for

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[8] Scofield et al., Community Production of Egyptian Cotton, 25-28; O. F. Cook, "Durango Cotton in the Imperial Valley," in Miscellaneous Papers, USDA Bureau of Plant Industry Circular No. 111 (1913), 11. It is noted here that Cook's 1913 paper documents that a long-staple Upland variety, Durango, was the first long-staple cotton recommended for the Southwest. He said it enjoyed an artificial and probably temporary advantage over Egyptian cotton, which at the time had not reached a level for commercial farming (p. 18). Durango, with a staple length of 1 1/8" to 1 1/4", was most popular in the Imperial Valley during the 1910s and was the first to be raised in a one-variety community, which is described later in the chapter. J. O. Ware, "Plant Breeding and the Cotton Industry," in Yearbook of Agriculture: 1936 (Washington, D.C.: GPO, 1936), 681-82.

[9] Kearney and Peterson, Egyptian Cotton, 37-39.

[10] Ibid., 48, 54. I examine mechanization research in greater detail in Chapter Four.

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planting by the Indians. The Yuma variety was well favored in both field and spinning manufacturing tests. For the first time in 1912, the year the Salt River Project opened its operations, the USDA furnished this Yuma variety seed to farmers for commercial production. The early plantings in the Salt River Valley of Arizona and the Imperial Valley of California quickly increased to where annual production five years later was about 16,000 bales.[11]

In the meantime, the experiments continued. In 1909 the USDA expanded its cotton testing facilities at Sacaton. The next year, the chief of the USDA Bureau of Plant Industry established a "Committee on Southwest Cotton Culture" to coordinate efforts among several scientists, which included Kearney, Carl Scofield, and O. F. Cook. During the 1910 harvest, staff at Sacaton identified a single plant from the year's Yuma variety tests that was a finer fiber, lighter colored, and 1/8" longer in fiber length. The seed from the plant was propagated and rechristened as a new variety—Pima, named for the nearby Indian tribe. After several years of developing a seed stock, the USDA introduced Pima as the replacement for Yuma in the Salt River Valley in 1918.[12]

The industry managed a successful transition, in large part, because farmers there had organized a series of growers' cooperatives that carefully managed local production. More importantly, the start of World War I and the reduction of cotton available from Egypt caused market prices for long-staple cotton to rise sharply. Between 1915 and 1917 the production of American-Egyptian cotton rose fifteen-fold, with the cash value of the crop increasing from $129,660 to over $6 million. The new variety became so popular that, despite later improvements, the term "Pima" became universally known as the generic term for all extra-long staple cotton.[13]

One of the significant players in this new Pima cotton industry must be introduced here. One of the byproducts of cotton was the pneumatic tire. While the inner tube was all

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[11] Ware, "Plant Breeding and the Cotton Industry," 694; McGowan, History of Extra-Long Staple Cottons, 58. Yuma cottons had a fiber staple length of 1 5/8" to 1 3/4". Mark L. Stemen, "Genetic Dreams: An Environmental History of the California Cotton Industry, 1902-1953" (Ph.D. diss., University of Iowa, 1999), 80-81.

[12] McGowan, History of Extra-Long Staple Cottons, 59-60, 77; Ware, "Plant Breeding and the Cotton Industry," 694-95.

[13] McGowan, History of Extra-Long Staple Cottons, 62-65, 77.

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rubber, the outer casing used a fabric harness with several layers of strong and resilient cotton coated with rubber to protect it from moisture and abrasion. Paul Litchfield, the man who developed Goodyear Tire and Rubber Company's pneumatic truck tire, saw great possibilities for its production with the emergence of World War I if it could find an alternative source for cotton.[14]

In the 1910s the principle sources of suitable material were Egyptian cotton and American Sea Island cotton. As World War I expanded, England diverted Egyptian harvests for its war effort. In the meantime the boll weevil, a recent newcomer to the Carolinas having completed its decade-long trek across the South, threatened to bring the production of Sea Island cotton to an abrupt end. Litchfield, now a vice president and factory manager for Goodyear, felt that the USDA's experiments with American-Egyptian cotton in Arizona was the answer.[15]

In late 1916 Litchfield made arrangements for Goodyear to purchase or lease about 22,000 acres in the Salt River Valley outside of Phoenix and established the Southwest Cotton Company.[16] Within a few months Goodyear had brought in a fleet of tractors and a labor force of two thousand men and a thousand mules to clear the barren desert landscape and transform it into a farm, complete with irrigation wells, cement-lined canals, and its first 1,500 bale crop of long-staple cotton. By 1921 Goodyear's holdings had reached 38,000 acres, about half of which was in cotton production, with its own network of twenty-four cotton gins and the Phoenix Cotton Oil Company mill.[17]

Goodyear's bold move spurred the Arizona cotton industry. Arizona cotton acreage expanded from 6,800 acres in 1916 to 180,000 acres at its peak in 1920. Other American tire companies like Firestone sent their buyers to the Salt River Valley, driving prices up and causing most everyone in the region to switch to cotton production. The regional Phoenix

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[14] Hugh Allen, The House of Goodyear: Fifty Years of Men and Industry (Cleveland, Ohio: Corday & Gross, 1949), 92.

[15] Ibid., 150-51.

[16] Some writers refer to the project as the Arizona Cotton Ranch. In 1943 the company changed the name to Goodyear Farms. Some of the individual units of over 10,000 acres were sometimes referred to separately, such as the Litchfield Ranch—one of the original component parks west of Phoenix that eventually became the resort community of Litchfield Park.

[17] Allen, House of Goodyear, 152-53; Allen C. Reed, "Goodyear Farms: Laboratory in the Desert," Arizona Highways 28(4) (April 1952): 30.

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population doubled in almost a decade, causing a vast network of modern highways to be built to accommodate all the people and the cotton being produced.[18]

The post-war depression hit in 1920. The peak year of long-staple cotton production occurred just when the market bottomed out. At the same time, cotton mills had developed new spinning techniques that could spin short fiber cotton into the cords and fabrics needed for tires. Thus on two fronts the demand for Pima cotton suddenly plunged. The difficult market caused most contract farmers to drop out of cotton production, and the Southwest Cotton Company reorganized its operations. While it remained a major player in the Salt River Valley cotton community, the shine of American-Egyptian cotton lost its luster as new varieties of Upland Acala cotton emerged to a prominent new role in the Cotton West.[19]

Unseen Influence of the Boll Weevil in Developing Western Cotton

In the early twentieth century cotton was one of the largest segments of American agriculture, yielding approximately $600 million in 1904. Second only to corn production, this figure did not include any subsequent economic impacts from buying machinery, fertilizer, or other farm accessories. Thus, observers viewed the arrival of the Mexican boll weevil, which entered Texas in the early 1890s, as more than just "some pest;" it represented a vital threat to the cotton and agricultural economy. Over about a decade the boll weevil quickly moved into Louisiana and the rest of the Cotton Belt, leading one entomologist to note that "in less than twenty years [the boll weevil went] from a most obscure species to undoubtedly one of the most important economically in the world."[20]

One of the first agencies to react to the boll weevil was the USDA Department of Entomology, which began field studies in 1894. The researchers immediately recommended the establishment of a cotton-free region to block the weevil's migration, but the State of Texas declined to create one. Four years later, however, seeing the boll weevil quickly spreading through its largest agricultural industry, Texas created an entomology agency and

[18] Allen, House of Goodyear, 154-55; Reed, "Goodyear Farms," 30.

[19] Reed, "Goodyear Farms," 30-33.

[20] Wilson, "Report of the Secretary," 11; W. D. Hunter and W. E. Hinds, The Mexican Cotton Boll Weevil: A Revision and Amplification of Bulletin 45, to Include the Most Important Observations Made in 1904, USDA Bureau of Entomology Bulletin No. 51 (1905), 13.

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began its own efforts to both research and combat the boll weevil. Though scientists learned more about the boll weevil, they did not halt its advance.[21]

The United States Congress joined the fray in 1901. Congressmen were displeased by the failures of Texas' efforts and its refusals to enact several USDA suggestions. They also saw the fast moving weevil, then starting to encroach upon Louisiana, as a growing threat to the national agricultural economy. Starting in 1901 and for several years thereafter, Congress appropriated funding for research and development to combat the boll weevil threat. By 1904 about 32 percent of the total cotton acreage was affected, with damage estimated at about $22 million. The USDA, Texas, and Louisiana diverted numerous resources, but Congress made a specific, additional appropriation of $250,000 for the boll weevil emergency.[22]

The USDA split the funds between the Bureaus of Entomology and Plant Industry, but they coordinated their plan of work in many of the same areas. Plant Industry chief B. T. Galloway described several lines of work, including farm diversification, demonstration farms, and investigations of tropical cottons. Much of the emphasis was on cotton breeding, selection, and improvement.[23]

The "rediscovery" of Gregor Mendel's research on plant genetics in the late 1890s and its introduction into American agricultural science was a major spark to begin research on plant breeding for all crops. According to one article, "No organization played a more important role in the dissemination of Mendelism than the USDA." It was a convenient addition to USDA's policy since the 1870s of increasing variation and producing stable plant hybrids. USDA scientists became new followers, readily embracing and spreading breeding concepts proposed by Mendel. New developments became widely available to scientists and state experiment station personnel through USDA schools and publications. This expansion of science became a major tool in social and economic reform, and the tremendous interest in

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[21] Hunter and Hinds, Mexican Cotton Boll Weevil, 18-19.

[22] Ibid., 20-23.

[23] B. T. Galloway, "Work of the Bureau of the Plant Industry in Meeting the Ravages of the Boll Weevil and Some Diseases of Cotton," in Yearbook of the United States Department of Agriculture: 1904 (Washington, D.C.: GPO, 1905), 497-98.

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breeding became the principal tool to fight the boll weevil by developing new cotton varieties.[24]

From Common Roots

Leading the Bureau of Plant Industry's efforts was biologist O. F. Cook. Originally a specialist in tropical plants, Cook became one of the country's leading cotton scientists and advocates, starting with a 1902 research trip to Central America to search for new tropical plants. Among those that he sought was cotton that grew despite the presence of the boll weevil. His team hoped to find a variety that had developed a natural resistance to the pest.[25]

They found an intriguing crop of Upland cotton in northern Guatemala among fields cultivated by the Kekchi Indians. The field attracted attention for its combination of small plant size and the lack of weevil destruction, even though perennial "tree" cottons nearby were clearly infested. Cook returned in 1904 to specifically research this cotton culture.[26]

Cook found two key reasons for the success of the Kekchi cotton. The first was an ant-like insect, locally called a kelep, which stung and fed upon the boll weevils. Sensing a possible aid in controlling the boll weevil, USDA authorities cabled Cook to spare no expense to bring several colonies for introduction in Texas. The American press subsequently described the "Guatemalan ant" as the solution to "exterminate the boll weevil," but Cook clearly believed this not to be the case. The keleps could do no better, he wrote, than to keep the weevil population in check, as they had not eliminated the pest in the fields of Guatemala.[27]

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[24] Diane B. Paul and Barbara A. Kimmelman, "Mendel in America: Theory and Practice, 1900-1919," in The American Development of Biology, edited by Ronald Rainger et al. (Philadelphia: University of Pennsylvania Press, 1988), 281-310. The rise of agricultural science in the late nineteenth century and its relationship to land-grant colleges and state agricultural experiment stations is discussed in several works, including Alan I Marcus, Agricultural Science and the Quest for Legitimacy: Farmers, Agricultural Colleges, and Experiment Stations, 1870-1890 (Ames: Iowa State University Press, 1985); and Charles E. Rosenberg, No Other Gods: On Science and American Social Thought (Baltimore, Md.: Johns Hopkins University Press, 1976).

[25] O. F. Cook and C. B. Doyle, Acala Cotton, A Superior Upland Variety from Southern Mexico, USDA Circular No. 2 (1927), 6.

[26] O. F. Cook, "Cotton Culture in Guatemala," in Yearbook of the United States Department of Agriculture: 1904 (Washington, D.C.: GPO, 1905), 476.

[27] Ibid., 485.

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The more important trait in Kekchi cotton, Cook recognized, was a result of how the Indians managed the crop. The Kekchis planted peppers and cotton together, removing the cotton shortly after the early bolls opened so the peppers could ripen to maturity. As a result of years of unconscious selection, much of the Kekchi cotton matured several days earlier than American Upland varieties. Cook also discovered that, as with several Texas varieties, bolls that had been damaged by weevils showed some ability to, in effect, poison the larvae and still produce normal fiber, a process that Cook and other researchers would not completely understand for several more years.[28]

Starting in 1905 Cook and the USDA sent Kekchi seed to Texas for acclimatization and evaluation. Researchers saw the new variety as promising because it offered some protection against the boll weevil and was a strong and remarkable plant producing good fiber. Although clearly not the solution, Kekchi cotton did become part of the new breeding materials that would make up the cottons of the American West.[29]

Still looking to improve American cotton in general and try to alleviate the growing boll weevil crisis, Cook returned to Guatemala and southern Mexico in 1906 in a new exploration for cotton. At one stop, near Ocosingo, Chiapas, they found a single plant growing wild from discarded seed that was immediately recognized as being superior not only to the American Upland varieties but to the Kekchi as well. The plant grew upright, had large bolls with unusually long fibers, and had the same resistance to weevil punctures and damage. A second trip in late 1906 by C. B. Doyle tracked this cotton to an area near Acala, Chiapas, an area with a climate and elevation similar to western Texas and Oklahoma. They acquired a sample of cotton ginned from a local field and returned it to the U.S.[30]

Over the next couple of years the newly arrived Acala variety readily acclimatized in USDA fields at Victoria, Kerrville, and Del Rio, Texas. The similarity between growing conditions there and its origins near Acala made it immediately productive, unlike the Kekchi

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[28] Ibid., 486.

[29] Cook and Doyle, Acala Cotton, 7.

[30] Ibid., 7-10. In backtracking the cotton through local trade networks, the first cotton similar to the Ocosingo plant was found in a market at Tuxtla Gutierrez, the capital of Chiapas. Though this was the variety Doyle sought in Acala, he did not locate it. The team brought back a small number of seeds bought at Tuxtla to the U.S. for the breeding program, resulting in some production of Tuxtla varieties (such as the Tuxtla Big-Boll variety), but these seeds and characteristics were effectively rolled into the Acala seed stock. Cook and Doyle, Acala Cotton, 9 n. 3.

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cotton, which was only then starting to produce after several years of adaptation. USDA researchers at the San Antonio experiment station were impressed by its drought resistance, its earliness in maturing, and its good production even in the presence of the boll weevil. By the early 1910s they were sharing Acala cottonseed with other USDA breeding researchers in North Texas and Oklahoma. A long list of favorable characteristics and some careful selections by breeders soon made the Acala variety progenies popular throughout the American cotton-breeding program.[31]

The Acala varieties, in general, were plants of medium height growing on a strong, upright main stem, making them both larger and sturdier than traditionally grown Texas big-boll varieties of cotton. Acala bolls were apparently comparable in size, producing fibers 1 1/8" in length with good spinning characteristics. Like its Texas "cousins," Acala cotton had a "storm-proof" character where the fiber stayed in the boll after opening but yet opened widely so it was easy to pick by hand. Compared to other American Upland varieties, Acala was superior for its earliness, productivity, better growth in cooler weather, better ripening of late bolls, and a greater resistance to unfavorable conditions. Most importantly, Acala did favorably against the boll weevil, both because it matured earlier than most fall infestations and because when attacked, it exhibited resistant characteristics, similar to those described earlier in Kekchi cotton.[32]

By the 1920s Acala cotton was being introduced and cross-bred throughout the United States. Pure Mexican Acala did not perform well in the traditional Old South cotton belt because its drier-climate origins and a less-than-desired level of boll weevil resistance. Acala, however, was bred into other Upland varieties across the South in several experiments over the next several decades.[33]

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[31] Ibid., 10-11. The USDA breeding facilities were Waco, Greenville, and Clarksville, Tex., and Okemah, Okla.

[32] Ibid., 11-14.

[33] C. Wayne Smith et al., "History of Cultivar Development in the United States," in Cotton: Origin, History, Technology, and Production, edited by C. Wayne Smith and J. Tom Cothren (New York: John Wiley & Sons, Inc., 1999), 143; Cook and Doyle, Acala Cotton, 2-5, 13-15.

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Keystone Selections of Acala in Oklahoma

One of the initial development sites for Acala cotton was in Okemah, Oklahoma, where C. N. Nunn was in charge of a USDA farmers' cooperative demonstration project. In 1914 he received a bushel of Acala cottonseed and supervised its planting on a local farm. That fall USDA cotton breeders, including O. F. Cook, visited the field and made plant selections for development the next year. Two key strains emerged from these selections. The fifth selection, favored by Nunn because its early maturity was ideal for Oklahoma growing conditions, became known as Acala 5 or Nunn's Acala.[34] The other outstanding row, Acala 8, was almost identical to the original Mexican Acala cotton. Acala 8 had longer fruiting branches, somewhat larger bolls, and a little bit longer fiber than Acala 5. The USDA returned the row of Acala 8 to its Clarksville, Texas, research farm for further development with other Acala breeding stocks, all of which a few years later became foundation stock for California Acala cottons, to be described below.[35]

Nunn continued working with Acala 5, making it available to farmers as commercial seed starting in 1918. It became very popular throughout Oklahoma, Arkansas, and parts of North Texas—on both sides of the dividing line between Cotton South and Cotton West. Nunn subsequently developed a new strain called Acala 5-37, which replaced its parent type about 1927. Just before his death in 1934, Nunn developed a later strain that he called Nucala. Nunn's influential work with Acala 5, however, was not limited to his commercial seed business. Breeders used Acala 5-type stocks in Oklahoma, Arkansas, and Tennessee experiment stations in their public breeding work, while private cottonseed companies in Oklahoma, New Mexico, and Arkansas purchased Acala 5 foundation material to establish commercial seed varieties for customers in those areas.[36]

Nunn's Acala, however, was not the only seed used in western Oklahoma. The Lawton Field Station of the Oklahoma Agricultural Experiment Station (OAES) was the site of joint testing of cotton varieties by OAES and the USDA Bureau of Plant Industry. In a description of sixteen years of testing at that station, W. M. Osborn reported that four varieties had been

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[34] By fall 1915 Nunn had left the extension service to become a private seed dealer with the farming firm Lynde & Darby. The company had grown the progeny rows of Acala 5 and Acala 8 raised in 1915 on its farm near Porter, Okla.

[35] Cook and Doyle, Acala Cotton, 10-11; Ware, "Plant Breeding and the Cotton Industry," 675.

[36] Ware, "Plant Breeding and the Cotton Industry," 675.

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the most popular. Acala 5 and Mebane Triumph, a popular variety from the family-owned firm of the same name in Lockhart, Texas, were similar plants with average size bolls, medium earliness, and fiber (staple) length of 15/16 to 1 inch. Rowden and Lone Star, both from more traditional Texas and Southern big-boll types of cotton, were later maturing with good fiber length but lower overall yields than Acala 5 and Mebane. They also noted the recent popularity of Half and Half, a short-staple cotton that originated in Georgia.[37]

Since 1914 the OAES had developed some of its own cotton breeding material. At the Stillwater station, researchers selected a very early emergent plant from a field of Mebane Triumph that was christened Oklahoma Triumph 44 in the mid-1920s; interestingly, the Mebane Triumph remained more popular in the western part of the state, while the Oklahoma Triumph replaced it in the eastern part. In 1924 the Stillwater station designated an earlier maturing type of Acala 5 as Acala 44, which apparently did not reach commercial status but may have been used in further breeding tests. Meanwhile, breeders named another selection from Acala 5 made at the Lawton station "Lawton Acala," which had numerous favored characteristics; however, it also never became a commercial cotton variety.[38]

A 1933 OAES report indicated that, while Mebane, Half and Half, Acala, and Oklahoma Triumph 44 accounted for the plants in three-fourths of the state's cotton fields, farmers did not clearly favor any one type in any area of the state, and the most common type changed annually. This wide array of cotton varieties perhaps is indicative of Oklahoma's location on the fringes of the Cotton West and South. The variety characteristics likely did not stabilize until after the introduction of West Texas stormproof cotton characteristics (described later) and the early mechanical stripper harvesters in the 1930s and 1940s.[39]

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[37] Ibid., 735; W. M. Osborn, Cotton Experiments at the Lawton (Oklahoma) Field Station, 1916-1931, Oklahoma AES Bulletin No. 209 (1933), 12-13. According to some oral history interviews, but not affirmed in contemporary publications like Ware, Half and Half was so-called because the product was about half seed and half fiber. Joe H. Lambright, Interview by Richard Mason, 11 April 1983 (Southwest Collection, Texas Tech University, Lubbock, Tex.), Tape Two, Side One.

[38] Osborn, Cotton Experiments, 13-15; Ware, "Plant Breeding and the Cotton Industry," 708-9.

[39] Roy A. Ballinger and Clyde C. McWhorter, Economic Aspects of the Grade and Staple Length of Cotton Produced in Oklahoma, Oklahoma AES Bulletin No. 212 (1933), 32-35.

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Evolution of California Acala Cotton and the System Behind It

USDA researchers in California were not always satisfied with the American-Egyptian cotton varieties developed in Arizona. In part from scientific curiosity, and perhaps seeing that the long-staple cotton industry could collapse after World War I, researchers began testing several varieties of Upland cottons. Among these were several cultivars of the Oklahoma and North Texas-grown Acala, most notably the so-called Acala 8, which the USDA shipped to California in 1919. From those plants came the basis for what became known simply as Acala cotton in the certified one-variety cotton production of that state, all of it bred and developed at the USDA experiment station at Shafter. [40]

The first field planting of Acala in California occurred under the supervision of Wofford Camp, who since 1917 had been planting test plots of several varieties of Upland and American-Egyptian cotton in the San Joaquin Valley to see which—if any—could grow there. The initial Acala seed that Camp planted in 1919 came from Acala-8 stock from the USDA facility at Clarksville, Texas. The next year Camp expanded from the first planting of eight acres to several USDA-cooperator fields totaling a few hundred acres. The block planted at the U.S. Experiment Date Garden in the Coachella Valley in 1920 attracted considerable interest.[41]

Farmers in the relatively isolated Coachella Valley had been planting cotton since 1909. Between 1910-14 and 1918-20 growers had planted various fields of the Texas big-boll type varieties Rowden and Mebane. They also attempted to raise American-Egyptian cottons, but they had to transport the harvested cotton to the Imperial Valley for ginning. The 1920 debut of the Acala variety was stunning—a harvest equivalent to two-and-a-half bales per acre—and attracted numerous visitors to see the new crop.[42]

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[40] Cook and Doyle, Acala Cotton, 11, 17-19.

[41] Wofford B. Camp, Cotton, Irrigation and the AAA (Berkeley: University of California Bancroft Library, Regional Oral History Office, 1971), 38-48; Cook and Doyle, Acala Cotton, 18-19. Camp's report is noteworthy for his observation that California agricultural experiment station officials viewed the USDA cotton tests as useless, including extension director B. H. Crocheron who strongly discouraged farmers from planting cotton on the basis that it would "ruin the state."

[42] H. G. McKeever, Community Production of Acala Cotton in the Coachella Valley of California, USDA Bulletin No. 1467 (1927), 2-5. McKeever notes that low cotton prices resulted in very little or no cotton being planted in the Coachella Valley between 1915 and 1917.

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Several cotton growers wanted to try Acala for the next growing season, but USDA representatives suggested that everyone in the valley would need to grow it to avoid any cross-pollination from other "lesser" varieties. As a result, the growers immediately formed the Acala Cotton Growers' Association of the Coachella Valley in December 1920. For the 1921 season the association purchased seven tons of seed for its members to plant from the original USDA cooperative grower who started the 1918 tests with Camp.[43]

Camp's cotton variety trials had included a little of everything—Durango, Lone Star, Meade, Mebane, Gila, Pima, and Acala. Some of the choices, no doubt, were made because some new settlers to the area were familiar with the Texas types (Lone Star, Mebane, Meade) from their previous locales. While most of the cotton tests showed decent fiber production, only the Pima and the Acala seemed climatically adapted to the San Joaquin Valley. While Pima cotton had been successfully grown around Bakersfield and Fresno for a couple of years, Camp suggested that Acala cotton would be better adapted to a larger area than the Pima, which needed a lengthy growing season. He also suggested that Acala produced bolls that opened wide for easy picking, that it had higher fiber yields than any other variety, and that it could better stand adverse weather or poor growing (cultural) conditions than other cottons. The uniform fiber length of 1 1/8" to 1 3/16" also was netting growers a premium price that other varieties did not yield. Thus, Camp recommended pursuing Acala as the primary cotton to grow in the San Joaquin Valley.[44]

In his recollections, Camp noted that having all these test plots scattered about California and the Southwest not only "was running me to death," but also the lack of control of cooperative farmers' planting methods made many experiments about cotton production virtually impossible. This, combined with the surge of interest in Acala cotton, demonstrated a need for a dedicated cotton research facility in the San Joaquin Valley. Working with individuals and companies in Kern County, Camp persuaded the USDA to establish the U.S. Cotton Field Station at Shafter, California, in November 1921. The Shafter Station quickly became a knowledge base for the growers of the region, who eagerly sought advice on every

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[43] Ibid., 5-7.

[44] Wofford B. Camp, Production of Acala Cotton in the San Joaquin Valley of California, USDA Circular No. 357 (1925), 2-3.

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aspect of cotton production, from growing practices to marketing. But its significance for the next several decades was that it bred California's official one-variety Acala cotton.[45]

One-Variety is Good For Everyone

Coinciding with the effort to bring permanent cotton cultivation to California was an attempt to alter the cultural practice of raising cotton. As early as 1909 O. F. Cook and other government officials advocated cotton improvement on a community basis, instead of farmers making their own, individual decisions. "Many important advantages are not realized by farmers working alone, but require the united action of entire cotton-growing communities. Only in this way can improved varieties and other results of scientific investigation be effectively utilized."[46] California seemed a natural place to implement community cotton growing. Refinements and improvements for production and handling of California fruits and other specialty crops had already seen great success.[47]

Put simply, a one-variety cotton community is a group of growers in a gin district, county, or other contained region who organize to improve cotton crop quality through standardized production by growing one superior variety of cotton. The chosen variety is determined by extensive testing by state or federal experiment stations in the region. It is one best adapted to local conditions based on yield, quality of staple, market demand, and financial return. Members of such a community can also share with each other the latest methods of production to increase output and improve the fiber quality and purity of seed. The resulting output would have a more uniform staple length and quality that could be sold for a premium price. "Standardization of cotton production in one-variety communities

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[45] Camp and Baum, Cotton, Irrigation, and the AAA, 50-53; John Turner, White Gold Comes to California (Bakersfield: California Planting Cotton Seed Distributors, 1981), 42-44.

[46] O. F. Cook, Local Adjustment of Cotton Varieties, USDA Bureau of Plant Industry Bulletin No. 159 (1909), 41; O. F. Cook, "Cotton Improvement on a Community Basis," Yearbook of the United States Department of Agriculture, 1911 (Washington, D.C.: GPO, 1912), 397. By profession Cook was a plant geneticist. At the time he wrote these articles he was in charge of cotton-breeding investigations. After an extensive literature survey I believe Local Adjustment of Cotton Varieties to be the earliest mention of raising cotton on a community basis in official documents. However, Cook does not indicate where the genesis of this idea originated. Nothing in his background to 1911 indicates a previous understanding of community-based farming. See W. Andrew Archer, Bibliography of O. F. Cook (Beltsville, Md.: U.S. National Arboretum Plant Industry Station, 1950). Further research into whether this idea originated with Cook or from another source is likely called for.

[47] O. F. Cook, Extension of Cotton Production in California, USDA Bulletin No. 533 (1917), 11.

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promotes cooperative effort in all lines of agriculture, business, and social development in the community, to the mutual benefit of every grower and citizen in the community."[48]

In the minds of many people, "cotton is a community crop." Large cotton gins required many farmers to bring their harvest to one facility for processing, resulting in cotton bales to sell and cottonseed for the next year's planting. Neighboring farmers also share similar climate, soil, and growing conditions each year. Cook went so far as to suggest that the old plantation complexes of the antebellum South were the original cotton communities. Each estate was large and isolated and had its own gin and community of farmers. Further, they could maintain a good stock of seed from year to year. These communities, though, had broken down after the Civil War for reasons unrelated to improved crop science.[49]

Scientists viewed pure seed as the most critical issue and the most important reason for one-variety communities. In a mixed-variety community, seed varieties easily cross-pollinated in the fields. Later, after harvesting, different seed varieties became mixed in the seed box at the gin because gin operators did not bother to clean the stands after each farmer's run, thus ensuring further mixing of different seed varieties.[50] The widespread belief that farmers must "change the seed" annually to maintain good varieties prevailed. Cook pointed out that seed dealers, gins, and oil mill owners and managers propagated this myth as a means of ensuring annual sales of "fresh seed" to farmers. By getting an entire community to agree on a single variety, many of these problems could be eliminated in order to maintain the major traits of the selected variety. Further, with proper isolation and local acclimatization, breeders could improve the seed to give better results than seed brought in from other areas.[51]

USDA researchers also cited other, lesser benefits of one-variety communities. They advocated common marketing of the crop, but from the aspect of improved seed rather than as a marketing cooperative. If all farmers grew the same, improved variety they could at

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[48] Ronald S. Byrd, "The Relation of One-Variety Cotton Communities to the Improvement of Cotton Quality " (Master's thesis, Iowa State College, 1941), 69-70.

[49] O. F. Cook, One-Variety Cotton Communities, USDA Bulletin No. 1111 (1922), 3, 13-14. A later, related bulletin is O. F. Cook and R. D. Martin, Community Cotton Production, USDA Farmers' Bulletin No. 1384 (1924).

[50] Cook, Extension of Cotton Production, 13-14.

[51] Cook, One-Variety Cotton Communities, 1, 19.

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least individually receive premium prices for their production. If marketed as a group, the price paid might increase further.[52] Proponents also felt that one-variety communities would increase the pride and competitiveness of individual farmers. Instead of blaming a "poor variety" for poor performance, a farmer would be judged strictly on his farming abilities since he and his neighbors would be planting the same seed under approximately the same conditions. "Community production does not mean that the individual farmers are any less responsible for the careful handling of their crops, but the underlying conditions are improved." All farmers would discuss their common problems for their common benefit. Skills would increase, production would become more uniform, crops would become larger, and the product would become more valuable. Farmers would not waste time or money buying and experimenting with unproved varieties and would not be swayed by the often-unfounded claims of seed dealers. Most importantly, the familiar relationships in a community would establish a closer and more sympathetic contact with the local agricultural agencies, whether they were bankers and businessmen or state and federal agricultural scientists and officials.[53]

The strongest advocates of one-variety communities appear to have been the USDA researchers and scientists. They viewed this as "an essential step in the progress of the American cotton industry." Farmers might be persuaded to plant improved seed and avoid inferior varieties, but USDA officials felt that they would not benefit from the best intentions and possibilities of these improvements on an individual basis. It seemed natural that communities could do many things that were impractical for individual farmers. With centralized communities, the several involved branches of the Department of Agriculture could establish more effective cooperation and sharing of information.[54] The implications of these developments have not been lost on later researchers:

> In reviewing the early history of cotton in California, one is struck by the crucial role of government policies during an era when farming was generally free of government intervention. [Wofford B.] Camp's educational campaigns, the Shafter [experiment] station's research program, and the political organization of the industry were followed

[52] Ibid., 22-23.

[53] Ibid., 22-25; Camp, Production of Acala Cotton, 5.

[54] O. F. Cook, "Cotton Improvement Laws in California," Journal of Heredity 16(9) (September 1925): 336; Cook, Extension of Cotton Production, 15, 36.

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> by massive government investments in water development. The single-variety community and centralized sources of seed, besides facilitating marketing and improving yields, brought farmers together with important consequences for labor relations, lobbying activities, and the spread of new techniques.[55]

Cook believed that the USDA was the proper vehicle for determining and creating community-farming efforts. Like industrial companies, irrigation districts, and other cooperative ventures, all that was needed was to establish some one-variety communities, study their flaws, and revise and perfect them.[56]

The first areas to effectively practice one-variety cotton farming were in the Imperial Valley of southern California and in the Salt River Valley of Arizona, where the USDA-developed Durango, Yuma, and Pima varieties originated. These efforts dated back to almost the original mention of the concept by Cook in 1912. A 1915 report indicated that many critical problems with the community concept still needed work. However, many positive aspects of community production had already been realized, particularly in the cooperation and communication of researchers, farmers, bankers, buyers, and manufacturers.[57]

When cotton farming resumed in the San Joaquin Valley of Central California in the late 1910s, it was based on a community farming approach adopted from the Salt River Valley. Researchers found that growing conditions were less extreme and the cultural requirements for growing in the San Joaquin Valley simpler than in regions where one-variety communities had been attempted. Farmers initially utilized the long-staple Pima cotton developed around 1920 at experiment stations in Arizona. After 1921, though, farmers shifted production to the further evolved and selected Acala variety cotton. A couple of years of additional experimentation and practice resulted in much of the valley producing Acala-variety cotton on a community basis.[58]

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[55] Moses S. Musoke and Alan L. Olmstead, "The Rise of the Cotton Industry in California: A Comparative Perspective," Journal of Economic History 42(2) (June 1982): 390.

[56] Cook, Extension of Cotton Production, 30.

[57] Argyle McLachlan, Community Production of Durango Cotton in the Imperial Valley, USDA Bulletin No. 324 (1915), 1; Scofield et al., Community Production of Egyptian Cotton, 27-28. As discussed elsewhere, one-variety production in the Imperial Valley did not last.

[58] Wofford B. Camp, Cotton Culture in the San Joaquin Valley in California, USDA Department Circular No. 164 (1921), 3-4; Camp, Production of Acala Cotton, 1-3.

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As discussed earlier, from the onset of cotton growing in the Coachella Valley in 1920, community production was the practice, so it always functioned on the basis of raising a single variety. By 1923 nearly all the valley was using the new Acala variety, to the point where gins were refusing stock from any other variety. "It was felt, however, that the community needed some sort of protection from newcomers who might not understand the valley situation, from the reactionary element who could not understand the advantages of one-variety production, and from those who might maliciously plant some other variety." Thus in January 1924, the Riverside County Board of Supervisors passed a one-variety ordinance for the Coachella Valley. A county one-variety ordinance was not entirely unheard of. Wofford Camp reported that Kern, Kings, Tulare, and possibly Fresno counties all had one-variety ordinances passed late in World War I as a "war measure." These statutes named Egyptian cotton as the single variety and were to ensure an ample production for the war effort.[59]

No one person or agency is mentioned as the instigator of the idea of protecting one-variety communities in law. The earliest remark, though, comes from one of its strongest proponents: the U.S. Department of Agriculture. In 1922 Cook reported that someone suggested that cotton farmers in Arizona and California could use their local-option laws to create districts to establish a single-variety culture and to secure legal protection against the planting of other varieties that would hurt the community.[60] This was seen as analogous to the systems already in place for farmers to organize irrigation districts to build dams or canals for water improvements. Similarly, other states had districts to control weeds, plant diseases, insect pests, and other nuisances. "The underlying principle of such regulations is

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[59] McKeever, Community Production of Acala Cotton, 1, 26; Camp and Baum, Cotton, Irrigation and the AAA, 102; J. E. Hite, Community Production and Distribution of Cotton Planting Seed in a One-Variety Cotton Community, USDA Circular No. 286 (1933), 3. The World War I-era ordinances likely either expired or were removed after the war when the market for Egyptian-variety cotton busted. Later efforts, like a 1924 Kern County one-variety ordinance (the only one known of after the war), were likely superseded when the state passed the one-variety law.

[60] Many states, including much of the Southwest, have local-option laws where local residents can petition to form a new governmental entity—a district—to meet a particular need. The most common examples across the country are hospital, school, and water districts. Each district can establish rules and regulations for landowners in the district and, in most cases, can tax residents to fund the district's operations.

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to assert the right of the community to agree upon and carry through such general community improvements."[61]

County officials immediately recognized, though, that they might not have the authority to protect one-variety communities. In March 1924 a statewide conference convened to hear papers on the advantages of one-variety communities. By the end of the conference the members had created the California Cotton Growers' Association (CCGA) to investigate the issue and, if necessary, bring about enacting legislation.[62]

In late 1924 the CCGA had arranged for the filing of the one-variety bill in the state legislature. They also had the support and assistance of all the local Farm Bureau associations in the affected areas. Nearly all the farmers in Riverside County (including the Coachella and Palo Verde valleys) and the San Joaquin Valley were growing Acala variety cotton and wished to be included in the districting provisions. Imperial Valley growers from the south, however, felt that one-variety communities had not developed to a point where they could be incorporated. Proponents only wanted areas where the concept was already popular and the law could be easily enforced. In May 1925 the legislature passed and the governor signed the one-variety law. "The enactment of this legislation by the State of California gave added stability to the one-variety district and constituted the first recognition by State legislation of the fact that the growing of more than one variety of cotton is injurious to the community welfare."[63]

Shortly after passage of the one-variety law, the state legislature followed up with a bill authorizing the certification of seed distributors to produce and distribute the selected variety bred at the USDA's Shafter Experiment Station. These organizations were to sell seed to farmers at near-cost to save farmers money. "In that way it is a completely co-operative organization by the University [of California], the Department of Agriculture [through the Shafter Experiment Station], and cotton growers." The Kern County Farm Bureau, where the station was located, took the lead by establishing the Farm Bureau Planting Cotton Seed Distributors. After about four years the Kern County Farm Bureau gave up the

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[61] Cook, One-Variety Cotton Communities, 29.

[62] McKeever, Community Production of Acala Cotton, 32.

[63] Camp and Baum, Cotton, Irrigation and the AAA, 72; McKeever, Community Production of Acala Cotton, 33-35.

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distributorship to the renamed California Planting Cotton Seed Distributors (CPCSD), which became the exclusive distributor of seed for one-variety farmers statewide.[64]

The CPCSD distribution process was relatively simple. They contracted with ginners to sell seed to growers and ensure the seed would remain pure in the field and in the gin. In turn they contracted with farmers to see that fields were kept clean and weed-free, to abide by the CPCSD rules, and to maintain the single-variety strain.[65]

CPCSD managed a very careful seed production program. Scientists at the Shafter station selected seed the first year to produce an "increase block" the next year. Those plants produced the "foundation seed." In the third year contracted farmers planted 4,000 acres of the foundation seed to produce the "parent seed." In the fourth year of development, that seed was raised on 70,000 acres to make reproduction seed labeled as "purple tag." This became the premium pure seed available for sale to farmers. The seeds from purple tag plantings produced 30,000 tons of marketable "green tag" pure seed, which was even more widely available and cheaper to farmers.[66]

Within just a few years California established in practice and in law a complete one-variety community cotton farming system. "The industry has now been reestablished on the basis of new cultural and community production ideas not originating in the eastern Cotton Belt, but developed in this and other irrigated valleys of the Southwest." Many residents, including Wofford Camp, believed California was able to do this because cotton farming had not become entrenched in a certain subset of ideas or "way of doing things." Rather, many individuals were interested in cotton experiments. This led to an extensive use of committees with representatives from USDA, the University of California, the California Department of Agriculture, county agencies, growers, processors, buyers, and textile mills. These types of committees, themselves a symbol of community notions, became the backbone of the one-variety program in California.[67]

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[64] Turner, White Gold, 59; Hite, Community Production and Distribution, 3; Camp and Baum, Cotton, Irrigation and the AAA, 75, 169.

[65] Turner, White Gold, 68.

[66] James D. Blick, "An Analysis of Cotton Production in the San Joaquin Valley, California" (Ph.D. diss., University of California, Los Angeles, 1956), 33-34; Turner, White Gold, 68-69.

[67] Wofford B. Camp quoted in Musoke and Olmstead, "Rise of the Cotton Industry," 390; Camp and Baum, Cotton, Irrigation and the AAA, 75.

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Researchers and cotton farmers in other areas of the country recognized the advances made in California and some of the benefits that one-variety communities offered. However, except for sporadic attempts in very small areas, nowhere else in the traditional cotton belt could government officials overcome the political difficulties and stigmas of individual farmers to establish a similar system.[68]

Many farmers opposed cooperative efforts such as community farming, seeing them as a waste of time and an interference with their personal business. Some liked organization, particularly for the marketing advantages, but did not appreciate the difference between superior seed varieties and inferior types. Oklahoma cotton farmers, likely representative of farmers in other states, believed one-variety cotton communities offered too many disadvantages. Soils and climates varied too widely to have a single, superior cotton variety. Different types were needed for different conditions. Extreme weather conditions, such as hailstorms, wind, or drought, forced some farmers to replant every year. If limited to one variety that had to be grown under near-perfect conditions, what were these farmers supposed to do? Few were interested, or could even afford, to become a seed breeder instead of a cotton farmer. Cotton buyers often refused to pay premium prices to farmers who did organize to take advantage of community-based notions. Some farmers were obligated, by contract or by debt, to buyers, bankers, and merchants who objected to shipping cotton through an organization rather than through them. Finally because of the small, sporadic nature of these efforts in other regions, community farmers often ended up competing with inferior cotton brought from neighboring areas passed off as just as good or superior to the community-grown cotton.[69]

Even in California everyone was not satisfied with the legal protection offered in the one-variety law. Periodically someone brought in outside seed and planted it. When local agents discovered these plants, they quarantined the field and sent the cotton (if they allowed it to produce) out of state for ginning. In 1938 some oil mill operators sought waivers to grow any variety of seed for use exclusively in the mill. These owner-operators also

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[68] Cook, "Cotton Improvement Laws," 336-37.

[69] Cook, One-Variety Cotton Communities, 31; John D. Campbell, One-Variety Cotton in Oklahoma, Oklahoma AES Bulletin No. B-386 (1952), 16-19; Byrd, "Relation of One-Variety Cotton Communities," 72; R. F. Saunders, A Pioneer One-Variety Cotton Community in Collin County, Tex., USDA Circular No. 293 (1933), 1, 6-7.

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expected to benefit from increased payments from the Agricultural Adjustment Administration (AAA) for their increased cotton acreage. The most serious threat, though, historically came from the Imperial Valley and southern California, which were exempted from the one-variety district legislation in the 1920s. Mississippi seed breeders established some of their "improved" seed stocks developed in the South in the Imperial Valley. They then tried to expand northward into Madera County, a marginal cotton farming area at the southern end of the San Joaquin Valley one-variety cotton district. They called for private tests conducted by "non-partisan public agencies" to demonstrate the use of the new southern varieties. All the participants in the one-variety cotton program, however, strongly rebuked these efforts.[70]

USDA officials also did not give up on converting southern cotton farmers into one-variety communities. Low cotton prices in 1931 marked a fresh effort to establish new communities by USDA's Bureau of Plant Industry and the Agricultural Extension Service.[71] These groups, along with county agricultural agents, teachers hired under the Smith-Hughes program, and state and federal experiment station employees, sponsored a general cotton-improvement plan generally known as the one-variety community program. Congress made some appropriations for agents specifically dedicated to this task. Under this program about a thousand one-variety communities organized across the Cotton Belt. Their effectiveness, as previously indicated, was limited.[72]

One-variety proponents in California supported the USDA efforts by crafting a federal enabling law that would permit any county or area to create their own one-variety district. The act would likely have been more an educational model than a working law, as the federal government could not empower state or local governments to create such districts. The plan enjoyed good support from President Franklin Roosevelt's administration, particularly from his Secretary of Agriculture, Henry Wallace. However, the effort eventually died after an influential southern cotton breeder raised many objections to the plan. He felt that such an

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[70] Camp, Cotton, Irrigation and the AAA, 76-77, 172-74.

[71] Franklin Roosevelt's presidency consolidated several bureaus of the USDA for political and economic reasons. Thus by the late 1930s, many of the advocates of community farming (by coincidence) were together in one agency: the Bureau of Plant Industry, Soils, and Agricultural Engineering.

[72] Byrd, "Relation of One-Variety Cotton Communities," 17-18; Clarence E. Pike, Cottonseed Improvement Associations, Farm Credit Administration Circular No. C-130 (1947), 3.

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act, even as a federally encouraged model, would eventually hurt his business and his pocketbook.[73]

It is fairly clear that the United States Department of Agriculture strongly favored the creation of one-variety cotton communities. However, despite widespread efforts and promotion, only California adopted community cotton-farming on a large-scale basis. This resulted in its own bureaucratic organization of certified seed and legal enforcement—a practice that was not seriously threatened until the 1990s. Many other areas of the Cotton West, though, eventually developed a single-variety philosophy that was economically, scientifically, or climatically-based. These varieties, such as New Mexico's Acala 1517 and the West Texas-evolved storm-proof cotton varieties, offered some of the same advantages as California's "superior" one-variety system.

California's Certified One-Variety Cotton

Having been designated the official originating breeder for California's cotton variety by the one-variety law, the USDA Shafter Experiment Station had a focused, primary mission after 1925. In test fields at Shafter and nearby Indio, the USDA continued to work with descendants of the Acala-8 type cotton for several years. The new lines had a variety of names—California Acala, Shafter Acala, Date Garden Acala, Acala S5, and Acala P12. The Acala S5 and the P-numbered lines, several of which were eventually released for commercial production, came from fields at Indio that were transferred to the Shafter breeding program in the late 1920s.[74]

The Shafter breeding program began to focus on two changing needs of the San Joaquin Valley in the 1930s. Verticillium wilt, a soil-borne fungus, began to infect fields and spread through the valley by 1930. The USDA identified wilt tolerance characteristics in several varieties, including Kekchi and other southern cotton varieties, and began to cross-breed this into new seed lines. At the same time, as western cotton production volume increased, California's Acala crops gained a reputation as having inferior fiber quality and strength as compared to southern cottons of similar fiber length. Breeders began lab test and

[73] Camp and Baum, Cotton, Irrigation and the AAA, 135-37.

[74] John H. Turner, History of Acala Cotton Varieties Bred for San Joaquin Valley, California, USDA Agricultural Research Service Report No. W-16 (1974), 4-7.

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new variety crosses in an attempt to improve the spinning characteristics of the Shafter Acala.

Using new breeding methods utilized by director George Harrison (1934-1949), the Shafter Station developed Acala P18C, which became the standard variety from 1944 to 1948. This new line included only some of the identified wilt tolerance and fiber quality characteristics that was of concern to breeders. Harrison began bringing in Acala strains from New Mexico, Arizona, and Mississippi to pick up more of these characteristics. The eventual result was Acala 4-42—labeled by some as "the finest short staple [cotton variety] in the United States"—which the CPCSD released to farmers in 1949.[75]

When John Turner took over the Shafter breeding program in 1953, he instituted new tests to improve the existing Acala 4-42 variety and to pioneer new strains that might succeed it someday. It took a decade for the latter to begin to emerge in field plots. In 1967 the USDA replaced Acala 4-42 with this newly christened Acala SJ-1, which became the new parent line for four subsequent USDA releases. The Acala SJ line was the last developed by the USDA Shafter Experiment Station. In 1979 California amended its one-variety law to permit private breeding companies to develop certified Acala cottons for the San Joaquin Valley. The USDA decided to release its Shafter germplasm to private breeders and shut down the experiment station, ending the longest-running impact of USDA's efforts to establish a cotton industry in the San Joaquin Valley and ending its extensive involvement in breeding the valley's only official cotton variety.[76]

Acala Cotton in Arizona

As noted earlier, the largest cotton-growing areas of Arizona are the Salt River Valley (including the Sacaton station in the adjacent Casa Grande Valley), the lower Colorado Valley (Yuma station), and the upper Gila Valley in Graham County. The Sacaton and Yuma areas were where many of the original USDA cotton tests began with American-Egyptian cotton, and several producers in those regions grew Pima almost exclusively until

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[75] Ibid., 7-10; Arizona Farmer, 15 March 1958, 28.

[76] Turner, History of Acala Cotton Varieties, 10-20; Smith et al., "History of Cultivar Development," 146-47. The subsequent lines (and dates released) were Acala SJ-2 (1973), SJ-3 (1975), SJ-4 (1976), and SJ-5 (1977).

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the post-World War I falloff in long-staple cotton prices. It was in the late 1910s and early 1920s that many farmers began switching to Upland cotton varieties.[77]

As in other regions, growers planted a little of everything—Delfos, Lone Star, Mebane, Hartsville, and Durango—but they soon replaced these with Acala-8 types, which were better adapted to local growing conditions than any of the others. Increasingly, farmers got their Acala seed from California stocks. Meanwhile, some producers continued to plant Pima cottons.[78]

Demonstrating the influence of the USDA Shafter Experiment Station, many Arizona cotton growers opted to plant the same variety of Acala P-line seed as their colleagues in the San Joaquin Valley. This generally lasted until 1949 when Acala 4-42 came out. The new variety was so customized for the San Joaquin Valley that it did not do well in Arizona. Left without a good source for quality and consistent seed, Arizona scientists and farmers met to create the Arizona Cotton Planting Seed Distributors (ACPSD), an organization that would serve a similar function as the California Planting Cotton Seed Distributors did for that state's producers. Instead of the USDA, however, the ACPSD got its foundation seed from the Arizona Agricultural Experiment Station. ACPSD used the A-44 [Arizona Acala 44] family as its primary variety, later supplementing that with the wilt resistant WR-44 variety.[79]

Unlike California, Arizona never chose to implement any kind of one-variety cotton system. Thus, Arizona's cotton culture evolved to accommodate an array of cotton varieties. California Acala cottons and the ACPSD successors became popular in Maricopa, Pinal, Pima, and Yuma counties. Throughout the state, individual farmers and extension researchers continued to experiment with other Upland varieties that were "premium staple"

[77] Cook and Doyle, Acala Cotton, A Superior Upland Variety, 19.

[78] Ibid., 19-20; R. S. Hawkins, Field Experiments with Cotton, Arizona AES Bulletin No. 135 (1930), 573-80. It is apparent from Bulletin 135 and the 1935 Bulletin No. 150, The Quality of Arizona Cotton (by R. L. Matlock and J. R. Kennedy), that the Arizona AES was only testing existing seed varieties from other states, particularly New Mexico and California, and was not conducting any breeding experiments of their own. Geographer Erik-Anders Shapiro notes that some producers continued to float back in the 1930s to other Upland varieties, including Mebane and Stoneville, but most producers stuck with Acala. Erik-Anders Shapiro, "Cotton in Arizona: A Historical Geography" (Master's thesis, University of Arizona, 1989), 171-74.

[79] Arizona Cotton Planting Seed Distributors, Story of Arizona Cotton Seed Development (Tempe, Ariz.: ACPSD, 1958).

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or short-growing season varieties. At the higher elevations, in Graham and Greenlee counties, the Arizona AES recommended that farmers order New Mexico Acala.[80]

By 1947 Upland cotton was Arizona's major cash crop, occupying one-fourth of the state's cultivated fields. Improvements continued after 1950 as mechanization and insecticides became more commonplace. In the meantime, the Pima cotton industry slowly collapsed. Whereas Arizona Pima production averaged over 20,000 bales a year from 1912 to 1937, the total grown in 1947 was 163 bales, prompting predictions that the era of American-Egyptian cotton was over. The modern Pima/SuPima cotton industry of the Southwest emerged in a market revival in the 1950s that falls beyond the scope of this dissertation. But with both types of cotton—Pima and Acala—Arizona cotton producers would probably agree with G. E. Thompson's and C. J. Wood's statement: "We are indebted wholly to the United States Department of Agriculture for the selection and development of the varieties now used in Arizona."[81]

New Mexico's Upland Cotton Developments

For many years researchers at the New Mexico Agricultural Experiment Station (NMAES) grew, tested, and developed several Upland cotton varieties, including progenies of Acala and Kekchi, many of which were furnished by the USDA Bureau of Plant Industry. The first result was a reselection from one of the initial California Acala fields, Acala P12. Researchers released this initial New Mexico variety in 1920 as College Acala, which became popular in both the Rio Grande and Pecos valleys as New Mexico's cotton agriculture began to take shape. In 1926 the USDA established a cotton field station at Las Cruces in conjunction with the NMAES. Together, they developed Acala cultivars for New Mexico and Far West Texas under the direction of agronomist G. N. Stroman.[82]

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[80] W. I. Thomas, Upland Cotton Production in Arizona, Arizona AES Bulletin No. 214 (1948), 3-6.

[81] Ibid., 3; McGowan, History of Extra-Long Staple Cottons, 123-25; G. E. Thompson and C. J. Wood, Growing Cotton in Arizona, Arizona AES Bulletin No. 90 (1919), 265. While the latter assessment came early in Arizona's cotton history, the history described above shows that this statement continued to be true up into the 1950s and 1960s. The 1950s marks the transition to a new chapter for the Arizona cotton industry. In addition to the resurgence of the SuPima industry, Acala was challenged by the introduction of Deltapine as the principal Upland cotton variety after the Mississippi-based Delta and Pineland Company breeder moved into the state with a vigorous sales campaign. Shapiro, "Cotton in Arizona," 195-96.

[82] Smith et al., "History of Cultivar Development," 149-50; Glen Staten, Breeding Acala 1517 Cottons, 1926 to 1970, New Mexico State University Memoir Series Number 4 (Las Cruces: NMSU College of

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The next major release was Acala 1064, selected in 1935 from plantings of Young's Acala variety, a direct descendent of the original Acala brought from Mexico. Acala 1064 produced higher yields and longer fibers with earlier maturity than College Acala. Acala 1064 quickly replaced College Acala throughout the region.[83]

Stroman quickly followed this with three significant selections: 1517, 1517A, and 1450. Acala 1517A had even earlier maturity that made it highly adaptable to the shorter growing season in the Pecos Valley. Acala 1450 produced longer cotton fibers, but NMAES elected not to release it. Instead, a Las Cruces cotton and pecan operation, Stahmann Farms, acquired 1450 and developed it in a private breeding program. This produced the locally known Mesa Acala and Mesilla Valley Acala varieties, some of the longest fiber-length cottons derived from Acala stock.[84]

The major 1517 selection in 1940 by Stroman became the germplasm foundation for all future lines of New Mexico cultivars, all of which have carried the Acala 1517 label in its title. The initial 1517 was better suited to the Rio Grande Valley than its 1517A cousin; it was largely on this premise that researchers developed subsequent 1517 types. The next selection was Acala 1517WR, as NMAES improved wilt resistance. Later breeding developed 1517s with stronger fiber strength, blight resistance, and bolls suitable for the new spindle-picker mechanical harvester.[85]

The significance of the New Mexico breeding program extends well beyond the immediate Las Cruces-El Paso region. The selection of Acala 1517 proved to have great genetic diversity. With its favorable fiber quality and verticillium wilt tolerance, the 1517 germplasm spread throughout the U.S. cotton industry. According to a 1996 study, over 45 percent of the cultivars issued between 1970 and 1990 in the U.S. included Acala 1517

Agriculture and Home Economics, [1971]), 5-7. The New Mexico AES reported its field trial results in Bulletins No. 141 (1924), 181 (1930), 201 (1932), and 217 (1934). Readers did not realize until Bulletin No. 256, Improved Strains of Acala Cotton for New Mexico (1938), how extensive the breeding efforts had been.

[83] A private breeder in El Paso developed Young's Acala. It was later crossed into the California Acalas for its high fiber strength. Carl Moosberg, Interview by Richard Mason, 11 November 1983 (Southwest Collection, Texas Tech University, Lubbock, Tex.), Tape One, Side One; Smith et al., "History of Cultivar Development," 149; Staten, Breeding Acala 1517 Cottons, 7-9.

[84] Mesilla Valley Acala was one of the parents of the Del Cerro variety, which exhibited similar fiber characteristics as the long-staple Pima varieties developed in Arizona. Smith et al., "History of Cultivar Development," 150-51.

[85] Ibid., 151-53.

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germplasm in their genetic pedigree. Thus Acala 1517 became the largest genetic contributor coming from public breeding programs in the U.S. and was second only to the private Coker breeding lines from South Carolina.[86]

West Texas Goes a Different Way

As mentioned earlier, the Acala variety did not prove to be the savior against the boll weevil menace in Texas. Though widely hailed for all the positive traits discussed previously, many of the cotton varieties developed largely from careful selection and breeding of the existing Texas big-boll cultivars. The Texas Agricultural Experiment Station (TAES) system carried on most of this work, with some collaboration from USDA and several private breeders, many of whose names were put on the major varieties. The earliest varieties were Rowden, Mebane Triumph (so named for its "triumph" over the boll weevil), and Lone Star. Private breeding programs produced Lankart, Lightning Express, Lockett, Stoneville, and Deltapine. TAES developed its own Mexican hybrids, first Westex in 1921 and then Ducona in 1927, based in part from cotton found in Durango, Mexico, about 1905.[87]

One of Texas' most popular commercial cotton varieties, though, includes nearly all of the common roots discussed to this point. Though a private company, Paymaster Seed Company made wide use of a large number of early varieties developed by USDA or state experiment stations. Paymaster Seed Company has developed numerous cultivars, to the point where 24 percent of U.S. cotton planted in 1995 was a Paymaster variety. One of its first bred varieties, the Paymaster 54 (selected in 1944) is a direct descendent of the USDA-located Kekchi type. Half of the original Stormmaster line, also started in 1944, descends from Acala. The other key ingredient to Stormmaster comes from an independently derived variety originating on the Texas South Plains and advanced by the Lubbock Substation of the TAES in the 1930s and 1940s.[88]

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[86] Ibid., Smith et al., "History of Cultivar Development," 153-54; Daryl T. Bowman, O. Lloyd May, and D. Steve Calhoun, "Genetic Base of Upland Cotton Cultivars Released Between 1970 and 1990," Crop Science 36(3) (May-June 1996): 577-80.

[87] Smith et al., "History of Cultivar Development," 128-41. A brief discussion of the West Texas cotton variety tests at the TAES Lubbock Substation is in R. E. Karper and D. L. Jones, Varieties of Cotton in Northwest Texas, Texas AES Bulletin No. 364 (1927), 21-34, 56-59.

[88] Smith et al., "History of Cultivar Development," 134-37.

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One of the major problems on the South Plains in late fall and winter are large windstorms. This was brought home in November 1926 when much of that year's bumper cotton crop was literally blown out of the bolls just as harvesting was beginning in earnest. Nearly everyone lost their crop, and what little cotton survived was full of sand and not worth hiring people to hand pick it.[89] Up to that point the Lubbock Substation had concentrated on developing cotton varieties with increased yield, as the region to that point was largely devoid of disease and pests, particularly the boll weevil.[90]

The 1926 storm led station director Don L. Jones to shift his entire research program to breed a "stormproof boll." Over the next eight years he bred numerous test varieties, including several he had imported or cross-pollinated from around the world, including Mexico and India. The Lubbock Substation was nearing completion of its first stormproof varieties when a fire destroyed all the station's breeding material. Jones turned to an area farmer to get the program back on track.[91]

After the 1926 storm, farmer H. A. Macha walked through his field of Half and Half variety cotton to see what was left.[92] He found a single plant—a mutant—that had retained all its cotton in the boll. While open, the boll had remained fairly compact, thus keeping the cotton inside undamaged. Macha removed the plant and used the seeds as base material for developing his own stormproof cotton. He soon became well known for his home-grown Macha variety cotton. When the fire struck the Lubbock Substation in 1934, Macha donated some of his stormproof seed to help restart the experiment station's breeding program.[93]

Through the continuing breeding program of the TAES, Macha quickly became the dominant and standard cotton variety on the South Plains. In the 1930s and 1940s the Macha

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[89] This economic factor led to the first widespread experiments with box strippers and the eventual development of the stripper harvester concept. See Cameron Lee Saffell, "Working in the Cotton Fields of the South Plains, 1910-1990" (Master's thesis, Texas Tech University, 1996), 115-52.

[90] Ibid., 121, 127.

[91] Richard Willson Arnold, "The History of Adaptation of Cotton to the High Plains of Texas, 1890-1974" (Master's thesis, Texas Tech University, 1975), 28; D. L. Jones, "Cotton and the Texas High Plains," n.d. (Don L. Jones Reference File, Southwest Collection, Texas Tech University, Lubbock, Tex.), 5.

[92] Half and Half was fairly popular on the South Plains, particularly around Vernon, home of the brother of the Georgia breeder who developed it. They set up a seed distributorship for Half and Half for the region there. Aubrey L. Lockett, Interview by Jeff Townsend, 16 March 1974 (Southwest Collection, Texas Tech University, Lubbock, Tex.), Tape Two, Side One.

[93] Saffell, "Working in the Cotton Fields," 128; Felix Macha, Interview by Jeff Townsend, 24 May 1974 (Southwest Collection, Texas Tech University, Lubbock, Tex.), Tape One, Side One.

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variety itself disappeared, except for the amounts produced by Macha himself until he retired in the early 1950s. Instead, TAES and other breeders used Macha as a parent cultivar. Paymaster Seed Company crossed it with Acala to create its Stormmaster variety in 1944. Macha has been one of the most widely utilized varieties in breeding programs, becoming the primary ancestor for nearly every modern cotton variety planted in West Texas, Oklahoma, and Eastern New Mexico.[94]

As the NMAES had done for New Mexico, the Texas Agricultural Experiment Station in Lubbock promoted and further developed one of the nation's most important cotton varieties. The 1996 study mentioned earlier found that 24 percent of the cultivars issued between 1970 and 1990 include genetic material first developed in Lubbock. The findings are even more impressive if one combines the work of the TAES from both Lubbock and College Station; about 46 percent of the cultivars for the same period resulted from the experiment stations' research.[95]

Conclusion

The western cotton industry owes its existence to the government agencies and scientists who oversaw the research and creation of these cotton varieties.[96] Driven by economic concerns about the boll weevil and great scientific interest in breeding theory, the USDA and cooperating state agricultural experiment stations developed critically important programs to locate, create, and improve new cultivars of cotton. Many of those derived from the Central American Kekchi and Acala cottons and became the foundation for the modern cotton agriculture of the American West.

USDA scientists, particularly O. F. Cook, influenced the development of one-variety concepts of cotton farming. In California their efforts resulted in state laws and a complete production bureaucracy based entirely on one-variety of cotton—that produced at the USDA Shafter Experiment Station.

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[94] Saffell, "Working in the Cotton Fields," 128; Macha interview, Tape One, Side One.

[95] Bowman, May, and Calhoun, "Genetic Base of Upland Cotton Cultivars," 577-80.

[96] In fact, as alluded to here, the work of these researchers as far back as the 1920s has had long lasting and influential impacts on the modern commercial cotton varieties planted today in the same areas of the Cotton West.

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Thus, when it came to what kind of cottonseed a farmer planted and often how he got it, the role of the USDA and state experiment station scientists cannot be understated. A major goal of these men's work was to develop specific types of cotton best suited to the growing conditions and methods of a particular region. Their goals often included directing farmers toward either short-staple or long-staple cotton productions. As this chapter shows, one can trace these goals back to the original behest of USDA secretaries and the leading scientists of the Bureau of Plant Industry to establish cotton farming in the West. While the outcomes necessarily vary from region to region, the principles guiding the USDA and state experiment stations and the methodologies of enacting them are virtually identical throughout the Cotton West.

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CHAPTER IV
MACHINES, PRACTICES, AND
THE ROLE OF AGRICULTURAL EXTENSION

The last chapter outlined the development of cotton varieties used across the West. In order to explore issues about labor and labor requirements from season to season, one needs some understanding of cotton farming practices and how they changed during the early twentieth century. The process of raising cotton was the same across the Cotton West, irrespective of region. The differences between regions were more a question of whether a particular practice was necessary and of how the work was performed or mechanized.

The Cotton Farming Year

Regardless of what part of the United States one is in and of what time frame one is looking at historically, raising a cotton crop is a year-round process. Figure 9 depicts the amount of human labor needed by task and time of the year for a Central Texas farm in about 1932. The relative amounts of labor needed at different times of the year will be considered in the next chapter. Of interest here is the notation about what tasks are occurring. The timing of each task is what varies the most from region to region throughout the American cotton producing areas. The basic tasks—plowing and preparing fields, planting, irrigating, cultivating (including chopping cotton), and harvesting—have been virtually identical for every American cotton farmer.[1]

The farmer started his cotton each year with general field preparation, a process that saw the most variation depending on local conditions. Field preparation might include clearing trees or sprouts, cleaning ditches, forming terraces, breaking out land, cutting down stalks, plowing or harrowing, forming rows, and distributing fertilizer. Mechanical stalk cutting to reduce the previous year's plant residue was one of the earliest substantial labor-saving measures, replacing hand clearing. The western cotton farming regions likely had stalk cutters from the outset, largely because of the use of larger (multiple-row) machines

[1] Irrigating does not appear as a specific task in figure 9. In the Blackland Prairies of Texas, at the western edge of the southern cotton belt, there is usually plentiful rainfall that makes irrigation unnecessary. As discussed in Chapter Two, this is a particular distinction between the Cotton West and the Cotton South.

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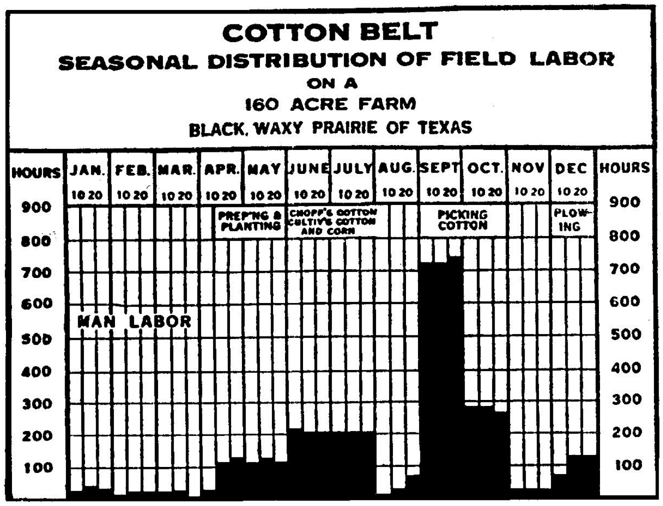

Figure 9. Typical Distribution of Field Labor by Task and Time of Year
Source: Free, Seasonal Employment in Agriculture, 50.

operated by one man on a tractor. By World War II, though, stalk cutters came to be replaced by other plowing implements used under different field conservation practices.[2]

After his field was prepared and the time was right, the next task for the farmer was planting his cottonseed, which started in mid-March in warmer areas and was completed by late May. Farmers used a planter implement, often a combination corn-cotton unit, that one laborer could easily operate. Western farmers initially utilized one-row planters but quickly shifted to two- and four-row implements by the 1930s, cutting the labor hours for planting in half. Use of commercial fertilizer as a separate process in the West was negligible. Most farmers applied fertilizer, using a unit built onto their planters if they used any at all.[3]

A critical variable across the regions was the amount of seed planted per acre, which reflected how "thick" the plants were. The typical Mississippi Delta region farmer planted thirty-six pounds of seed per acre in 1936, while western region farmers only sowed sixteen pounds. Many western farmers did not follow the traditional southern practice of planting a

[2] William C. Holley and Lloyd E. Arnold, Changes in Technology and Labor Requirements in Crop Production: Cotton, Works Progress Administration, National Research Project Report No. A-7 (Philadelphia: Works Progress Administration, 1938), 22-25; Cameron Lee Saffell, "Working in the Cotton Fields of the South Plains" (Master's thesis, Texas Tech University, 1996), 62-65.

[3] Benjamin J. Free, Seasonal Employment in Agriculture (Washington, D.C.: GPO for Works Progress Administration, 1938), 21; Holley and Arnold, Changes in Technology and Labor Requirements, 37-39.

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thick stand, only to thin them out after the plants had grown three to five inches high. Instead, they only planted enough seed to ensure a good stand and to eliminate much of the thinning, thus reducing the labor need as well. Advancing technology on multiple-row seed planters used in the West also reduced the amount of seed used. Seed plates in planter boxes carefully regulated the amount of seed dispensed. Further, various chute mechanisms, in particular the "trip" valve used on "check-row" systems, spaced out seeds exactly and usually produced a plant at every drop point, resulting in a perfect grid of cotton plants. Thus, western cotton practices and improved machinery substantially reduced, but did not eliminate, the need for chopping out excess cotton.[4]

The next seasonal task was cultivation, which included both general cultivating and hoeing to remove or kill weeds and chopping cotton to thin it out to an even stand. Cultivation also assisted in opening soils so irrigation water could better penetrate the surface or to clear rows to prevent debris from collecting. Chopping cotton was almost a science unto itself, as a laborer had to reduce the number of plants so the remaining ones could reach maturity, trying to ensure that spacing between plants was even, and to eliminate weak or sickly plants in favor of stronger, healthier ones. Outside of harvesting, chopping was the most time-consuming and labor-intensive operation, accounting for half of the pre-harvest labor in raising cotton (see fig. 9). While chopping cotton, between May and July, the laborer also expected to hoe any weeds that might have grown. Because this process was largely unmechanized until about World War II, the average time spent chopping cotton remained almost constant. In some areas of the West, producers increasingly utilized mechanical cultivator implements in lieu of hand laborers to remove weeds and stray plants from cotton fields.[5]

A crucial task for western cotton growers, though one of the least-often considered by labor historians, was irrigation. As discussed in Chapter Two, most cotton agriculture could not be practiced in the arid West if it were not for local irrigation projects. Many

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[4] Holley and Arnold, Changes in Technology and Labor Requirements, 36-39; Saffell, "Working in the Cotton Fields," 39-44. Planting fewer seeds also did not waste precious water on plants that would be thinned out later.

[5] Holley and Arnold, Changes in Technology and Labor Requirements, 38, 44-46; E. Holekamp, W. I. Thomas, and K. R. Frost, Cotton Cultivation With Tractors, Arizona AES Bulletin No. 235 (1951), 3-4; Saffell, "Working in the Cotton Fields," 83.

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contemporary sources failed to account for this all-important task as part of the growing process.[6] When and how often to irrigate was one of the areas that marked some of the distinctions between different regions. In some areas, farmers irrigated just before they planted their fields, both to help prepare the soil and to provide some moisture so seeds would germinate. In other areas farmers needed to irrigate during the growing period. Whether one did it regularly, say weekly, or only in a couple of larger waterings, was a matter of debate and often depended on weather conditions in a given year and the availability of irrigation water. Whatever the timing, almost every Cotton West farmer had to irrigate at some point during the growing cycle. Equally important in field preparations was leveling the field to control irrigation water. Agricultural writers particularly emphasized this point in several California and Arizona publications.[7]

After plants matured and produced fibrous bolls, the final stage of cotton raising was the harvest. This by far marked the largest labor-use of any stage of production (see fig. 9). In the early to mid-twentieth century in all cotton-producing areas of the nation, cotton harvesting occurred three times each season, beginning shortly after the first bolls matured in late summer or early fall until the field was cleared out in the winter. In most of the United States, the harvest method was picking cotton—the long-traditional means of snatching cotton fiber clean out of the boll. Western Oklahoma and High Plains Texas cotton farmers developed a new means of harvesting called snapping or pulling cotton—where one pulled the entire boll off the stalk. As will be discussed below, pulling cotton was the principle in the initial mechanization step using fences or slot harvesters. Local producers called this "stripping cotton." In the ensuing discussion, the terms "picking" or "harvesting" cotton are inclusive of this alternative method of harvesting as well as the traditional method. Specific

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[6] Harry Bates Brown wrote some of the most authoritative textbooks on cotton. His first edition textbook in 1927 does not mention irrigating at all, an oversight corrected by the time of the 1958 third edition. Harry Bates Brown, Cotton: History, Species, Varieties, Morphology, Breeding, Culture, Diseases, Marketing, and Uses (New York: McGraw-Hill Book Company, Inc., 1927); Harry Bates Brown and Jacob Osborn Ware, Cotton, 3rd ed. (New York: McGraw-Hill Book Company, Inc., 1958).

[7] Brown and Ware, Cotton, 337-38. For examples of this emphasis, see Wofford B. Camp, Cotton Culture in the San Joaquin Valley in California, USDA Department Circular No. 164 (1921), 5-6; C. J. Wood, Preparation and Use of Seedbed, Arizona AES Circular No. 102 (1937), 3; and Charles C. Ellwood, Growing Arizona Cotton, Arizona AES Circular No. 222 (1954), 5-6.

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references to the High Plains area of the country will call the harvest method "stripping" cotton.[8]

Once the harvest was complete—which could be as early as October or as late as January or February, depending on the area of the country and how bountiful the crop—the cotton farming cycle could start over again. With this understanding of the typical pattern of annual cotton farming tasks, one can review the evolutionary development and mechanization of each task in different regions of the Cotton West.

Implements and Machinery in the Fields

A discussion of farm implements must necessarily start with motive power. Prior to the introduction of tractors, the power source was animals—horses, oxen, or mules. With additional pairs of animals, the equipment could be larger or wide, but in most cases was limited in size to two rows. One-row, horse-drawn equipment was very common into the 1920s, about the time manufacturers introduced the row-crop tractor.[9]

The concept of using an internal combustion engine on wheels for farm work had been around for a number of years before producers applied it in a newer practical form on cotton farms. The Hart-Parr Gasoline Engine Company produced the first commercially successful tractors in 1907, quickly becoming a leading manufacturer alongside International Harvester and Deere & Company. These early machines, known as standard-wheel or wheatland tractors, were popular only in the Great Plains. They were large with a low base and a wide wheel-width. Farmers in other regions of the country did not readily accept the standard-wheel tractors; they were too awkward to use in row-crop applications like corn and cotton. In fact, they could only be used for about 38 percent of the overall work—mostly plowing. A more suitable design could do as much as 77 percent of the job—nearly everything except the harvest.[10]

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[8] Holley and Arnold, Changes in Technology and Labor Requirements, 48-53; Saffell, "Working in the Cotton Fields," 116-17. Gins in Northwest Texas and western Oklahoma developed new machine attachments in the ginning process to remove the trash material resulting from pulling or stripping cotton. This led to the High Plains becoming referred to generally as "stripper cotton" areas—a term still used today.

[9] Saffell, "Working in the Cotton Fields," 29. Throughout this dissertation, the term "horse drawn" will be used to refer to any implement pulled by any animal.

[10] Robert Charles Williams, "Fordson, Farmall, and Poppin Johnny: The Development and Impact of the American Farm Tractor" (Ph.D. diss., Texas Tech University, 1981), 30-35, 125-27, 141-42, 153.

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International Harvester Company's (IHC) McCormick-Deering division developed the first mass-produced tractor specifically for row crops—the "Farmall." The machine was taller and narrower than its "squat, fat, clumsy" predecessors. The increased height allowed it to drive over growing corn or cotton plants. The narrow size permitted the operator maximum visibility of the crop rows. The Farmall's front wheels were paired together at the center of the machine, rather than out on the corners as on the standard-wheel tractors. This tricycle design allowed the tractor to make very tight turns at the ends of rows.[11]

IHC turned out a small handful of Farmalls in 1924 but was not really ready to advertise it. Instead, the company sent several Farmalls to Corpus Christi and San Angelo for extensive testing by the Texas Agricultural Experiment Station. Texas farmers observing the tests expressed so much excitement about the new design that IHC released the Farmall for commercial sale in Texas in 1925. IHC extended it to the rest of the country over the next year as their production increased.[12]

One of the original design features of the Farmall was to accommodate front and side-mounted cultivator attachments. The Farmall's frame was wide enough to mount a two-row cultivator between the rear wheels, while later attachments covered four rows. Interest intensified with the introduction of other implements designed specifically for the new row-crop tractors. An Oklahoma study reported that a farmer with two-row, horse-drawn equipment needed almost seven hours of human labor per acre to produce a cotton crop. With new two-row tractor equipment, the time dropped to five hours. IHC competitor Deere & Company quickly introduced their first General Purpose row-crop tractor in 1927, featuring an innovative power-lift feature for its tractor-mounted implements. Other manufacturers followed suit as well. By 1937 three-fourths of all the tractors sold in the U.S. were row-crop units.[13]

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[11] Ibid., 166-69.

[12] Ibid., 158, 161-63.

[13] Saffell, "Working in the Cotton Fields," 53-55; Don Macmillan and Russell Jones, John Deere Tractors and Equipment: Volume One, 1837-1959 (St. Joseph, Mich.: American Society of Agricultural Engineers, 1988), 116-17; R. S. Kifer, B. H. Hurt, and Albert A. Thornbrough, "The Influence of Technical Progress on Agricultural Production," The Yearbook of Agriculture, 1940: Farmers in a Changing World (Washington, D.C.: USDA, 1940), 513. Several contemporary writers and historians refer to the row-crop tractor as a "general purpose" or "all-purpose" tractor because of its application in general use as opposed to the wheatland (standard-wheel) tractor which had fewer practical applications.

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In his major study of the process and impact of cotton mechanization, economist James Street reviewed how the tractor was often the measuring stick of the degree of farm mechanization in a particular area, while also noting that tractors represented an ability to only partially mechanize cotton production. In reporting on his research, he suggested that tractor acquisition began in the west and moved eastward. Much of this initially took place in Texas and Oklahoma, mainly in the 1930s, though it was also happening in California. With tractors, producers could consolidate into larger farms and operate them cheaper with seasonal labor than under any other arrangement, including the tenant farming system that had evolved in much of the South.[14]

Street's study compared the uses of tractors in mechanizing the basic farming operations of plowing, planting, and cultivating (table 1). By 1939 at least 70 percent of the cotton-farming process involved a tractor in California and Arizona, with the rest of the Cotton West at around 40 percent. In contrast, southern farmers did as little as 2 percent of their planting and cultivating with a tractor. By the end of World War II, the Far West was passing 90 percent "power farming," as described by Street, with California's cotton acreage alone having increased 160 percent during this period alone.[15]

Some of the extension publications give more specific examples of this transition. The Arizona Agricultural Experiment Station noted the shift away from horse power—57 percent of cotton farming work was done with horses in 1929, a percentage that plummeted to less than 5 percent by 1941. In New Mexico between 1930 and 1940, the number of irrigated cotton farmers owning tractors increased from 9 percent to 29 percent. A study from the Texas High Plains reported that the number of farms depending on tractor power (and multi-row equipment) increased from 26 percent in 1931 to 79 percent six years later. In the hub of the plains, Lubbock County, 41 of 43 cotton farmers (95 percent) indicated they were using tractors in 1938.[16]

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[14] James H. Street, New Revolution in the Cotton Economy: Mechanization and Its Consequences (Chapel Hill: University of North Carolina Press, 1957), 158-60.

[15] Ibid., 162-65. These statements are somewhat relative, as they assume that the least percentage of one stage of production represents the minimum amount of tractor usage possible in all stages. Thus, for New Mexico in 1939, at least 34 percent of farms used tractors all the time, even though 49 percent used them for the single step of breaking cotton lands.

[16] Ned O. Thompson, Efficiency in the Use of Farm Machinery in Arizona, Arizona AES Bulletin No. 174 (1941), 257; P. W. Cockerill, Labor Needs for Seasonal Operations on New Mexico Farms, New Mexico

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Table 1. Tractor Power Use for Plowing, Planting, and Cultivating in Cotton-Producing Areas of the United States, 1939 and 1946

State	Breaking		Harrowing		Planting		Cultivating	
	1939	1946	1939	1946	1939	1946	1939	1946
California	85	97	71	95	71	85	73	90
Arizona	89	94	77	88	65	80	76	85
New Mexico	49	86	34	70	39	70	41	80
Texas	49	85	40	82	45	80	43	83
Oklahoma	44	81	38	78	28	69	25	73
Far West	81	94	67	89	64	81	69	87
Southwest	49	84	40	81	42	78	40	82
Mid-South	16	42	13	37	4	16	6	18
Southeast	10	38	8	29	2	13	2	11
Nat'l. Avg.	30	60	25	54	21	43	21	45

Source: Based on table 6 from Street, New Revolution in the Cotton Economy, 164.
Notes: The USDA Bureau of Agricultural Economics study that Street cites separated plowing into breaking (general turning of the soil, an old term used for unfarmed land) or harrowing (a finishing of the field prior to planting). Region groupings in the report were: Far West—Calif., Ariz., N.Mex.; Southwest—Tex., Okla.; Mid-South—Miss., La., Ark., Tenn., Mo.; Southeast—Va., N.C., S.C., Ga., Fla., Ala. The defined Southwest states would be almost evenly split between the Cotton West and South, with tractor use in the eastern halves of those areas probably closer to that of the Southeast and in the western halves to that of the Far West.

The widespread introduction of tractors in western cotton farming well exceeded the transition in the South. The same 1938 Texas report stated that there were more tractors in Texas than in eight southern cotton belt states combined at that time. Similarly, economic historians Musoke and Olmstead said that in 1929 a California farm was almost twenty times more likely to have a tractor than a farm in Mississippi.[17]

The transition to multi-row equipment closely paralleled the transition to the introduction and use of tractors in many areas of the Cotton West. A 1940 report by the Texas Agricultural Experiment Station on mechanization in the High Plains details an example of this. In 1931 the surveyed group of West Texas farmers included a mixed assemblage using both horse-drawn and tractor-drawn equipment. Thirty-one percent

AES Bulletin No. 299 (1943), 4; C. Horace Hamilton, The Social Effects of Recent Trends in Mechanization of Agriculture, Texas AES Progress Report No. 579 ([1938]), 5.

[17] Hamilton, Social Effects of Recent Trends, 5; Moses S. Musoke and Alan L. Olmstead, "The Rise of the Cotton Industry in California: A Comparative Perspective," Journal of Economic History 42(2) (June 1982): 394.

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reported using one-row horse-drawn implements, while 43 percent were pulling two-row equipment with their horses. Already almost 26 percent had acquired tractors with two-row attachments. Six years later the numbers had shifted radically. Only about 21 percent were using any horse-drawn equipment. About 82 percent were now using two-row equipment (with either horse or tractor), while 11 percent were operating tractors with four-row implements.[18]

The implications of this on average farm size are clear in this report as well. Based on data from 1936, farms with one-row, horse-drawn equipment averaged only 98 acres in size; two-row, horse-drawn operator farms were 182 acres. Just introducing the tractor with similar two-row equipment increased the average size to 233 acres. Those farms with four-row, tractor-drawn equipment averaged 408 acres. A similar but less detailed assessment from Oklahoma reported that a family-sized farm in the older (e.g., Cotton South) cotton belt, using one mule and probably one-row equipment, averaged 10 to 20 acres. At the same time, a typical family with two-row equipment drawn by at least four mules operated a farm of 100 to 150 acres, with tractors starting to supplant the horse-drawn implements. The difference in time between one-row, horse-drawn equipment of five labor days per acre versus five hours per acre with tractors was truly remarkable.[19]

An anecdotal story provides some insight on the importance of getting a tractor to make a bigger farm operation. The Vocale family owned a small farm near Deming, New Mexico. Son Emanuel related how he threatened to leave the farm to take up another occupation if his father did not get a tractor. Not only would it make their lives easier, he argued, but it would allow them to buy some neighboring properties and expand their operations, including areas where they were raising livestock feed. His mother chimed in agreement, causing a reluctant Mr. Vocale to agree to see the local tractor dealer. He soon traded in some of his old equipment and mules for a new tractor and all the related attachments, but he held back a cultivator and two mules "in case that tractor don't work out." So important was making a sale that many dealers kept an animal buyer on retainer to

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[18] C. A. Bonnen, Mechanization and Its Relation to the Cost of Producing Cotton in Texas, Texas AES Progress Report No. 684 (1940), 5-6.

[19] Bonnen, Mechanization and Its Relation, 6; P. H. Stephens, "Mechanization of Cotton Farms," Journal of Farm Economics 13(1) (January 1931): 31-34.

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handle trade-ins for new equipment. It was not uncommon early in this transition period that dealers shipped the mules and horses, as well as some of the horse-drawn equipment, to be sold to producers in the Cotton Belt South.[20]

A 1938 article provides some statistical evidence of this transition from horses to tractors in the Texas High Plains. In 1931 farmers reported owning an average of 6.2 workstock animals for their operation—a figure that well might be higher if the 25.5 percent of farms with tractors were excluded. By 1937 this number had dropped to 2.7 animals per farm. The authors suggest a two-fold reason influencing this shift. By the mid-1930s the credit situation during the Great Depression had improved, making it possible for more farmers to finance the purchase of tractors and larger equipment. At the same time, crop failures and low yields caused feed prices to rise, thus sharply increasing the overall cost of animal power versus tractors.[21]

By Task

For most cotton producers, the point of mechanizing—or at least the effect of it—was to reduce the amount of time it took to complete routine tasks and to reduce the number of total laborers needed at any given time. This increased the efficiency of an existing operation and permitted the farmer to expand his production acreage using the same resources. Chapter Five will focus attention on farm workers and the impacts of mechanization on them. This section will explore how mechanization choices affected time management and practices for each task in cotton growing each year, from plowing and field preparation through the harvest.

Plowing practices widely varied based on local custom, with all types of plowing in the West averaging 2.9 hours per acre in 1909. This rate fell to 1.3 hours per acre by 1936, aided largely by the use of tractors and multiple-row implements, thus reducing some need for

[20] Emanuel Vocale, Interview with Nigel Holman, 22 June 2000 (New Mexico Farm & Ranch Heritage Museum Oral History Program, Las Cruces, N.Mex.), Tape Three, Side One; Saffell, "Working in the Cotton Fields," 50-51. The Vocales got rid of the other two mules the next year. The power and popularity of horse-drawn implements is reflected in the fact that Deere and Company included them in their catalogs through 1954—presumably for reluctant converts in the Cotton South.

[21] C. A. Bonnen and A. C. Magee, "Some Technological Changes in the High Plains Cotton Area of Texas," Journal of Farm Economics 20(3) (August 1938): 605-9.

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laborers.[22] A 1939 WPA National Research Project report commented on the shift from horse-drawn to tractor-drawn moldboard plows. Increasing from a one-bottom to a two-bottom plow reduced man-hours per acre by about 75 percent. Upgrading from horse power to tractor power, even with the same size plow, reduced labor needs by 25 to 45 percent because of greater speed. Investigators found similar results for lister plows, with time per acre being only about half that required for a moldboard plow. An Arizona study cited that both disk and moldboard plows were suitable, but operating a disk plow was less expensive and was better adapted to tractor use.[23]

Farmers used a planter, often a combination corn-cotton planter, from one to four rows across operated by one laborer. After 1919 a majority of western cotton farmers used two-row or larger planters. The required time decreased from 1.2 hours per acre to 0.6 hours per acre between 1909 and 1936, largely because of the increased use of tractors and two-, then four-row cotton planters. With this setup, a farmer needed only one or two laborers (including himself). Observers said that two-row planters were better than one-row units to create more uniform depth of planting, making straight rows (to aid later cultivation), and saving overall time. One might assume that a similar assertion could be offered for going from two-row to four-row equipment, but an Arizona study reported that the speed was only one and a half times as fast as when using two-row implements.[24]

Planting practices related to equipment use and design was an important issue. If placing the seeds did not generate a good stand of plants, then the whole process was futile.

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[22] Holley and Arnold, Changes in Technology and Labor Requirements, 26-36; Saffell, "Working in the Cotton Fields," 76-78. Figures for total plow work come from Holley and Arnold, adding the average hours required per acre for all farms in the Western Semiarid regions in tables 8 (flatbreaking or plowing), 9 (disking), 10 (harrowing), 11 (bedding and rebedding), and 12 (laying off rows). This WPA-NRP report did not survey any representative areas in its defined Irrigated regions, which include California, Arizona, New Mexico, the Rio Grande Valley, and Far West Texas. The author assumes that the Western Semiarid statistics would at least equal, if not exceed (i.e., even lower time requirements in the Irrigated regions), results for the irrigated areas should they have been recorded. This assertion is indirectly supported by Malcolm Brown and Orin Cassmore, Migratory Cotton Pickers in Arizona (Washington, D.C.: GPO for Works Progress Administration, 1939), 55-56, who report that average production costs for irrigated cotton-producing areas had similar costs as non-irrigated areas in the rest of the country.

[23] Eugene G. McKibben, John A. Hopkins, and R. Austin Griffin, Changes in Farm Power and Equipment: Field Implements, WPA National Research Project Report No. A-11 (Philadelphia, Pa.: Works Projects Administration, 1939), 27-35; Wood, Preparation and Use of Seedbed, 5.

[24] Holley and Arnold, Changes in Technology and Labor Requirements, 36-39; Camp, Cotton Culture in the San Joaquin Valley, 7; Thompson, Efficiency in the Use of Farm Machinery, 265.

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Thus, this subject was discussed considerably in extension publications. Most planters had some kind of furrow opener—either a small shovel, a runner blade, or sometimes a disc opener—which opened up the soil immediately in front of the chute where a seed dropped. The simplest planting placement was called flat planting, where the opener simply inserted a gap in an otherwise level field to insert the seed. For some types of soil or irrigation situations, growers thought it advisable to build up rows and plant the seed on top of the ridges of soil. With this, a farmer could irrigate immediately after planting and not be concerned that a seedling would be unable to break through any dry crust that developed after irrigation. In sandy soils, windier conditions, or for certain irrigation methods, producers thought it best to plant the seed in the bottom of a furrow, as would be the case when using a lister planter—a lister plow with a planter unit in the back. With this method the seed is in firmer and moister soil, and the plant is better watered at times of irrigation later in the season.

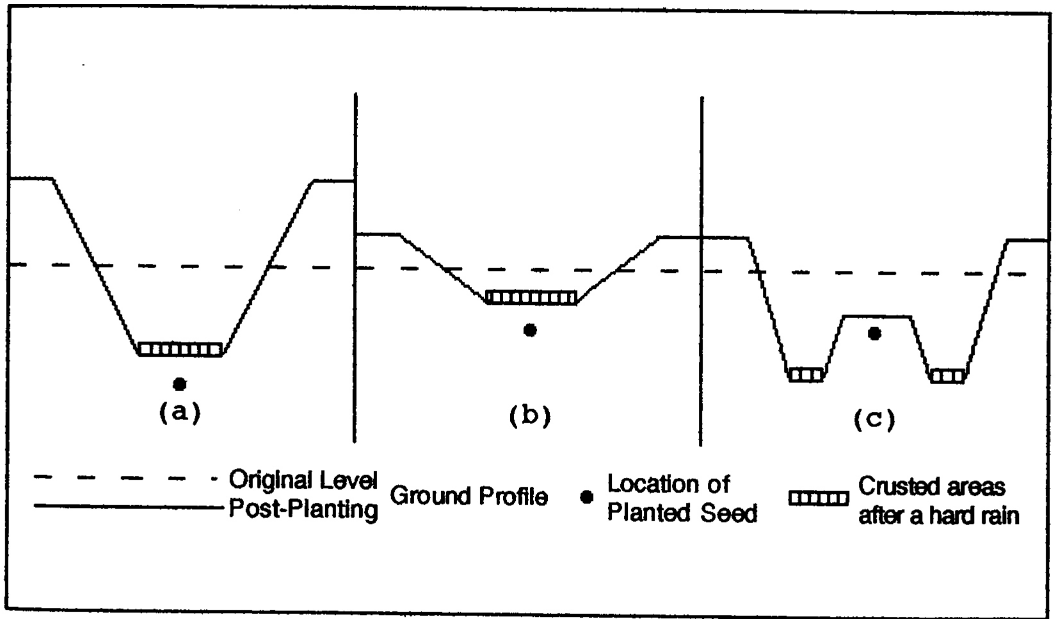

Figure 10. Diagrams of Furrow Types
(a) Traditional Deep V-furrow. (b) Hudspeth-style Shallow V-furrow. (c) W-furrow.
Source: Drawing by the author based on Matthews, "History of the Lubbock Experiment Station," 72, 76.

The depth of these furrows (fig. 10) was the subject of a Texas research project after World War II, where investigators found that shallow furrows resulted in earlier, more complete seed germination and harvester efficiency improved because the lowest plant

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branches were elevated to reach the machine. A subsequent Oklahoma A&M research project combined the benefits of planting in the furrow bottom by creating a small ridge down the center—called a W furrow (fig. 10c)—to provide ample moisture but avoid the problems with crusted soil. All of these methods were common throughout the Cotton West.[25]

Many planter units included some type of covering shovel or press wheel to put soil back over the freshly planted seed. Farmers later found that implements with press-rim wheels behind the chutes, instead of the earlier shovels and single-rim wheels, were more effective. The wheel pressed the seed firmly into the ground, insuring that it was indeed beneath the surface. USDA researchers had recognized as early as 1905 that the use of a press wheel sometimes resulted in poor stands of growth because either the soil dried out too soon, causing a failure to germinate, or the wheel created a compacted surface that a seedling could not break through. In the mid-1920s USDA researchers developed a new device with a heavy roller to press the seed into wet soils, followed by a chain or shovel that left a lighter soil mulch on the top. Farmers in the San Joaquin Valley reportedly began using this modification on the planters in 1925. Texas researchers reported that a rubber-covered wheel offered better results than earlier steel or wood wheels and vigorously pursued improvements to the design in studies that were part of the Regional Cotton Mechanization Project studies after World War II.[26]

Western cotton laborers spent about six hours per acre each season chopping cotton, as opposed to twenty-three to thirty-four hours per acre in regions in the Old South cotton belt. Again, this disparity was largely because of regional variations in planting practices. USDA researchers presented the arguments both ways. Planting relatively close together was advantageous as a means of controlling weeds and vegetative growth of the cotton plants

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[25] Wofford B. Camp, Production of Acala Cotton in the San Joaquin Valley of California, USDA Department Circular No. 357 (1925), 10-12; Saffell, "Working in the Cotton Fields," 90-99. For other discussions of planting locations, see R. S. Hawkins, Field Experiments with Cotton, Arizona AES Bulletin No. 135 (1930), 560-62; H. P. Smith and M. H. Byrom, Effects of Planter Attachments and Seed Treatment Stands of Cotton, Texas AES Bulletin No. 621 (1942), 11-13; and E. W. Hudson, Growing Egyptian Cotton in the Salt River Valley, Arizona, USDA Farmers' Bulletin No. 577 (1914), 4.

[26] Saffell, "Working in the Cotton Fields," 39, 90-97; Wofford B. Camp and James S. Townsend, Uniform-Depth Press-Wheel Cotton-Planter Attachment, USDA Department Circular No. 381 (1926), 1-5; Smith and Byrom, Effects of Planter Attachments, 8; E. R. Holekamp et al., Planting Equipment and Practices for Cotton on the High Plains, Texas AES Publication B-992 (1962), 13.

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themselves, which resulted in more leaves and less fruiting bolls. The greater density with more plants made up the difference in lost yield. A 1925 report from California, though, suggested that the best fields had resulted from spacing cotton rows as much as four feet apart. The higher the density of planted seeds, the more likely some kind of thinning or chopping was needed. The lower the density (within and between rows), the less likely a producer would need to chop his cotton. Manufacturers developed a variety of mechanical cotton choppers for use with tractors prior to 1940, but as western growers seldom chopped their cotton, few of them purchased or used these machines in the West.[27]

Two- and four-row cultivators became particularly common after the introduction of the row-crop tractor in the late 1920s. Prior to that time the only tractors available were large machines with a low base and a wide wheel-width. The increased height on the row-crop tractor allowed the operator to drive above growing plants. Designers made the McCormick-Deering Farmall Regular tractor specifically to accommodate a four-row cultivator attachment and required only one laborer—the driver. Thus, these new cultivators further replaced laborers. Where one cultivation by hand took approximately 3.6 hours per acre, four mechanized cultivations over the course of the season could be accomplished at a rate of 2.3 to 3 hours per acre total.[28]

Cultivators came in a variety of forms, which farmers might employ at different times of the year. The traditional type had sets of shovels or sweeps that straddled the plant row. These ranged from the one-horse, one-half row walking cultivator up to two-row riding units and the four-row, tractor-mounted cultivator. A variation replaced some or all of the shovels with disks, either individually or in gangs of three or more. Operators turned their gang disks at an angle to control the amount of dirt thrown to or from around the plant. Combinations of the two were also common. In either case, many units had "fenders" or hoods to protect the plants as the implement passed by. A near variant classified as its own type of cultivator was

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[27] Holley and Arnold, Changes in Technology and Labor Requirements, 44-46; Stephen H. Hastings, Irrigation and Related Cultural Practices with Cotton in the Salt River Valley of Arizona, USDA Circular No. 200 (1932), 15; Camp, Production of Acala Cotton, 10; Saffell, "Working in the Cotton Fields," 83.

[28] Saffell, "Farming in the Cotton Fields," 52-55; Holley and Arnold, Changes in Technology and Labor Requirements, 39-44; R. L. Adams, Seasonal Labor Requirements for California Crops, California AES Bulletin No. 623 (1938), 8. Adams reports that in a usual man-day of nine hours, a man could chop 2.5 acres of cotton, which translates to 3.6 hours per acre. Therefore, the shift to mechanical cultivators reduced cultivation time 11.5 to 12.1 man-hours per acre, representing approximately 3¼ fewer laborers per acre.

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a rotary hoe—a rimless wheel with curved spokes or teeth which cut into the ground surface. Rotary hoes were better for managing the soil than killing anything but the smallest of weeds. Rotary hoes, used at a high rate of speed, were ideal for breaking a crusty soil after a rain to help cotton seedlings emerge. Because of this, western cotton producers were more likely to use a shovel or disk cultivator than a rotary hoe.[29]

A somewhat curious development in field cultivation after World War II that elicited much testing and discussion throughout southern and western cotton production was flame cultivators. Traditional cultivators killed weeds by cutting them apart. A flame cultivator killed weeds by burning them, leaving no plant or seed residue that could regerminate. The government granted the first patents for flame cultivators in 1900, but they were unpopular because of the higher potential for damaging cotton plants until the labor shortages of World War II emerged and interest revived. A new type of burner used with LP (propane or butane) gas in 1948 had a smaller and flatter flame. Extension researchers found that when properly adjusted, these units were effective at eliminating small weeds and grasses in early season cotton without affecting the young plants or soil. Some publications suggested flame cultivation could be employed up to the time that bolls emerged. Flame cultivators reached the height of popularity in the early 1960s. They presumably fell out of favor as fuel prices skyrocketed during the oil crises of the late 1960s and 1970s. In addition Elanco Products introduced the commercial herbicide chemical Treflan in 1964. Where flame cultivation was used, most extension publications advocated supplementing it with traditional cultivators. The traditional cultivator, although more time-consuming, performed just as effective a job at less cost.[30]

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[29] Saffell, "Farming in the Cotton Fields," 45-48, 81-83; Holekamp, Thomas, and Frost, Cotton Cultivation with Tractors, 7-11. Cultivation was the first area of mechanization in row-crop production, even before the introduction of the Farmall tractor. The early motorized cultivator, or tractivator, is a forgotten stepchild in the history of mechanization. Most commercial testing became precursory work toward the development of row-crop tractors. At least one tractivator, a two-row Emerson-Brantingham "Multi-Row" Cultivator, was used in Borden County, Tex., and is now in the collections of the American Museum of Agriculture in Lubbock, Tex. For more, see Saffell, "Working in the Cotton Fields," 79-81, and C. H. Wendel, 150 Years of International Harvester (Sarasota, Fla.: Crestline Publishing, 1981; reprint, Iola, Wis.: Krause Publications, 2004), 97.

[30] Saffell, "Working in the Cotton Fields," 99-101; Ellwood, Growing Arizona Cotton, 9; James R. Tavernetti and H. F. Miller Jr., Studies on Mechanization of Cotton Farming in California, California AES Bulletin No. 747 (1954), 17-18; James R. Tavernetti and Lyle M. Carter, Mechanization of Cotton Production,

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Mechanical equipment for irrigation was more a matter of how a field was prepared prior to planting rather than some device used during the growing season. Thus, the time needed for irrigation was frequently how long additional laborers moved pipes, opened gates, or ran pumps. In the heavily irrigated areas of California (San Joaquin and Imperial Valleys), Arizona (Salt River Valley), New Mexico, and Far West Texas (Rio Grande and Pecos River valleys), farmers took anywhere from forty-seven to seventy-seven labor hours per acre just to water crops. The wide range of variation was likely due to year-to-year changes in precipitation.[31]

The two most common means of irrigation were flooding between borders and watering in furrows. Borders might consist of small temporary ridges or more permanent levees. Either could be formed with disk cultivators or plows and finished with a V ditcher. The use of furrows and the implications in planting were discussed earlier, with the furrows being created by plows prior to or as part of the planting process. Another innovation was using a special attachment called a damming lister or basin lister to create small dams in a furrow while plowing. The dams, spaced eight to ten feet apart, retained water from rainfall or irrigation without allowing much runoff. It is unknown where the damming lister originated, but descriptions of it appear in experiment station bulletins around the country (for several row crops) starting in the 1930s. There is little evidence to prove that they were commonly used in the Cotton West, though, until several Texas studies reported on "diked fields" in the 1970s. Furrow diking eventually became a popular water conservation tool extensively advocated by the High Plains Underground Water Conservation District, which

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California AES Bulletin No. 804 (1964), 10-11; Gilbert C. Fite, "Mechanization of Cotton Production Since World War II," Agricultural History 54(1) (January 1980): 205.

[31] Holley and Arnold, Changes in Technology and Labor Requirements, 102-6. The authors of this study make the distinction between the Irrigated areas and the Western Semiarid areas solely on the use of irrigation. Thus, the figures presented here are the total labor for the latter region subtracted from that for the former. They also note that the use of long-staple cotton varieties in much of this region resulted in greater amounts of time to harvest cotton, but I believe this difference to be negligible, perhaps less than five hours per acre. Holley and Arnold do not specifically define what labor is involved in irrigation, though it likely includes opening and closing canal gates, moving pipes, and diverting water by hand and hoe in the fields themselves. This work is relatively constant in nature from planting to near harvest, so it was likely performed by year-round laborers or by the owner-operators.

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reported that for every inch of water retained by the dikes an inch of underground aquifer irrigation water was saved.[32]

The use of tractors helped western cotton farmers by almost completely mechanizing plowing, planting, and cultivating, thus aiding in the increase of farm size and reducing pre-harvest labor needs. The labor hours required to raise cotton during these stages of production decreased from around 18 hours per acre around 1910 to about 4.5 hours per acre by the mid-1930s. Mechanization of the pre-harvest stages of cotton growing, though, resulted in even greater amounts of cotton to harvest, thus making harvest-time problems worse and requiring many more laborers.

Measuring harvesting by labor hours, as was done with the other stages, was very problematic; the number of hours involved per acre varied widely depending on crop yield and the cotton variety planted. The preferred measuring stick was pounds of seed cotton harvested per person per day. Most experienced harvesters, men and women, picked two to three hundred pounds a day.[33]

Over the decades, inventors and scientists made many attempts to create a mechanical means of harvesting cotton and reduce the labor needs of the harvest period. Nearly all prototype mechanical harvesters, however, were technically impractical, too costly, and produced markedly inferior-quality cotton as compared to hand-harvested. Thus, hand harvesting of cotton remained the only economically viable option for most cotton farmers until World War II—the point at which commercial-production cotton harvesters became widely available and used.[34]

Mechanization of Cotton Harvesting

Economist James Street wrote in 1957 that if the tractor was the symbol of partial mechanization in cotton production, then the mechanical harvester is the symbol of complete

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[32] James C. Marr and Robert G. Hemphill, Irrigation of Cotton, USDA Technical Bulletin No. 72 (1928), 5-7; Saffell, "Working in the Cotton Fields," 106-8. Irrigation of Cotton was an early and significant treatise on irrigation practices and needs specifically for all areas of the Cotton West and relied heavily on the work of agricultural researchers from Texas, California, Arizona, and New Mexico.

[33] Holley and Arnold, Changes in Technology and Labor Requirements, 48-54; Saffell, "Working in the Cotton Fields," 116-17. The accepted standard length of a cotton-picking day was ten hours.

[34] Saffell, "Working in the Cotton Fields," 118-40; R. Douglas Hurt, American Agriculture: A Brief History (Ames: Iowa State University Press, 1994), 250-51, 318-19.

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mechanization.[35] Even after the introduction of tractors and larger implements, cotton harvesting still had to be done by hand. For decades, innovators working with cotton were unable to find the "technological breakthrough" to make a feasible mechanical harvester. Between 1850 and 1931 the U.S. Patent Office granted over 750 patents for mechanical harvesters or their components.[36]

Of all the patents issued by World War II for any number of machines, only six prototype harvesters seemed feasible. Of those only two—pickers and strippers—wound up in mass production. Picker-type machines pluck the cotton from the bolls (as one would by hand) using spindles, fingers, or prongs. Farmers could use these machines at any time in the season without damaging either plant foliage or unopened bolls, so they could operate them as soon as bolls began opening. Cotton pickers emerged as the harvester choice for all of the southern and western cotton belts except for the plains of Texas and western Oklahoma.[37]

The mechanical cotton picker and its use in the Cotton West are one of the unusual contrasts in comparison with the South. Where state or federal experiment stations developed or heavily influenced almost every aspect of production and machinery in the West, the mechanical cotton picker is one of the only items from the traditional Cotton South, developed largely by private manufacturers, that was subsequently adopted in the Cotton West prior to 1950.

Historians have traced the basis of the cotton picker back to the work of Angus Campbell, an engineer for Deering Harvester Company. In 1885 he began experimenting with designs of spindles with rotating fingers to twist and pull cotton from the boll. Campbell and numerous other inventors throughout the South worked on significant spindle-

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[35] Street, New Revolution in the Cotton Economy, 165. At the time, Street was probably correct. Subsequent backups of cotton trailers at the gin, though, suggest that the harvester did not complete the mechanization of cotton farming. In my 1996 thesis, "Working in the Cotton Fields of the Texas South Plains" (Chapter VI), I demonstrate that the introduction of the cotton moduling process in the 1970s marks the completion of mechanized cotton production. Also see Cameron L. Saffell, "From Wagon to Module: New Ways of Handling Harvested Cotton," West Texas Historical Association Year Book 73 (1997): 46-61.

[36] Lowell H. Carlson, "Development of the Cotton Stripper," West Texas Historical Association Year Book 50 (1974): 76; H. P. Smith et al., The Mechanical Harvesting of Cotton, Texas AES Bulletin No. 452 (1932), 60-72. The latter includes a complete listing of all the patents granted for mechanical harvesting devices from 1850 to 1931. Street, New Revolution in the Cotton Economy, 107, makes an uncited statement that there were over 1,800 patents for mechanical harvesters between 1850 and 1945.

[37] H. P. Smith, "Mechanical Harvesting of Cotton Has Arrived," Agricultural Engineering 25(5) (May 1944): 167; Smith et al., Mechanical Harvesting of Cotton, 5-11.

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type picker designs from the 1890s to the 1920s. Notable among these was P. P. Haring of Texas, who over thirty years developed several prototypes that he demonstrated for Deering and subsequently the International Harvester Company to no avail. In 1912 Campbell and Theodore Price, another private inventor like Haring, combined elements from both their designs into what was called the Price-Campbell cotton picker. The machine never reached commercial production, however, because of its complexity, high cost to build, and difficulties in damaging cotton plants or breaking down in the fields.[38]

International Harvester Company (IHC) very much wanted to produce a mechanical cotton harvester. Starting from its formation in 1902 from the merger of several companies, including Deering Harvester Company, IHC spent an estimated $5,250,000 on developing a commercially feasible mechanical cotton picker over the next four decades. After investigating all the patents available and using its previous experience, IHC bought the Price-Campbell patents for a machine with rotating barbed spindles in 1924. Over the next six years, IHC engineers developed seven different prototypes with variations in shape, size, and arrangement of the spindles. They field-tested the machines, starting in the Rio Grande Valley and working their way north and east across Texas, Oklahoma, Arkansas, Mississippi, and Tennessee.[39]

At the same time, Texas brothers John and Mack Rust were developing and testing their own cotton picker. Using some of the concepts from the Haring machines, the Rust Brothers improved the way a machine removed cotton. For several years many engineers had figured out ways to get the cotton out of the boll with some sort of spindle but had been less successful getting the lint off the spindle. John receives the credit for introducing moisture to the process. He remembered from his youth how the morning dew would cause cotton to stick to his fingers. He also recalled how his grandmother moistened the spindle of her spinning wheel to get the cotton to adhere and start threading. He came up with a new design which incorporated dampened wire spindles to remove the cotton that, in turn, were stripped of the lint which was conveyed to a storage basket. The 1928 patented Rust Harvester was soon demonstrating great effectiveness at mechanical harvesting in field trials

[38] R. Douglas Hurt, Agricultural Technology in the Twentieth Century (Manhattan, Kans.: Sunflower University Press, 1991), 32-34.

[39] Street, New Revolution in the Cotton Economy, 120-22.

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in Texas and Mississippi, drawing great praise from many farmers and agricultural engineers. The Rust brothers recognized that the machine would have to be mass produced to be affordable, but for many years they refused to license the design to an established implement manufacturer for fear they would lose control over the spread of the machine and the profits that would go with it.[40]

The delays by the Rust Brothers ultimately worked to IHC's advantage. Their engineers applied Rust's concept of moistened spindles in their testing. They also made a critical decision in 1940 to invert the construction of the harvester. For several years IHC had built harvester units that would mount to or be pulled behind their Farmall tractors, but the setup had resulted in plants getting knocked over or damaged prior to the cotton reaching the harvester unit. The new design mounted the picking unit on the rear of the tractor, which was driven in reverse. The operator had better vision of the rows, and the plants directly entered the picker before encountering any other parts of the machine. The improved design also incorporated rubber doffers to remove the fibers from the spindles and an air conveyor to blow the lint into an overhead container. By mid-1942 IHC executives believed they had a machine ready for commercial production. Manufacturing restrictions resulting from World War II meant IHC limited their production. Less than two hundred pickers were made, in the shop by hand, between 1941 and 1947. In their first year of full production (1948), IHC built over a thousand new units at a retail cost of $5,985 (not including the tractor). They continued improving the design and cutting the cost, assembling more than eight thousand cotton pickers for $2,800 each by 1952. Their first two-row cotton picker came out in 1956. Most of these units ended up either in the Mississippi Delta region or California.[41]

The Rust Brothers tried to make it on their own but could not raise the financing to build a manufacturing plant. No doubt influenced by IHC's announcement, they decided in the mid-1940s to license their design to Allis-Chalmers and a small Arkansas manufacturer named Ben Pearson, Inc. In the 1950s J. I. Case Company and Massey-Harris-Ferguson introduced versions of the Rust harvester built by Pearson and mounted on their respective tractors. The latecomer was Deere and Company, who finally introduced commercial

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[40] Hurt, Agricultural Technology, 35; Street, New Revolution in the Cotton Economy, 123-27.

[41] Hurt, Agricultural Technology, 38; Street, New Revolution in the Cotton Economy, 129-31; Wendel, 150 Years of International Harvester, 82-87.

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production with their No. 8 Cotton Picker in the early 1950s, bringing mechanical pickers to the implement lines of every American farm equipment company.[42]

The mechanical harvester adopted in the High Plains region was the cotton stripper. Unlike the cotton picker, the evolution of the cotton stripper was heavily influenced by state agricultural experiment stations. A cotton stripper removed all of the bolls off the cotton plant, including any "bollie cotton" which had failed to open or mature due to bad weather or an early freeze. Patents for stripper harvesters dated back to as early as 1871, but no practical machine was made until the 1910s.[43]

The 1914 cotton crop was one of the first "bumper crops" on the Texas South Plains. While yields were high, prices were low, meaning that hand-harvesting cost more than the crop was worth. One farmer decided to use a picket fence pulled by a horse team to strip the bolls off the plant. This situation marked the beginning of scattered attempts by farmers to make their own primitive "sled strippers" when prices were low over the next decade. Depending on materials and design, a sled cost from $10 to $30 to make and cost about $2.50 a bale to operate. This compared to $15.75 a bale for hand-harvesting in the region.[44]

Conditions in 1926 motivated Texas Agricultural Experiment Station (TAES) researchers to develop a mechanical harvester for the High Plains. That November the enormous windstorm occurred that was discussed in the preceding chapter about the beginnings of "stormproof" cottonseed. The next year researchers at the Lubbock Substation began a comprehensive study of mechanical harvesting and the cotton best suited to harvest by machine in the region—a program that continued for fourteen years.[45]

One of the program's important discoveries was that plants of most cotton varieties tended to branch out too much to use with a mechanical harvester. Thus, as TAES researchers worked to improve stormproof cotton characteristics, they did it hand-in-hand

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[42] Street, New Revolution in the Cotton Economy, 128-32; Jim Jensen, John Deere Cotton Harvesters: An Engineering History (Ankeny, Iowa: [The Author], 2001), 6-2 to 6-4. Deere was late in developing a cotton picker but, in fact, had already been selling cotton strippers for over twenty years, as will be described below.

[43] Smith et al., Mechanical Harvesting of Cotton, 13-14.

[44] D. L. Jones, W. M. Hurst, and D. Scoates, Mechanical Harvesting of Cotton in Northwest Texas, Texas AES Circular No. 52 (1928), 5-6, 30; Carlson, "Development of the Cotton Stripper," 78; R. E. Karper and D. L. Jones, Varieties of Cotton in Northwest Texas, Texas AES Bulletin No. 364 (1927), 11. Sled designs and types are discussed in greater detail in Saffell, "Working in the Cotton Fields," 122-26.

[45] Saffell, "Working in the Cotton Fields," 121, 126.

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while developing a suitable mechanical harvester. As one historian put it, "Mechanical harvesters were not practical until cotton breeders could design the plant to fit the machine."[46]

The TAES had an extensive testing program for harvesting equipment. However, with much of the interest nationally being placed on a mechanical picker, only a handful of commercially produced stripper units existed. International Harvester Company briefly had a one- or two-row stripper attachment for their Farmall tractor but found it impractical and, instead, focused on developing a cotton picker. Aside from the Smith-Conrad Cotton Stripper, produced for just a few years by a Fort Worth manufacturer, the only company that showed any interest in stripper technologies was Deere and Company. They manufactured their first production-model stripper in 1929—the horse-drawn Model 30—a full two decades before they sold a picker harvester. Not only did they send stripper prototypes for testing by the Lubbock Substation, they also sent their own team of engineers to observe the tests between 1927 and 1930.[47]

Generally content with their commercial models, Deere discontinued sending prototypes for testing by TAES in 1930. Still wanting to experiment and improve the concepts involved, TAES researchers opted to build their own cotton stripper. They used the tractor-mounted Texas Station Cotton Harvester (fig. 11) each season and usually overhauled it completely each year between 1930 and 1945 to test various components and principles. The "Texas Harvester" usually opened the season with initial field tests at College Station before it was shipped to Lubbock for the bulk of the Plains cotton harvest. Over the years, the TAES improved components for the rollers that pulled off cotton bolls, a new burr extractor and cleaning unit, and an auger design to move cotton back into a trailer.[48]

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[46] Ibid., 128; Leota Lightfoot Matthews, "The History of the Lubbock Experiment Station, Substation No. 8" (Master's thesis, Texas Technological College, 1959), 55.

[47] Saffell, "Working in the Cotton Fields," 130-32. Jensen, John Deere Cotton Harvesters, 11-2 to 11-5, describes Deere's additional testing in Oklahoma and South Texas. The Model 30 and the slightly improved Model 31 were the only harvester machines Deere made until 1946.

[48] H. P. Smith, D. T. Killough, and D. L. Jones, Factors Affecting the Performance of Mechanical Cotton Harvesters (Stripper Type), Extractors and Cleaners, Texas AES Bulletin No. 686 (1946), 5-8; Smith et al., Mechanical Harvesting of Cotton, 24-28; H. P. Smith et al., Progress in the Study of Mechanical Harvesting of Cotton, Texas AES Bulletin No. 511 (1935), 5-12.

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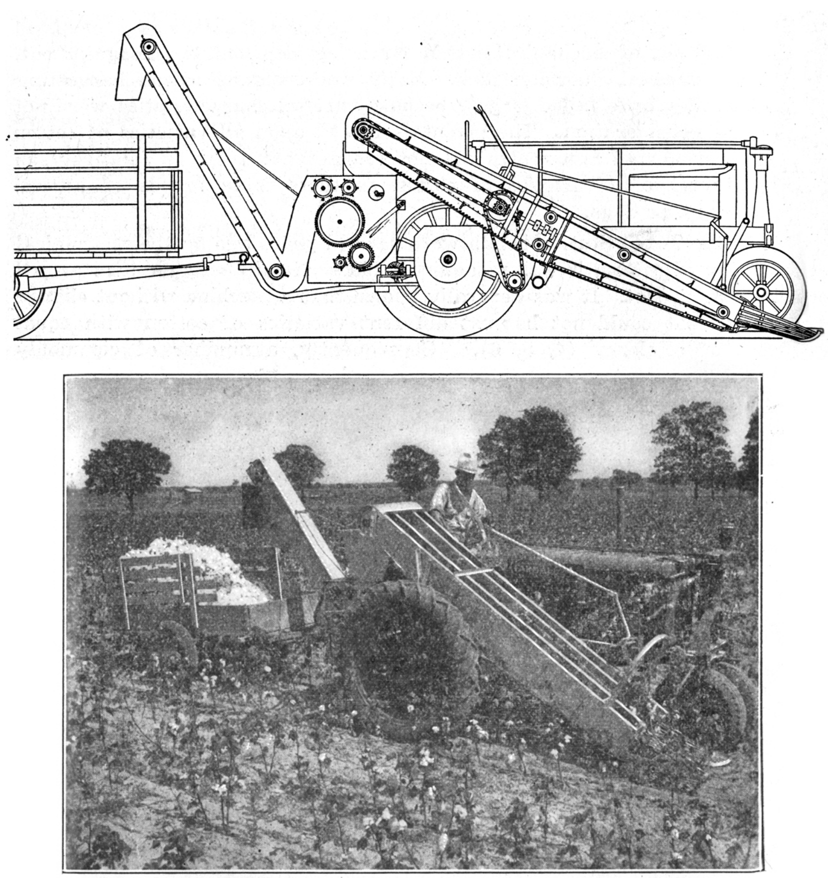

Figure 11. Texas Station Cotton Harvester
Source: Smith et al., Mechanical Harvesting of Cotton, 6-7.

The economic results were very favorable. In early tests researchers reported that the Texas Station Cotton Harvester cleared a field at the rate of 1.75 hours per acre at a net cost of $3.08 per 500-pound bale of ginned cotton. The comparable cost of hand-snapping the cotton came to $15.75 a bale. Including the cost of ginning and labor costs, the hand-harvested cotton was $26.25 a bale, while using the Texas Station Cotton Harvester cost only $14.08, a savings of over $12 per bale. The savings increased as efficiency improved, commercial machines became available, and labor costs increased. For the 1944 season the TAES estimated that machine-only harvested cotton cost around $7-8 per bale versus $29-42 per bale for entirely hand-harvested cotton, a savings of up to $30 per bale.[49]

[49] Smith et al., Mechanical Harvesting of Cotton, 31; Troy Mullins, Harvesting Cotton in the High Plains Area of Texas: Machine versus Hand, Texas AES Progress Report No. 952 (1945), 1.

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In 1943 the TAES began licensing the Texas Harvester design for commercial production, resulting in as many as 1,000 mechanical cotton strippers by 1945. Deere and Company also had monitored the TAES testing and in 1942 resumed production of cotton strippers with their first tractor-mounted type, the John Deere No. 15 Cotton Harvester. They quickly capitalized on their earlier stripper work and the TAES research to become the leading manufacturer of cotton strippers, producing 4,000 units between 1946 and 1948 at a retail price of $905. By 1953 the National Cotton Council estimated that there were over 18,000 cotton strippers available for harvesting work in the United States.[50]

The cotton stripper continued to evolve over the next several years. Manufacturers added overhead baskets to replace the trailing wagon to collect the cotton—a move that purportedly reduced labor needs by 40 percent in one-bale per acre cotton. Mounted at the back of the stripper, the popular Fowler Air-Blast Attachment—a combination separator, distributor, cleaner, and blower unit—helped eliminate the laborer on the trailer who had manually raked cotton back as it came out of the stripper. This accessory increased profits by $35 a bale. The Oklahoma Agricultural Experiment Station also got involved when, in 1949, they replaced the metal roller component with fiber nylon brushes. In 1953 Johnson Manufacturing Company of Lubbock introduced what was not only one of the first four-row harvesters anywhere but one of the first self-propelled strippers ever produced—two innovations that other companies did not adopt until the 1970s.[51]

Despite the existence of some commercial mechanical cotton harvesters prior to World War II, it took the introduction of the International Harvester's cotton picker into the Mississippi Delta and California during the war years to alleviate the shortage of hand-harvesting laborers to really kick off the final transition—one which mostly took place in the Cotton West. In 1945 an estimated 3 percent of cotton was mechanically harvested in the

[50] Street, New Revolution in the Cotton Economy, 114-15; Saffell, "Working in the Cotton Fields," 139-40. Jensen, John Deere Cotton Harvesters, 11-5 to 11-8, provides details of the development of Deere's cotton stripper line during this period.

[51] Saffell, "Working in the Cotton Fields," 146-49. In my study of the Texas High Plains, I uncovered several other cotton harvester inventions. Among these was 1952's "The Thing," on which six Mexican Braceros rode on a flat trailer and pulled bolls by hand. This process left the plant intact to serve as a barrier to wind erosion during the emerging period of drought. "The Thing" enjoyed a brief popularity (or notoriety) on the Texas South Plains for a couple of years while Bracero labor was available. For more on this and other South Plains innovations, including the pneumatic "Enos Cotton Picker, Harvester, and Insect Catcher," see Saffell, "Working in the Cotton Fields," 140-45.

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Southwest and about 1 percent in the Far West (table 2). Within ten years farmers mechanically harvested 52 percent of Far Western and 24 percent of Southwestern (probably almost entirely in the High Plains region) fields. California reported that machines picked 67 percent of its cotton, leading all of the cotton-producing states of the country. By 1970 several states reported that producers harvested all of their cotton mechanically. The lag in switching in some areas—throughout the United States, not just in the Cotton West—probably can be attributed to the availability of laborers through the Bracero Program (discussed in greater detail in Chapter Five) through 1964. This allowed some traditionalists and smaller farms, particularly in the South, to use a cheaper labor source without buying new equipment.[52]

Table 2. Percentages of Cotton Crop Mechanically Harvested, 1945-1955

State	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
California	*	*	*	*	13	34	53	59	59	62	67
Arizona	*	*	*	*	4	9	26	46	54	44	39
New Mexico	*	*	*	*	3	1	7	12	15	10	16
Texas	*	*	*	*	11	12	19	22	24	21	24
Oklahoma	*	*	*	*	2	6	13	17	19	15	20
Far West	N	1	N	6	9	23	41	50	53	50	52
Southwest	3	2	6	6	10	12	18	22	24	21	24
Mid-South	1	N	N	2	2	2	5	6	13	15	22
Southeast	N	N	N	1	N	N	2	2	5	3	2
United States	1	N	2	3	6	8	15	18	22	22	23

Source: Based on table 7 from Street, New Revolution in the Cotton Economy, 167.
Notes: N – less than 0.5 percent. * – not reported by state. Region groupings in the report: Far West—Calif., Ariz., N.Mex.; Southwest—Tex., Okla.; Mid-South—Miss., La., Ark., Tenn., Mo.; Southeast—Va., N.C., S.C., Ga., Fla., Ala. Almost all the mechanically harvested cotton reported in the Southwest is from the western halves of those states, which falls within the Cotton West. The eastern halves of those two states probably had rates closer to that for the Southeast.

[52] Street, New Revolution in the Cotton Economy, 165-69; Fite, "Mechanization of Cotton Production," 190-207. A recent study of the introduction and impact of mechanical harvesting, particularly socially, with passing comparisons of the West (California) to the South (Arkansas) is Donald Holley, The Second Great Emancipation: The Mechanical Cotton Picker, Black Migration, and How They Shaped the Modern South (Fayetteville: University of Arkansas Press, 2000).

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The process of mechanization and the transition from horse-drawn to tractor-drawn equipment ultimately represented an ability for western cotton farmers to increase their production and do it with fewer laborers than they had before World War II. Oklahoma researcher P. H. Stephens noted this fact in 1930, even before mechanical harvesting began:

> One of the reasons for the recent rapid introduction of power machinery in the western cotton country was the lack of hindering customs and the progressive nature of a pioneering type of farmer. Further, the change from large, mule-drawn equipment to tractor equipment in the western cotton country does not precipitate the revolution in farm organization and business methods that the institution of power equipment makes necessary in the areas of small farms or on plantations [of the South].[53]

For these reasons, there was a general openness to adopt and alter cotton production methods in the Cotton West. While they were not the only influence upon farmers, the newly established network of state and federal agricultural experiment stations and extension agents and their publications were a key element in researching and engineering the expansion of western cotton production.

The Role of Extension Research and Publications

As discussed in previous chapters, the agricultural experiment stations and the federal government were primarily responsible for much of the development of western cotton varieties. Similarly, I have referred earlier in this chapter to the work of state agricultural experiment stations to improve (or invent) cotton equipment—most notably in the development of the mechanical cotton stripper.

As noted in earlier chapters, the U.S. Department of Agriculture and its array of scientists and experiment stations played a major role in researching and instituting a new cotton industry in the West, particularly in California and Arizona up to 1930. They issued dozens of publications under the main USDA serials—USDA Bulletins, USDA Circulars, Department Circulars, Farmers' Bulletins, Miscellaneous Publications, and Technical Bulletins. The Bureau of Plant Industry played a key role in development of cotton varieties

[53] Stephens, "Mechanization of Cotton Farms," 33.

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and recommendations on planting practices, starting from its first publications on western cotton in 1906 up to the 1920s.

Since the USDA played such an important role in research, especially in California, it is perhaps not unexpected to find that the Arizona and California agricultural experiment stations did not publish extensively about cotton on their own. As the USDA focused its work at the Shafter Experiment Station in California, the Arizona Agricultural Experiment Station increased its output of bulletins, starting about the 1930s. Among California's two dozen bulletins, the most significant began appearing in the 1940s as mechanization of cotton harvesting and adjustments in farm practices emerged in the San Joaquin Valley.

As described in an earlier section, the Texas Agricultural Experiment Station (TAES) played a critical role in developing and disseminating knowledge on, first, cotton varieties and, later, on mechanical cotton strippers. Since Texas was the largest cotton producing state, it is not surprising to know TAES published more on cotton than any of the other states in this study—well over two hundred bulletins, circulars, and progress reports starting in 1888 up to 1960. Between 1904 and 1934 staff from several substations and the main office at College Station published about twenty bulletins and progress reports specifically on variety experiments and evaluations of the best seed for particular areas of the state. As the importance of breeding receded, attention shifted between 1932 and 1960 toward mechanical harvesters. Most of the publications came out of the Lubbock substation, most about strippers with several making economic observations on hand versus mechanical harvesting. The results were important to farmers, manufacturers, and the overall development of the new cotton industry, particularly on the Texas High Plains.[54]

Their influence was not limited to informing farmers on strippers; their work was equally important for other agricultural engineers working on mechanical harvester designs. Bulletin 452, The Mechanical Harvesting of Cotton, included major sections describing the evolutionary development of the major types of harvesters and included a list of all registered

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[54] Personal research lists of extension publications relating to cotton and cotton production and observations by the author. While my lists are by no means exhaustive, in compiling these over several years, I have found about 450 publications from USDA agencies and a similar number from all the combined state extension services directly or mostly about cotton for the period up to 1960. A number of these are in the Selected Bibliography. Though not mentioned in the narrative, the New Mexico and Oklahoma extension services were generally as active as Arizona, though they covered a broader range of topics.

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patents from 1850 to 1931. This bulletin became a key bibliographic item for contemporary work by other state experiment stations and private companies and in subsequent work by historians.[55]

Did all these reports of agricultural experiments and extension work, whether through bulletins and circulars or through the local work of a county agent, really have a significant effect? Study of the effectiveness of extension work began even before a fully established network of agricultural extension agents existed in the 1910s. A 1913 study found that in a national sampling, 84 percent of the farmers who received extension bulletins read them; 48 percent practiced some of the ideas they obtained from them. Follow-up studies in the 1920s, which examined a variety of methods, point out that demonstrations and visits by extension personnel to cotton farms were more significant factors than publications, but fully a third were influenced by indirect means such as hearing from other farmers and agricultural businesses. Overall, the most effective means of communication as far as an extension worker's time was news articles. Several studies reported that the amount of farmers using extension bulletins and adopting practices they had read about ranged between 62 and 68 percent. Analysts attributed this increase to the development of the nationwide network of county agents, thus affirming (at least to the analysts) the effectiveness of bulletins in extension teaching.[56]

A 1926 survey report asked farmers what they thought of extension services. Sixty-six percent indicated they thought favorably of what experiment stations and extension agents did, with only 4 percent who outwardly opposed the work. The same study indicated that 49 percent had made changes based on what they had heard in the community. A 1947 study in

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[55] Smith et al., Mechanical Harvesting of Cotton (1932). Two examples in which Bulletin No. 352 appears is Tavernetti and Miller Jr., Studies on Mechanization of Cotton Farming; and George H. Abernathy, Comparisons of Cotton Harvesting Methods, New Mexico AES Bulletin No. 496 (1965). In historical accounts, Bulletin 352 is frequently cited by Gilbert C. Fite, "Recent Progress in the Mechanization of Cotton Production in the United States," Agricultural History 24(1) (January 1950): 19-28; Street, New Revolution in the Cotton Economy (1952); Fite, "Mechanization of Cotton Production" (1980); Saffell, "Working in the Cotton Fields" (1996); and others.

[56] C. Beaman Smith and H. K. Atwood, "The Relation of Agricultural Extension Agencies to Farm Practices," in Miscellaneous Papers, USDA Bureau of Plant Industry Circular No. 117 (1913), 14-15; M. C. Wilson, Extension Methods and Their Relative Effectiveness, USDA Technical Bulletin No. 106 (1929), 28, 44; M. C. Wilson, Distribution of Bulletins and Their Use by Farmers, USDA Extension Service Circular No. 78 (1928), 8; M. C. Wilson, The Effectiveness of Extension in Reaching Rural People, USDA Department Bulletin No. 1384 (1926), 19.

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Lubbock County, Texas, asked many similar questions in a small survey in the heart of a key cotton-growing area. About 80 percent of respondents were familiar with the Extension Service; nearly as many could name the county agricultural agent. Nine out of ten people thought favorably of extension work, and a majority of farmers had adopted extension-recommended practices. Lastly, 65 percent of survey participants believed that extension work benefited the community as a whole, not just farmers.[57]

As radios became popular, the Extension Service examined how this communication form influenced farmers. Nationwide, 94 percent of farmers had heard a county agent's radio program, with about one-fourth being regular listeners. Investigators believed that as many as half adopted practices described in these programs. Analysts contended that radio took extension work to an entirely new group who had never participated in any extension activity before. A 1950 article in Rural Sociology affirmed the increased importance of mass media in conjunction with extension publications and contacts. However, it pointed out that increasingly farmers looked to well-established neighbors and businesses over other sources of information on farming practices. This detail is significant to a study of the development of the Cotton West. In the early decades of the twentieth century, when there were no established cotton farms, new producers would, of course, look to state and federal experiment stations and extension personnel for advice on how to grow cotton in these newly established areas. By mid-century the western cotton industry was well established and extension publications were becoming less effective after World War II—a fact reflected in the decrease of extension materials after about 1950.[58]

The research work of state agricultural experiment stations continued after World War II, even as the nature of extension work and reporting to the public changed. In 1946 Congress passed the Research and Marketing Act, which included additional appropriations for special research projects. Emphasis was given to those projects where two or more state agricultural experiment stations cooperate "to solve problems that concern the agriculture of

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[57] Wilson, Distribution of Bulletins, 8; Wilson, Effectiveness of Extension, 19; Kate Adele Hill, The Lubbock County Study: An Evaluation of the Effectiveness of Extension Work in Lubbock County, Texas, 1947 (College Station: Agricultural and Mechanical College of Texas and the USDA, 1948), 2, 10, 17-18.

[58] Gladys Gallup, Radio as a Source of Agricultural and Homemaking Information: A Summary of Recent Extension Radio Surveys, USDA Extension Service Circular No. 453 (1948), 6-10; Eugene A. Wilkening, "Sources of Information for Improved Farm Practices," Rural Sociology 15(1) (March 1950): 19-30.

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more than one state." In one of the first endeavors to involve the entire U.S. cotton industry, representatives from fifteen states met to establish the National Cotton Mechanization Project. Headquartered at the Delta Branch Experiment Station at Stoneville, Mississippi, research on various phases of production took place from South Carolina to California.[59]

For example, the Texas and Oklahoma AES focused on the issues of cotton production in the "Southwest region" (Texas and Oklahoma). The Lubbock Station concentrated on issues regarding planting. Supported by testing assistance from Oklahoma A&M, investigators identified both mechanical factors and changes in farming practices which led to new alterations of mechanical equipment and planting methods. Similar testing was undertaken in other states for the Far West (Arizona, California, and New Mexico), investigating both local conditions and the role of irrigation and its relation to mechanization. The California AES and the Shafter Experiment Station coordinated at least one project to more closely match cotton breeding improvements with mechanization efforts.[60]

S. P. Lyle reported in 1955 that state and federal extension officials played an integral role in spreading the knowledge about how to properly use the recently introduced mechanical harvesters. They solicited assistance from manufacturers and local dealers to set up schools for picker operators. In conjunction with the National Cotton Mechanization Project, state and federal agencies were critical in both improving and promoting new mechanical equipment for every stage of production.[61] With so many new developments emerging, USDA officials, the National Cotton Council of America, representatives of farm machinery manufacturers, and agricultural engineers looked for new means to share their results with each other. The outcome was the annual Beltwide Cotton Mechanization Conference, which began in 1947. The conferences increased the sharing of machinery improvements throughout the American cotton industry, which in turn were tested and

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[59] Fite, "Mechanization of Cotton Production," 200.

[60] Matthews, "History of the Lubbock Experiment Station," 66; Saffell, "Working in the Cotton Fields," 91-93.

[61] S. P. Lyle, "Skill in Harvesting and Ginning Required," in Cotton Mechanization: Its Impact on Cost and Quality, Proceedings of the Ninth Annual American Cotton Mechanization Conference (Memphis, Tenn.: National Cotton Council of America, 1955), 20-21.

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reported to farmers through the traditional extension methods of experiment farms, special schools and field tours, and publications.[62]

With the coordination of research and reporting throughout the Cotton West and South as exhibited by the National Cotton Mechanization Project and the beltwide cotton conferences, the mechanization of the South began catching up with that of the West from 1950 through the 1970s. While individual regions continued to improve upon production methods, the distinctions diminished as farm sizes increased, the use of large commercial equipment expanded, and national and international economic factors and policies became more and more influential. Economist James Street suggested that the process of mechanization was irreversible. He also acknowledged that there were great social implications, which would fall upon those groups who were the workers of the cotton fields.

[62] Fite, "Mechanization of Cotton Production," 200-202. In Arizona, for example, station researchers reported in 1951 on tests regarding cotton planting (Bulletin No. 233) and cultivating cotton with tractors (Bulletin No. 235). In the comments for both bulletins, the authors mention test results from other states and the funding for their work provided by the Research and Marketing Act of 1946. The annual conference was also an opportunity to bring everyone to one place to discuss common issues, with the papers and comments of the speakers published in an annual volume of proceedings of each meeting.

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CHAPTER V
LABORERS OF THE COTTON FIELDS

The rise of cotton farming in the Southwest is very different from the simple expansion story of the South, particularly as far as labor is concerned. Producers in modern-day California dabbled in cotton farming as early as the 1790s. Between 1854 and 1890, they made more serious efforts in the San Joaquin Valley to raise short-staple cotton for commercial sale using seed from the Old South cotton belt. Few local people knew how to harvest cotton, so landowners brought in experienced African Americans from the South. These workers often were unemployed during the off-harvest months and subsequently disappeared, requiring new recruiting efforts and training each year. By 1890 these earliest cotton farmers had given up trying to grow cotton commercially or for profit in California. Most observers agreed that labor and transportation costs were too high to grow cotton economically in the state.[1]

As discussed to this point, the first decades of the twentieth century witnessed widespread expansion of the cotton-producing areas into the Southwest. The government's introduction and encouragement of cotton farming in western Texas and Oklahoma and irrigated areas of Arizona, California, and the Rio Grande Valley of New Mexico and Texas increased the need for labor to raise and harvest the crop. By the 1930s farmers had become established with their particular varieties—long-staple Pima or Acala in California and Arizona and short-staple Uplands in Texas—and practices for raising cotton in their respective regions. Mechanization and large farm sizes resulted in periods when additional, seasonal labor was needed, particularly for harvesting in the late fall and early winter. Thus, laborers were in the fields year-round.

This chapter examines the role of labor in the Cotton West during its establishment and formative development. The use and type of various farming implements and means of harvesting, discussed in the previous chapter, are obviously linked to the people using—or being replaced by—mechanized equipment. Over the course of the several decades considered here, the ethnic background of the laborers of the cotton fields went through

[1] John Turner, White Gold Comes to California (Bakersfield: California Planting Cotton Seed Distributors, 1981), 9-25.

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several dramatic shifts, affected in part by mechanization and in larger part by the government politics and policies of the day. Combined, these factors affected the wages paid to laborers, which varied depending on who was available to work and in what quantities.

Types and Amount of Cotton Labor

As they became available, western cotton farmers used tractors to almost completely mechanize plowing, planting, and cultivating, thus aiding in the increase of farm size and reducing pre-harvest labor needs. The labor hours required to raise cotton during these stages decreased from approximately 18 hours per acre around 1910 to about 4.5 hours per acre by the mid-1930s. Mechanization of the pre-harvest stages of cotton growing, though, resulted in even greater amounts of cotton to harvest, thus making harvest-time problems worse and requiring many more laborers.

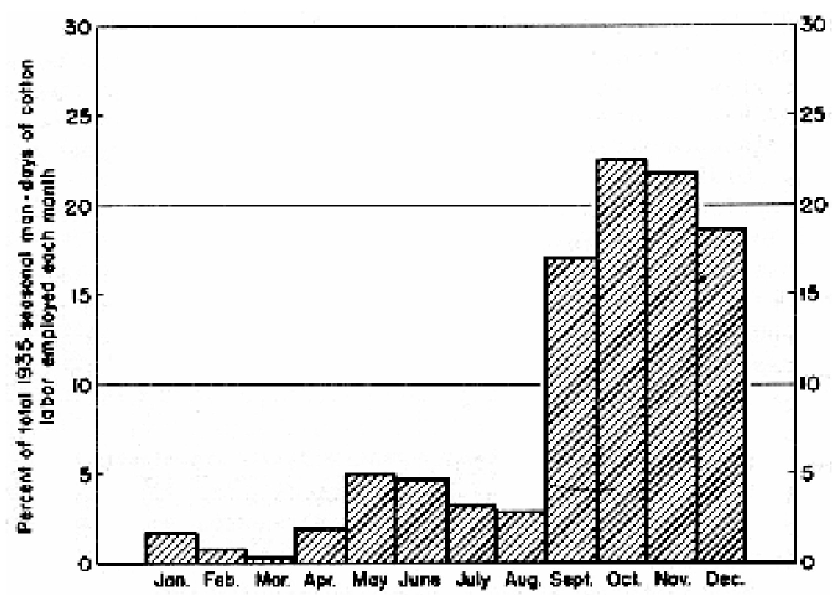

Figure 12. Seasonal Labor Employed on Arizona Cotton Farms, 1935
Source: Brown and Cassmore, Migratory Cotton Pickers, 54.
Note: This illustration does not include full-year wage laborers or family laborers. However, as figure 13 below shows, the number of regular laborers is a year-round constant that would uniformly raise the man-days of labor for each month.

Figure 12 demonstrates the premise that cotton farms needed laborers throughout the year. The peaks on this graphic, showing seasonal labor employed on Arizona cotton farms in 1935, came during the chopping and cultivating season (May–June, to a lesser extent

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through August) and during the harvest (September through early January). Farmers also needed laborers for every other stage of production, though in lesser numbers than during the peak periods.

Since the majority of labor needs were at the peak periods—chopping in late-spring and particularly the end-of-year harvest—and in lesser amounts the rest of the time, then there must be other methods of categorizing laborers other than by their ethnic group, which most historians appear to prefer. A 1940 USDA report provides one important classification, defining three major categories of cotton laborers.[2]

The first group in the report was share laborers, people who worked for part of the cotton crop. This included sharecroppers, who supplied the labor, used the owner's equipment to work the owner's land, and received half of the produced crop. The category also encompassed share tenants, who owned their own equipment and rented the land of the owner in exchange for one-fourth of the cotton and one-third of any other crops produced.[3]

Another category of workers was wage laborers, consisting of two divisions: regular and seasonal. Regular laborers were typically stable, skilled workers who were hired by the month, crop season, year, or longer (fig. 13). These were the "hired hands" that drove tractors or horse teams, repaired barns, fixed machinery, tended livestock, and performed regular farming tasks. The latter included general plowing, planting, and cultivating, as well as chopping and harvesting cotton. Often these "full-year" laborers, many of whom were "privileged" to be employed up to 360 days a year full-time, were heads of their households accompanied by their families. Full-year laborers might be paid weekly, monthly, or after the harvest. Part of their compensation might come in the form of perquisites such as owner-supplied housing. The whole family lived on or near the farm, and the wife and children were part-time, seasonal workers during peak-labor periods.[4]

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[2] Ernest J. Holcomb, "The Sharecropper and Wage Laborer in Cotton Production," paper presented to a Subcommittee of the Committee on Education and Labor, U.S. Senate, pursuant to S. Res. 266, May 1940.

[3] Ibid., 1-4.

[4] Ibid., 4-5. For more on the perquisites attached to pay for farm laborers, see Josiah C. Folsom, Perquisites and Wages of Hired Farm Laborers, USDA Technical Bulletin No. 213 (1931).

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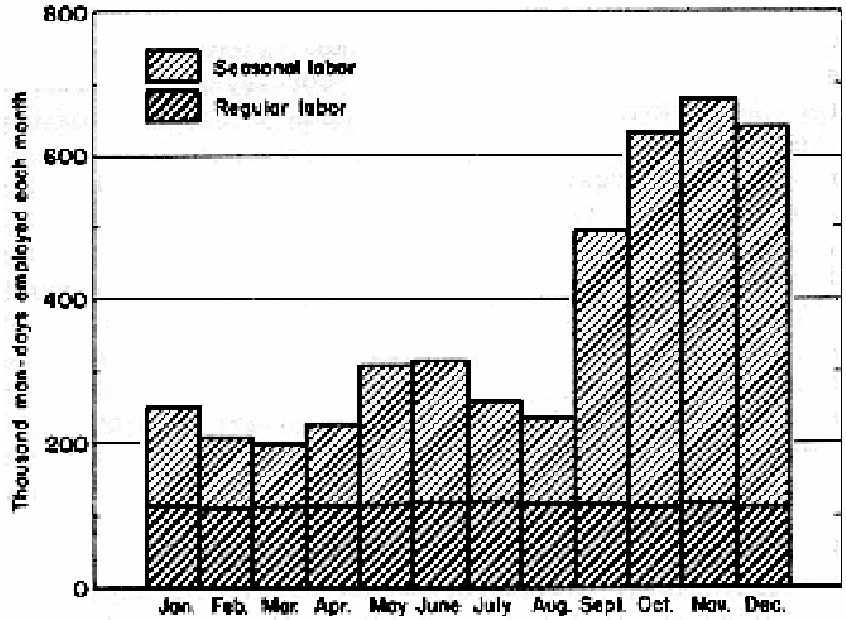

Figure 13. Full-Year (Regular) and Seasonal Labor on Arizona Irrigated Farms in All Crops
Source: Brown and Cassmore, Migratory Cotton Pickers in Arizona, 54.
Note: Notice that the number of man-days of full-year (regular) labor is almost exactly constant year-round, which correlates with the thirty percent of all agricultural labor man-hours noted in the text.

Seasonal laborers were usually unskilled workers on short-term employment and were paid by the day, hour, or piece rate. Sometimes they were local residents. If not, officials labeled them as migrant laborers. Seasonal laborers not only had to work at several locations doing a particular task, they likely had to work in several different crops or industries in order to earn income through the entire year. In any given year for all agricultural crops, seasonal labor made up about 70 percent of all wage laborers. The remaining 30 percent were regular, full-year wage laborers (fig. 13).[5]

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[5] Holcomb, "Sharecropper and Wage Laborer," 4-5; Harry Schwartz, Seasonal Farm Labor in the United States: With Special Reference to Hired Workers in Fruit and Vegetable and Sugar-Beet Production (New York: Columbia University Press, 1945), 4. B. H. Thibodeaux, C. A. Bonnen, and A. C. Magee, An Economic Study of Farm Organization and Operation in the High Plains Cotton Area of Texas, Texas AES Bulletin No. 568 (1939), 17, reports 73 percent seasonal labor for 1931–1935, while Malcolm Brown and Orin Cassmore state that 71 percent of laborers in Arizona in 1937 were seasonal (Migratory Cotton Pickers in Arizona, Washington, D.C.: GPO, 1939, p. 21). Schwartz recorded at-the-moment figures of 61 percent during the planting period of March 1940 and 77 percent at the onset of the harvest period in September 1940.

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The final group of laborers was family laborers (fig. 14). These were the owner-operators of their own land, together with their wives and children. Figure 14 is a typical representation of how important family labor was throughout the year and how much it was supplemented by hired wage laborers. The seasonal, migrant laborers of the harvest period, so often the focus of historians, actually constitutes only a small portion of the overall labor needs, not only during the harvest but also year-round. While figure 14 includes all agricultural pursuits, one would have found a similar relationship in the percentage of family laborers versus hired laborers specifically for cotton farms on a year-round basis. As discussed in the previous chapter, the seasonal nature of cotton farming meant that producers needed a relatively few year-round hired laborers with many more during peak periods of chopping and harvesting cotton.

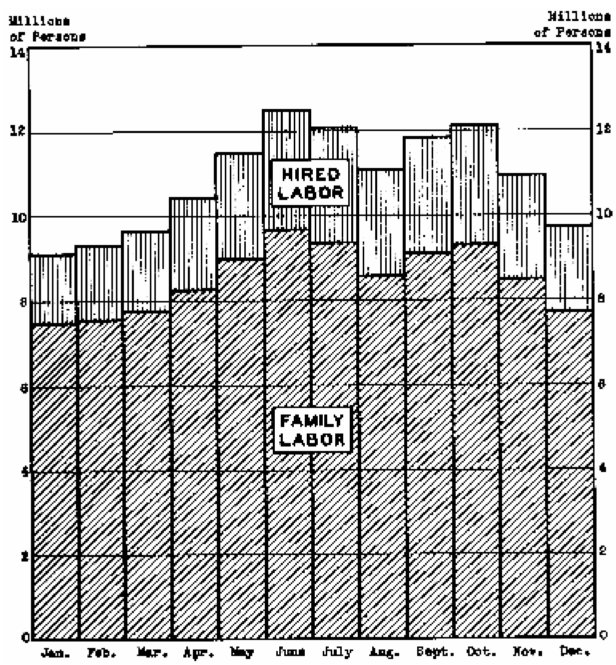

Figure 14. Comparison of Family Labor and Wage Labor (All Agricultural Employment, 1936)
Source: Free, Seasonal Employment in Agriculture, 9.

As with the simple USDA classifications, one can categorize cotton laborers by their gender or age and summarize their work experiences. The vast majority of workers in all the laborer categories were men. However, women and children made up significant portions of the labor pool, particularly in the seasonal wage labor and family labor categories. Women

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and children generally worked as cotton choppers and harvesters during the periods of greatest need.

Women worked similar hours to those of men—eight to twelve hours a day. A few also helped with plowing and cultivating, particularly in less-settled areas and on family-owned farms. In many areas, though, one researcher reported that women were ashamed to say they had ever done that kind of work because the farming community viewed plowing and cultivating as strictly men's chores. Outsiders viewed plowing or cultivating as easier work than chopping or harvesting because one rode implements or tractors. The paradox of the women's shame about plowing or cultivating, though, likely developed as part of the economics of cotton farming. Women's labor in the fields was generally not needed except during the rush periods around chopping and harvesting times. The shame of plowing or cultivating developed into a chivalric protection myth of women.[6]

A Texas study identified differences in the amount of total labor by women of different ethnic groups. Anglo American women performed an average of 4.1 months of cotton field work a year, while Mexican women worked 4.3 months and African American women worked 5.67 months. The figures for American and Mexican women seem plausible for female workers across the western cotton belt, as much of their work came during the three to four months of the harvest period each fall.[7]

Like their mothers, children did much of their work during the cotton harvests. "Child labor was a form of apprenticeship," particularly among Mexican American laborers. By age eight most children picked cotton in the fields beside their parents and older siblings. The need for children's labor during the harvest was sufficient enough in most years to cause officials to close school for several weeks during the peak period. Many children also worked in the fields as part of their after-school chores, both during the harvest and performing other tasks. Seventy percent of the children in a 1924 U. S. Department of Labor study indicated they had chopped cotton, 14 percent had helped plant, 15 percent had run a cultivator, and 10 percent had done some form of plowing. Children's labor typically added

[6] Ruth Alice Allen, The Labor of Women in the Production of Cotton, University of Texas Bulletin No. 3134 (Austin: University of Texas, 1931; reprint, New York: Arno Press, 1975), 125, 142-43, 247-48, 252.

[7] Ibid., 125, 142-43, 247-48, 252.

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up to about four months a year, with 60 to 75 percent of that time devoted to harvesting. Boys tended to work slightly more (4.5 months) than girls (3.7 months).[8]

By 1951 a Presidential commission reported that child labor had virtually disappeared, except in agriculture. Particularly in areas where wages were suppressed because of high numbers of migrant laborers, "the entire family must work in the fields in order to sustain life." This was such a pervasive problem that one contractor reported that if someone suggested that the children "have got to go to school," many families simply packed up and moved on. Congress attempted to limit this trouble in 1949 by amending the Fair Labor Standards Act to provide that no child under age sixteen could be employed during school hours. This situation continued to be a point of contention with producers, particularly in times and places of peak seasonal labor need, such as the cotton harvest.[9]

These categorizations, whether by age, gender, or annual employment status, remain relatively stable from the beginnings of the Cotton West to its maturity in the mid-twentieth century. The workers that fall within these categories, particularly among seasonal laborers, however, see historical shifts as more people from a number of ethnic groups move through the cotton industry.

Ethnic Groups Working in the Fields

As cotton became better established, farmers in the western cotton belt needed more laborers to keep up with increasing production. Their hired laborers, prior to and during World War II, represented many different ethnic groups, particularly in California and Arizona. The vast majority, even after the war, were Mexican or Anglo-American migrants

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[8] Devra Weber, Dark Sweat, White Gold: California Farm Workers, Cotton, and the New Deal (Berkeley: University of California Press, 1994), 63; James Gregory, American Exodus: The Dust Bowl Migration and Okie Culture in California (New York: Oxford University Press, 1989), 69; Cameron Lee Saffell, "Working in the Cotton Fields of the South Plains" (Master's thesis, Texas Tech University, 1996), 116; Thibodeaux, Bonnen, and Magee, Economic Study of Farm Organization and Operation, 34; The Welfare of Children in Cotton-Growing Areas of Texas, U.S. Department of Labor Children's Bureau Publication No. 134 (1924), 8-10. Note that the amount of labor reported in Welfare of Children by girls in Hill County, Tex. (3.7 months), is only slightly less than the amount of labor by women (4-5 months) from Allen's study.

[9] President's Commission on Migratory Labor, Migratory Labor in American Agriculture (Washington, D.C.: GPO, 1951), 161-64. The Commission noted that Congress included child labor in the Sugar Act of 1937 and the Fair Labor Standards Act (1938), but enforcement was generally lax. Most of the child workers by this time, the report implies, were members of migrant families rather than local children or members of a farm owner's family.

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or contract workers. As the years passed, federal government policy often dictated which of these groups were working in the fields at any given time.

Until the 1930s several Asian groups found employment in cotton fields in small numbers for brief periods in California. Hindus were some of the earliest pickers in the Imperial Valley from 1910 until the Immigration Act of 1917 excluded their coming to the U.S. Observers mention Chinese workers during approximately the same period, though no specific localities were given other than across the Mexican border in Lower California. Recruiters brought in Filipino workers starting in 1923 when some producers feared that the government would restrict Mexican immigration. The Filipino population increased steadily until 1930, in part because Filipinos were paid the least of any ethnic group. Possibly because they were not very good pickers or they tended to unionize, the Filipinos quickly fell into disfavor to the point where growers no longer wanted them for cotton work.[10]

Early in Arizona's cotton period, growers sometimes supplemented their labor force with American Indians. Their numbers were few compared to the overall total labor force (five hundred Papago Indians in 1913), but sometimes producers specifically desired them. A 1914 USDA bulletin said, "Indians are the most satisfactory laborers that can be had in Arizona … and have done well wherever they are employed. They are satisfied with fair returns for their labor and have learned to like the work, although until recently they were totally unfamiliar with it. It is of the utmost importance that this labor supply be developed thoroughly and that the Indians be treated fairly." Thus, some growers established cotton fields either on or near Indian reservations to use its residents as regular and seasonal laborers. The Pima Indians were among the tribes who had members that took up cotton farming.[11]

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[10] Carey McWilliams, Factories in the Field: The Story of Migratory Farm Labor in California (Boston, Mass.: Little, Brown and Company, 1939; reprint, Berkeley: University of California Press, 2000), 117-19; Argyle McLachlan, A History of the Cotton Industry in the Imperial Valley of California, U.S.A., and Lower California, Mexico, 1909-1914 (N.p.: [USDA], 1915), 45, 130-33; Colin Campbell Archibald, "A Historical Survey of the California Cotton Industry" (Master's thesis, University of California, 1950), 78.

[11] Brown and Cassmore, Migratory Cotton Pickers, 64-65; Archibald, "Historical Survey of the California Cotton Industry," 78; Erik-Anders Shapiro, "Cotton in Arizona: A Historical Geography" (Master's thesis, University of Arizona, 1989), 24-33, 134-45; E. W. Hudson, Growing Egyptian Cotton in the Salt River Valley, Arizona, USDA Farmers' Bulletin No. 577 (1914), 8; C. S. Scofield et al., Community Production of Egyptian Cotton in the United States, USDA Bulletin No. 332 (1916), 16-17. Readers will recall from earlier

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Farmers sometimes imported African Americans from the South to California to harvest crops. The prospects for year-round agricultural employment were low for these workers since cotton was usually the only crop they knew how to work. Thus, they often drifted away before the next harvest period. As a result growers shifted their efforts to other ethnic groups that would stay. However, there were pocket groups and settlements of African Americans throughout the Cotton West. Some were brought in on contract to pick cotton on large California ranch-farms as late as 1937. Historian Geta LeSeur documented accounts in Arizona of what she called "black Okies," African Americans from the Southern Plains and Arkansas who migrated westward as cotton pickers at the time of the Dust Bowl Anglo migrations. There is also documentation that significant numbers of African Americans worked on cotton farms in Central Texas.[12]

In 1926 Arizona growers imported two shiploads of Puerto Ricans to their fields as low-wage laborers. The outcome was a mild disaster because the recruited workers were not experienced agricultural laborers. Reportedly they were unemployed "scum" that labor agents found wandering on the shoreline docks, rather than laborers working on inland farm areas. The first group of five hundred, plucked from a swarming crowd of over six thousand on the dock at departure, immediately went on strike upon reaching Arizona because the facilities were not what the recruiters promised. The trouble and expense were not worth the growers' time, so the second shipment of five hundred became the last.[13]

Mexicans and Mexican-Americans became a major labor source for cotton work in the western cotton belt.[14] They likely were a significant portion of the work forces in Central and Far West Texas and New Mexico from the onset of farming in those areas. However, producers did not specifically seek them out as farm workers anywhere in the West until after the mid- to late 1910s, when new Asian immigration restrictions and the beginnings of the

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chapters that American Indians cultivated a native cotton in Pre-Columbian times and that the Sacaton Station developed a couple of new varieties specifically for the Indian reservations.

[12] Turner, White Gold, 23; McWilliams, Factories in the Field, 195; Welfare of Children, 3-4; Geta LeSeur, Not All Okies Are White: The Lives of Black Cotton Pickers in Arizona (Columbia: University of Missouri Press, 2000), 2-3; Allen, Labor of Women, 174-208.

[13] Brown and Cassmore, Migratory Cotton Pickers, 66-67.

[14] Much of the contemporary literature, as well as modern writers, referred to these migratory workers simply as Mexicans. This is with the understanding that the term is inclusive of all people of Mexican heritage, be they true natives of Mexico, Mexican-Americans, or Chicanos. The author continues that practice in this paper.

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first World War necessitated more labor. Growers in the late 1910s and 1920s favored Mexicans for several reasons. Observers viewed Mexicans as "docile," unionization did not appeal to them (as it had to Asian workers), and they left the area when their task was finished to look for work elsewhere. One California ranch foreman summed up growers' attitudes with the statement made to a Mexican field hand that "When we want you, we'll call you; when we don't—git." Americans also threatened Mexicans with deportation as a means to keep wages depressed. This was particularly true in the border areas of New Mexico and Texas where "wet" Mexicans had crossed illegally. Growers also favored Mexicans because they tended to travel and work in family groups. These groups were more than a nuclear family; they often included grandparents and other relatives, as well as close family friends. This structure provided a very efficient social and economic unit in which all members, including children, contributed.[15]

Migratory Mexicans often had previous experience as cotton pickers before they reached or were recruited to a particular area. In the early twentieth century Arizona and California recruiters sought Mexicans from the cotton-growing areas of Laguna and Baja California, Mexico, and in the Imperial Valley of Southern California near the Mexican border. These workers were well seasoned and accustomed to long-staple cotton varieties when first imported to the San Joaquin Valley of Central California after 1925. Importation on a grand scale for the 1926 harvest in the valley resulted in Mexicans comprising over 80 percent of the workforce—95 percent on ranch-farms of 300 or more acres.[16]

The numbers of Mexican migrants brought to the western cotton belt each year was fairly steady from 1917 to the late 1920s, making them the dominant ethnic laborers in many of the cotton-producing regions. Late in this period, however, anti-Mexican attitudes

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[15] McWilliams, Factories in the Field, 119, 124-26; R. Douglas Hurt, American Agriculture: A Brief History (Ames: Iowa State University Press, 1994), 239; M. S. Kistin, "Preliminary Report on Migratory Workers in the Cotton Areas of New Mexico," USDA Farm Security Administration Labor Division internal report (1941), 25-26; Juan L. Gonzales Jr., Mexican and Mexican American Farm Workers: The California Agricultural Industry (New York: Praeger Publishers, 1985), 11. In the 1920s, after the federal government imposed immigration restrictions, analysts estimated that as many as 80 percent of the Mexicans in California had entered illegally. Interestingly, one notes that many sources specifically cite 1917 as the first year of widespread use of Mexican labor in all agricultural pursuits. This fact likely coincides with the Immigration Act of 1917, which sharply reduced the numbers of all Asian immigrants that could come to the United States each year.

[16] Weber, Dark Sweat, White Gold, 49, 62-63, 35; McWilliams, Factories in the Field, 124-25.

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emerged in many areas, resulting in new federal restrictions, imposed deportations, and repatriations of Mexicans in 1929 and 1930. Texas and California enacted protectionist legislation to retain as much of the remaining labor force as possible in the early 1930s. Federal authorities did not lift legal restrictions until 1942, a result of the wartime agricultural labor shortage, whereupon Mexicans again became the dominant ethnic workforce. In the interim they were replaced by the other major group of cotton laborer workers of the West, white Anglo-Americans.[17]

Much attention, both past and present, has been devoted to a particular group of Anglo-American migrant workers—the refugees leaving the depressed and drought-stricken areas of the Dust Bowl region. The beginnings of the agricultural depression in the 1920s produced the first Anglo-American migrants who, by 1929 and 1930, became the replacement work force for the declining availability of Mexican laborers. New Deal programs, particularly payments made under the Agricultural Adjustment Act (AAA) after 1933, resulted in owners replacing sharecroppers with new tractors and mechanized equipment. Other sharecroppers incurred unmanageable debt because of low prices, poor crop production, and increasing rents, which forced them into bankruptcy. Some workers tried to stay on as hired hands to run the new equipment, while others went to towns and cities looking for work. Faced with few options, many migrated westward, lured by promises and rumors of work and good wages in the fields of the western cotton belt or other agricultural endeavors. This flow of migrant Anglo-Americans slowed, but did not end, until after World War II began.[18]

Neither contemporary observers nor modern writers explicitly mentioned a large portion of the Anglo-American workforce. Many of the owners and operators of cotton farms were Anglo-Americans, and many of the laborers were members of the owner-operator families.[19] These workers, along with true migrant Anglo-Americans, were the largest ethnic labor force in several areas until the 1920s. Several accounts observe that Mexicans were

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[17] Brown and Cassmore, Migratory Cotton Pickers, 64-65; Weber, Dark Sweat, White Gold, 77; Shapiro, "Cotton in Arizona," 89.

[18] Brown and Cassmore, Migratory Cotton Pickers, xix, 22-24, 27, 67-68; Gregory, American Exodus, 12-13; and Shapiro, "Cotton in Arizona," 89.

[19] The use of "Anglo-American" is intended to describe those white workers from the United States of northern, western, and eastern European descent. For some, the term "Anglo" includes many people of Spanish and Mexican descent and would lend to confusion. Those people are being described in this paper as Mexicans (note 14).

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"replacing" Anglo-American workers in California after World War II, particularly in the San Joaquin Valley, as the latter moved into higher-paying wartime industrial jobs. Anglo-Americans were also an almost exclusive work force on the High Plains of Texas and in some counties in Central Texas in the early years of cotton production in those areas.[20] For the period between 1900 and 1942, Mexicans and Anglo-Americans were the substantial majority of cotton laborers in the West.

In the late 1930s it became evident to many people that the United States might be forced to enter World War II. In many parts of the Cotton West, particularly in New Mexico and Arizona, the traditional patterns of local and migrant labor began disappearing. Some rural workers answered the call of military service. Other laborers who used to work in cotton fields, attracted by higher wages and steady work in large cities, instead began working in industrial and manufacturing jobs. These events marked a sharp turning point in the sources of labor used in cotton.

In 1941 and 1942 the USDA received conflicting reports about localized labor shortages and surpluses. Officials attempted to redistribute the labor to make it more efficient, but their efforts were complicated by conflicting responsibilities assigned to the U.S. Employment Service, the War Manpower Commission, and other non-USDA federal agencies. By March 1943 representatives of the American Farm Bureau Federation called for the entire responsibility for recruiting, transporting, and placing farm labor to be placed within the USDA and the Extension Service. After debate and modifications, what emerged was the Emergency Farm Labor Program.[21]

The overall mission of the Emergency Farm Labor Program was to recruit laborers and get them in the field to help farmers. This program consisted of several different campaigns, some of which are already well recognized in current historiography. The Victory Farm Volunteers sought non-farm youth between ages fourteen and seventeen to work on farms. Similarly, the Women's Land Army recruited women, mostly living in their own homes and being trucked to and from the farm each day, generally for seasonal work. In addition the

[20] Weber, Dark Sweat, White Gold, 35; Allen, Labor of Women, 22-23.

[21] Wayne D. Rasmussen, A History of the Emergency Farm Labor Supply Program, 1943-47, USDA Bureau of Agricultural Economics Agriculture Monograph No. 13 (1951), 13-34, 41-46.

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Emergency Farm Labor Program coordinated the placements of several groups of foreign workers.[22]

An unusual coincidence of local need and a U.S. Army dilemma came in the form of German and Italian Prisoners of War (POWs). Starting about the time of the successful Africa campaigns, the Allied powers suddenly had large numbers of POWs. The U.S. Army decided to send many of their captured POWs to detention camps in the United States. According to the terms of the Geneva Convention, prisoners had to be housed in camps of a similar climate as where they were captured. Thus, several large base camps were established across the American South and Southwest to hold the prisoners of the AfrikaKorps.[23]

The Geneva Convention permitted the holding power—in this case the United States—to make enlisted men available for work outside the camp under certain conditions. With the shortage of agricultural labor, many areas of the country appealed to have POW camps placed in nearby areas so farmers could hire these men as workers when local labor was not available. New Mexico and Arizona were particularly diligent in taking advantage of these opportunities.[24]

Under the Emergency Farm Labor Program, New Mexico officials made 70.5 percent of its placements with POW laborers. While this figure included all agricultural crops, a substantial number of these POWs worked specifically in cotton fields along the Rio Grande from Hatch to Anthony and in the Pecos Valley around Roswell and Artesia, as well as a smaller group along the Gila River in the southwestern corner of the state.[25] The initial group around Las Cruces was Italian POWs from the large base camp at Lordsburg, while the base camp at Roswell supplied German POWs to farmers in Southeast New Mexico. Germans replaced the Italians in July 1944.[26]

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[22] Ibid., 105, 135-36.

[23] Arnold Krammer, Nazi Prisoners of War in America (Lanham, Md.: Scarborough House, 1996), 1-42.

[24] Ibid., 79-94; Rasmussen, History of the Emergency Farm Labor Supply Program, 96-99; Wolfgang T. Schlauch, "Harvesting the Crops: Axis Prisoners of War and Their Impact on Doña Ana County during World War II," Southern New Mexico Historical Review 9(1) (January 2002): 30-37; Steve Hoza, PW: First-Person Accounts of German Prisoners of War in Arizona, 2nd ed. (Phoenix, Ariz.: E6B Publications, 2002), 89-110.

[25] With the widespread availability of these POWs being used in New Mexico, cotton producers in the El Paso area also made extensive use of this labor source.

[26] Schlauch, "Harvesting the Crops," 30-37; and New Mexico Farm & Ranch Heritage Museum, Prisoners of War in New Mexico Agriculture during World War II Research Project, 1999-2002, and the

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The program in Arizona emerged in similar fashion. Several large farms put up their own funds to build branch camps adjacent to their fields to ensure that they could utilize POW laborers. Nearly all the workers were Germans dispatched from the large base camps at Papago Park (near Phoenix) and Florence. Most of the branch camps were in central Arizona near the state's traditional cotton communities: Eloy, Litchfield Park, Buckeye, Mesa, and Cortaro.[27]

The lack of farm laborers was a concern even after the fall of the German Nazi government in Spring 1945. Farmers and farm groups throughout the country aired their concerns to President Truman, asking that the German POWs be retained at least through the 1945-46 harvest, if not through 1946 itself. The political pressure was great, even though the United States appeared obligated to release the POWs shortly after hostilities in Europe concluded. In the end Truman acceded to keeping the POWs until June 1946. It was a blessing for cotton farmers who had relied on POWs to help harvest their crops. Most were able to get everything out of their fields prior to the closure of most local branch camps in early spring 1946 as the United States began processing and shipping POWs back to Europe.[28]

Another very significant group of foreign workers during World War II is the only source that really continues afterwards—the Mexican workers who became known as the Braceros. During the Emergency Farm Labor Program period, this campaign imported foreign workers from Canada and the Caribbean islands as well, but by far the importation of workers from Mexico dominated cotton labor from the 1940s to the early 1960s.[29]

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resulting exhibit, "To Get the Job Done" [hereafter cited as POWs in New Mexico Agriculture Project]. The author was one of the staff members participating in the research/exhibit project. A noteworthy first-hand account was published as a result of this project. German POW Walter Schmid spent most of his captivity at Camp Las Cruces, where he worked extensively as a cotton harvester in the fall and winter months of 1943, 1944, and 1945. His observations and descriptions of this work appear in his autobiography, A German POW in New Mexico (Albuquerque: University of New Mexico Press, 2005).

[27] Hoza, PW, 88-110. Hoza's map on page 88 depicts the concentration of camps across central Arizona, though he omitted branch camps located on the Gila (Duncan) and the Colorado (Yuma area) rivers.

[28] Schlauch, "Harvesting the Crops," 34-36. In New Mexico some of the smallest branch camps were closed by January, with the last of the larger branch camps closed in March 1946.

[29] Rasmussen, History of the Emergency Farm Labor Supply Program, 199. Rasmussen reports that 5 Jamaicans were placed in Arizona and 2,693 in California for the year ending August 1945 (out of nearly 21,000 that year nationwide), but his description makes it appear unlikely that these men were placed in cotton work (pp. 249-72).

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Following the government restrictions imposed on Mexican laborers in the early 1930s, cotton growers in Arizona and New Mexico were among the first to question their continued use in late 1941. The Dona Ana County Farm and Livestock Bureau requested Congress modify or rescind immigration laws for their area specifically to permit Mexican laborers to chop or pick cotton. Similar requests came from sugar beet producers in Montana and Idaho and the California USDA war board in Spring 1942. A reluctant Mexico finally agreed to institute an agricultural labor importation program as part of its contribution to the Allied war effort in July 1942. The international agreement was based on the initial Congressional legislation authorizing the Emergency Farm Labor Program—Public Law 45 (April 1943)—which became the hallmark reference for what became the Bracero program for the next several years.[30]

Despite the early interests expressed by New Mexican, Arizonan, and Texan cotton producers, Mexican farm workers saw minimal official use in these states. Mexico specifically excluded Texas as a possible destination in the first several international labor agreements because the Mexican government was concerned by widespread reports of discrimination against its citizens in that state. Perhaps because of its strong reliance on the use of POWs, New Mexico received only twenty-three Mexican workers during the Emergency Farm Labor Program period (in 1946), and Arizona only imported between about eight and sixteen hundred each year. The lack of contracted workers probably does not mean that Mexican citizens were not laboring in cotton fields; more likely, growers in these states utilized “illegal entrants” or a group of 2,040 non-contract workers who were able to enter the United States to work for one year in New Mexico or Texas.[31]

California, however, made liberal use of the Mexican labor program, bringing in an average of 25,000 Mexicans annually between 1943 and 1947 for all its agricultural crops.

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[30] Ibid., 199-202, 41-46. Congress subsequently renewed the provisions of Public Law 45 each year through the end of the Emergency Farm Labor Program in 1947. After that, Congress extended the Bracero Program provisions through 1951 by Public Law 40 before it significantly revised the provisions in Public Law 78 in 1951. An example of the references to the early Bracero program 1942-1951 as Public Law 45 (PL-45), regardless of its then-current authority, can be found in several histories of the Braceros, including throughout Erasmo Gamboa’s Mexican Labor & World War II: Braceros in the Pacific Northwest, 1942-1947 (Seattle: University of Washington Press, 2000).

[31] Rasmussen, History of the Emergency Farm Labor Supply Program, 219-26. Indeed, some groups covertly recruited Mexican nationals in the traditional manners as had been done prior to the 1930s against the official federal labor policy (POWs in New Mexico Agriculture Project).

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How many of these Mexican laborers that worked in cotton fields is unknown, in part because the information was not specifically recorded and in part because some worked in multiple crops during their contract period.[32]

The Bracero program to import Mexican workers continued in the post-war years after the 1947 termination of the Emergency Farm Labor Program. At the federal level, the international agreements and accompanying laws were informally extended or renewed with minor changes up through 1951. Not until 1949 did Mexico permit Bracero workers to work in Texas, although some individual communities in the state remained blacklisted for several more years.[33]

In addition to the legalized Braceros came a large influx of illegal Mexican aliens, the so-called "wetbacks" because (at least in Texas) they had to swim across the Rio Grande to enter the U.S. This traffic grew stronger as demand for labor in the Southwest rose after the war, and farmers encouraged it, as they needed the workers and did not mind that their presence helped keep wage rates they would have to pay down.[34]

By 1951 Mexico questioned the continuation of informal agreements. Negotiations in Congress redefined the Bracero Program in statute in Public Law 78. This development generally coincided with public concerns and the work of a presidential commission on migratory labor. In the end, few of the commission's recommendations found their way into Public Law 78, which passed with little opposition. The final legislation explicitly authorized importing contract laborers, officially and permanently overturning a legal prohibition in place since 1885. To meet a concern of the Mexican government, the U.S. government agreed to be the official contractor and to guarantee that contract terms were fulfilled. It also stipulated that Braceros would receive the "prevailing wage" of the area and that anyone who employed illegal aliens would become ineligible to receive Braceros.

Supplemented by the Migrant Labor Agreement of 1951 with Mexico, Public Law 78 set the new, but little altered, guidelines the Bracero program operated under for the next

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[32] Rasmussen, History of the Emergency Farm Labor Supply Program, 224-26.

[33] Ernesto Galarza, Merchants of Labor: The Mexican Bracero Story (Charlotte: McNally & Loftin, 1964), 48-51; George Otis Coalson, The Development of the Migratory Farm Labor System in Texas, 1900-1954 (San Francisco, Calif.: R and E Research Associates, 1977), 95.

[34] Coalson, Development of the Migratory Farm Labor System, 78-88. Galarza, Merchants of Labor, discusses the wetback issue in greater detail and its relation to the Bracero program.

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decade. Congress failed to extend Public Law 78 past 1964, thus bringing an end to the Bracero program and its foreign worker program. Although growers feared its end—cotton had been responsible for 60 percent of Bracero employment—the successful mechanization of harvesting by the 1960s largely eliminated the need for seasonal laborers.[35]

Although after World War II many of the seasonal workers in cotton fields were Mexican or Mexican-American, a number of the year-round and owner-workers remained Anglo.[36]

This section only briefly describes the ethnic groups found in the fields of the Cotton West. Historians need to more closely examine these groups and their role in the overall agricultural labor force of the American West, not just in the limited harvest-period that many historians have already explored. At the same time, however, it is equally significant to examine labor needs and issues from the perspective of the agricultural producer—how much labor was needed, when and what it was needed for, and how much did it cost?

Cotton Labor Wages

With this understanding of who the laborers of the fields were, the final matter to consider is how much they were paid, their typical pattern of work during the year, and in some instances how farmers manipulated laborers and wages. This issue is somewhat more tricky, as a general lack of sources makes it difficult to summarize this information for the Cotton West as a whole, for any of the smaller regions, or in particular to trace some changes over time. Variations appear between the regions because of idiosyncrasies in state policies, local customs, and wage rates for harvesting cotton. Most contemporary writers and historians focused only on the latter. Thus one can say more about harvest wages than wages

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[35] Galarza, Merchants of Labor, 72-74; Kitty Calavita, Inside the State: The Bracero Program, Immigration, and the I.N.S. (New York: Routledge, 1992), 43-45; Linda C. Majka and Theo J. Majka, Farm Workers, Agribusiness, and the State (Philadelphia, Pa.: Temple University Press, 1982), 158-66. Congress pushed back the expiration date of Public Law 78 several times during this period but finally decided to allow it to expire at the end of 1964.

[36] Joe R. Motheral, William H. Metzler, and Louis J. Ducoff, Cotton and Manpower: Texas High Plains, Texas AES Bulletin No. 762 (1953), 8-23. A small exception to this was Pinal County, Ariz., where local Papago and Pima Indians were around 25 to 30 percent of the local labor force, both as seasonal and year-round workers. George W. Campbell Jr., Pinal County Agriculture, Arizona AES Circular No. 269 (1959), 12-13.

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at other times of the year. What is clear is the increasing role the federal government played in attempting to influence or control cotton wages.

From what few sources are available, one can reasonably propose that wages for chopping cotton and for other seasonal pre-harvest farm work (both paid by the hour) appear to have been fairly constant over time and across all parts of the western cotton belt. They also seem to have had similar "adjustments" based on skill and ethnicity.

The base wage rate prior to World War II appears to have been between twenty and thirty cents an hour. Two Arizona reports (1928 and 1930) included crop production costs estimated at thirty cents, noting that this would be a few cents higher than what "Mexican help" would receive and a few cents lower than what "skilled men" could get. A New Mexico report of the same period used twenty-five cents for general wages. Another study corroborates a lower wage in New Mexico for Mexican workers than for other workers, reported as seventeen cents an hour. Arizona tractor operators' wages ranged from $2 to $3 a day (twenty-two to thirty-seven cents an hour, depending on the length of the workday). Finally, an Oklahoma costs study used rates of twenty-five cents and fifteen cents an hour for 1929 and a depressed 1931 respectively, noting that overall wages had decreased 40 percent from 1929 to 1932 in this drought-stricken region.[37]

The prevailing wage for chopping cotton in the San Joaquin Valley was a subject for debate during the 1930s New Deal relief programs. The prevalent wage of twenty cents an hour was lower than what relief programs provided. This circumstance created a situation where recipients were unwilling to get off welfare rolls and resulted in a labor pinch for growers. In 1939 labor unions sought thirty cents an hour for field work, while the government asked for 27.5 cents. Few growers budged from twenty cents throughout this period, though some growers did pay twenty-five cents during the 1938 season, still below the welfare rate. Every year the chopping season would end before the government or labor

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[37] Brown and Cassmore, Migratory Cotton Pickers, 52; S. P. Clark, Cost of Producing Field Crops in the Salt River Valley, Arizona, 1928, Arizona AES Bulletin No. 139 (1931), 653; R. L. Matlock, Production Costs and Returns From Major Salt River Valley Field Crops, 1928-1930, Arizona AES Bulletin No. 146 (1934), 9; L. H. Hauter, A. L. Walker, and O. V. Wells, Production Requirements, Costs, and Returns from Dry-Land Farming in Eastern New Mexico: Part II of Economics of Agriculture on Dry-Land Farms in Eastern New Mexico, New Mexico AES Bulletin No. 187 (1930), 29; Edwin J. Foscue, "The Mesilla Valley of New Mexico: A Study in Aridity and Irrigation," Economic Geography 7(1) (January 1931): 16; P. H. Stephens, Farm Production Costs in Oklahoma, Oklahoma AES Bulletin No. 208 (1933), 51.

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unions could gain any concessions. Thus growers frequently got away with paying very low wages, usually even lower than the prevalent welfare rate during the New Deal.[38]

Overall, reports of non-harvest work wages on cotton farms are few in number prior to World War II, although there is vast data on general agricultural laborer wages.[39] Based on the extant information, one can generalize that most paid cotton laborers (but not family labor) received between twenty and thirty cents an hour. Skilled hired hands received five to ten cents an hour more, and Mexican laborers (and likely other ethnic minorities) got five to ten cents an hour less than that.

A simple summary of harvest wages or hiring practices and preferences in the West is not as easily accomplished, however. The historical record shows wide variations each year and in each state and production region. Table 3 presents statewide averages for wages for picking cotton and, as such, is subject to some inaccuracy when considering specific production regions. The local variations, however, must be examined individually.[40]

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[38] Bryan Theodore Johns, "Field Workers in California Cotton" (Master's thesis, University of California, Berkeley, 1948), 89, 113-18; Helen Dunlap Packard, "The Social Welfare Problems of Migratory Workers in the Cotton Industry of the Southern San Joaquin Valley during the 1937 and 1938 Seasons" (Master's thesis, University of Southern California, 1939), 49. None of these figures, when applied to longer-term or hired-hand workers, includes the in-kind value of landowner supplied housing.

[39] I analyzed general agricultural wages for the western cotton states as reported in "Farm Labor Wage Rates Per Day Without Board, 1866 to Date," Crops and Markets 19 (July 1942): 151-52. General agricultural labor wages are not included in the text for two key reasons. First, data is reported as statewide averages for all crops. Sources on crop-specific wages are very difficult to locate, if indeed they were ever recorded. An example is cotton-picking wages, which were not recorded in their own category until 1924 (table 3). Second, the data presented for seasonal labor in the Crops and Markets article was reported as "per day" wages. Farmers often hired cotton choppers by the hour in the West rather than by the day, hence I presented the information in the text in that fashion. While one could compute a per-hour rate based on that information, the length of a workday often varied depending on crop, locale, and time of year. A supporting example of a similar reporting problem is in table 1 in E. D. Tetreau, "Profile of Farm Wage Rates in the Southwest," Rural Sociology 4(1) (March 1939): 37. Tetreau, reporting from a USDA Bureau of Agricultural Economics study, gives side-by-side state averages for per month and per day farm wages. Dividing the per day rate into the per month rate, one finds that a California month had approximately twenty-four days, a Texas month had about twenty-three days, and a Georgia month had around twenty days. The identical problem would occur with per day and per hour wages, depending on whether the "day" had eight, nine, ten, or some other number of hours per workday.

[40] In California for example, the Agricultural Labor Bureau (ALB) rate, which was set and followed by producers in the San Joaquin Valley of Central California, was routinely a nickel to a dime less than the state average. Thus the state average likely reflects the higher wages offered to pickers in the Imperial Valley of Southern California. Similar kinds of disparity, likely on a grander scale, were found in Texas where there are several distinct cotton production regions (East Texas, Blackland Prairie, Lower Rio Grande Valley, Far West

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Table 3. Average Wage Rates for Picking 100 Pounds of Seed Cotton, 1924-1942 (in dollars)

State	1924	1925	1926	1927	1928	1929	1930	1931	1932
California	1.55	1.65	1.55	1.47	1.46	1.45	.89	.50	.45
ALB	--	--	1.25			1.45			.45
Arizona	1.60	1.75	1.45	1.53	1.50	1.50	.89	.58	.50
New Mexico	1.40	1.40	1.16	1.30	1.22	1.25	.68	.43	.44
Texas	1.48	1.33	1.20	1.24	1.21	1.11	.71	.44	.45
Oklahoma	1.48	1.60	1.28	1.40	1.28	1.22	.73	.45	.48
United States	1.25	1.27	1.11	1.12	1.10	1.06	.63	.41	.42

State	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942
California	.65	.90	.90	1.00	.95	.75	.85	.95	1.30	1.90
ALB	.60/ .75	.90	.90	1.00	.90	.75	.80	.85	1.25	
Arizona	.67	.90	.90	1.10	.85	.80	.90	.93	1.45	2.45
New Mexico	.55	.65	.65	.70	.70	.60	.65	.68	1.20	1.75
Texas	.55	.60	.60	.65	.65	.55	.55	.58	1.10	1.45
Oklahoma	.65	.75	.70	.75	.75	.70	.65	.72	1.20	1.50
United States	.53	.60	.58	.69	.69	.57	.58	.62	1.09	1.41

Sources: State and U.S. averages compiled from: "Average Wage Rates for Picking 100 Pounds of Seed Cotton," Crops and Markets 18 (November 1941): 257; and "Wage Rates: Average Rates for Picking 100 Pounds of Seed Cotton, by states, up to November 1, 1933-51," Crops and Markets 29 (1952). Rates set by California's Agricultural Labor Bureau (ALB) are from Weber, Dark Sweat, White Gold, 41-42; Johns, "Field Workers in California Cotton," 99; and Senate Committee, Violations of Free Speech and Rights of Labor, 502-4, 515. The 1933 California ALB rate of sixty cents was the initial agreement (see text), but an arbitration agreement during the cotton pickers strike ordered the rate raised to seventy-five cents (Senate Committee, Violations of Free Speech and Rights of Labor, 210-11).

Note: Wages for picking cotton were paid piece rate rather than by the acre, hour, or day, so pickers who could pick more, as much as two hundred pounds above average, could earn more each season. The prevalent wage rate is measured as some number of cents per one hundred pounds of picked cotton. Unless otherwise noted, the noted wage is against this standard. This allows for some comparison of prices between different regions, though there were variations in price and the amount of cotton picked based on the variety being harvested or the method being utilized (picking or snapping). Federal agencies did not collect data on cotton-picking wages for years prior to 1924.

Texas, the High Plains of West Texas, and the Rolling Plains), some of which are not in the scope of this paper and each of which had fairly distinct wages based on local conditions each year. Wages in Oklahoma also saw similar disparities from east to west across the state.

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The somewhat sporadic nature of early cotton farming in California when it did not have an established labor force made picking tricky and costly. Nineteenth-century producers attempting to raise cotton commercially in California abandoned their efforts because of high labor costs. The labor costs in early USDA tests in the Imperial Valley in the early 1910s almost stopped California cotton again before it started for the same reason. Traditional short-staple cotton in the Imperial Valley was picked for $1 to $1.25 per hundred pounds, about average for the industry. The long-staple variety being tested, though, commanded $3 per one hundred pounds. Until about 1917, with the importation of Mexican labor, picking wages in the Imperial Valley remained above $1. The opening of the San Joaquin Valley to cotton in the 1920s increased the wage in that area to as high as $1.65, thus encouraging many Mexican migrants to move north.[41]

Faced with the steadily increasing wages in the San Joaquin Valley, a devastating financial loss from the 1925 harvest, and seeking to centralize as many aspects of labor management as possible, California cotton producers gathered to create the Agricultural Labor Bureau (ALB) in 1926. The ALB helped organize and manage labor for all the San Joaquin Valley crop needs. Of particular interest to cotton farmers, the ALB met twice a year—just before the chopping and harvesting seasons—to set a standard rate to be followed throughout the valley. Individual farmers could deviate a little bit based on local conditions. In the first year (1926), the ALB dropped harvest wages to $1.25 per hundred pounds. It successfully maintained its set rate each year through 1949 except during the strike years of 1933 and 1937.[42]

The repatriation, deportation, and anti-Mexican immigration policies adopted in 1929 set part of the backdrop for the massive 1933 cotton strike. These policies caused much resentment among the remaining Mexican workers, leading more Mexicans to join the Cannery and Agricultural Workers Industrial Union (CAWIU) in the early 1930s. The ALB

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[41] McLachlan, History of the Cotton Industry, 21-22; Weber, Dark Sweat, White Gold, 62-63.

[42] Weber, Dark Sweat, White Gold, 37-41; Johns, "Field Workers in California Cotton," 44. For more information on the cotton labor situation in California and Arizona in the 1920s and 1930s, see Senate Committee on Education and Labor, Violations of Free Speech and Rights of Labor, 77th Cong., 2d sess., 1942, S. Rept. 1150, particularly pp. 208-12 and Part IV, Section 2, Ch. 2, "Associations in the Cotton Industry," pp. 496-533. This report is sometimes referred to as the LaFollette Report, named for the senator who chaired the committee and the hearings on this topic.

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exacerbated the conflict by setting the standard wage for the 1933 harvest at sixty cents per hundred pounds. The CAWIU sought, among its many conditions, a wage of $1. With California growers unwilling to compromise, the CAWIU called a strike in September 1933. Depending on the area of the state, between 75 and 95 percent of the strikers were Mexican. The conflict lasted twenty-seven days; the Mexican, Californian, and American governments worked together to resolve it. Growers were caught completely by surprise, expecting a short strike and an ability to easily replace the striking workers. However, they were unable to import sufficient numbers of people to harvest the crop. Violence ensued, as the growers became vigilantes. A federal mediator, brought in after successfully settling a 1933 Arizona strike, convinced the CAWIU to resume work at sixty cents with the growers' promise to raise the wage if market prices improved. Eighty percent of the strikers agreed, but the remaining 20 percent continued to hold out, seeking at least eighty cents per hundred pounds.[43]

The previously discussed debate about 1939 wages for cotton chopping helped set the stage for a strike later that year in the San Joaquin Valley. The union, unhappy that growers would not meet even the government's proposed wage, much less theirs, attempted to strike during the brief chopping season. However, the 1939 season ended before anything could happen. Later in the year the ALB set the fall harvest rate at eighty cents per hundred pounds. The strikers demanded $1.25 and had moderate success for a few days. Violent confrontations erupted, though, and police arrested many striker-picketers. Growers broke the strike in late October after about six weeks, forcing workers to take eighty cents or nothing. The failed strike sharply hurt remaining union interests and the rebellious strikers, forcing them to concede to the ALB rate of eighty-five cents in 1940 without protest. The onset of World War II raised wages the next year to $1.25, the highest level since 1929. Wages in California continued to increase during the war, reaching as high as $3.50 as Mexican workers reentered the fields en masse. The average wage rate for picking cotton was reported at $2.25 for 1945 in a summary of wartime wages and income.[44]

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[43] Weber, Dark Sweat, White Gold, 77-79, 97-111; Johns, "Field Workers in California Cotton," 56-57.

[44] Johns, "Field Workers in California Cotton," 125-47. Gregory (American Exodus, 183) notes that the prevailing wages were above the standard rates in 1940 and 1941, at $1 and $1.50 respectively. This was likely true for the rest of the war years as well. The 1945 data is from "Wartime Wages, Income, and Wage Regulation in Agriculture," Monthly Labor Review 63(1) (July 1946): 42.

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Arizona cotton growers were highly dependent on outside labor from the beginning of commercial farming in the twentieth century. The sparse local population left a low natural labor reserve. Many of the available workers, mostly unemployed industrial employees, did not have the skills to pick cotton. Further, the low wage being offered was insufficient to encourage locals to work in cotton. Thus, Arizona producers often advertised or recruited extensively to get their harvest labor. They depended on the same sources of Mexican laborers as their California neighbors until restrictions were put in place in 1930. The Anglo-American migrant labor stream coming from Oklahoma and Texas replaced the Mexicans. Emigrants often viewed Arizona as a first stop on the way to the fields of California. Fifty-four percent of these migrants came from Oklahoma in 1937, and 17 percent came from Texas. The most important factor in choosing to stop in Arizona, cited by 24 percent of respondents in a survey, was the extensive advertising by cotton growers that targeted Oklahoma and Texas residents. Some had heard rumors of good cotton and good wages, particularly in letters from family or friends, while others simply stopped because of local billboards and signs advertising jobs. Cotton growers' associations also participated in the statewide Farm Labor Service, which helped recruit and shift workers around during the harvest period. Unlike California, though, the associations did not set a prevailing wage each year. The average wage in Arizona ranged from $1.50 per hundred pounds in 1928 and 1929 to fifty cents three years later, recovering to eighty cents or higher after 1934 (see table 3).[45]

The situation in New Mexico looked significantly different from that of Arizona and California, partly because there was a greater resident Mexican population in many of the cotton-producing areas. Prior to World War II many of the migrant laborers in the state were Anglo Americans who worked in New Mexico, Northwest Texas, and Southwest Oklahoma. These migrant families were smaller, averaging 4.5 members. Thus they were usually just nuclear families, with 70 percent of the children over age ten working at some point during the year. Producers in the Mesilla Valley along the Rio Grande tended to use more Mexican workers, particularly from Mexico, either legally or illegally. This area, as well as the lower Pecos River Valley near Carlsbad, saw lower wage rates, typically around sixty cents per

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[45] Brown and Cassmore, Migratory Cotton Pickers, xx, 29-30, 68-74; Shapiro, "Cotton in Arizona," 89; Packard, "Social Welfare Problems," 49-50. Also see data in table 1. Packard notes that California and Arizona had maintained the highest picking wages for several years, coming in well above the U.S. average.

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hundred pounds increasing to about seventy by 1940, because of the high numbers of Mexican laborers. Further up the Pecos River in Chaves County, where there were fewer resident Mexicans and more migrant Anglo-Americans, wages were typically five cents—and sometimes ten cents—higher. These wages were likely for harvesting Acala variety long-staple cotton. Pickers of Pima cotton, which had about twice the yield of Acala, received about twice as much, around $1.25. The New Mexico Farm Labor Service provided placement and local advertising services for all agricultural growers in the state.[46]

The years immediately leading up to World War II severely tightened the labor market in New Mexico. Previous migrants plus local rural laborers moved into larger communities or out of state to take advantage of higher paying industrial jobs. As a result, harvesting wage rates increased. Average cotton-picking wages of sixty-five cents per hundred pounds in 1939 rose to $1.95 per hundred pounds in 1945.[47]

Western Texas cotton growers came to rely heavily on Mexican migratory workers as their output increased. As cotton production expanded across Central Texas into the High Plains and Trans-Pecos regions, Mexican workers extended their migration pattern. Many started picking cotton in July around Corpus Christi on the Gulf Coast and moved north and west until they reached Lubbock or El Paso in October and November, where the picking season extended into January. The family laborers of owner-operators in both regions also worked the harvest. The average wage varied greatly from year to year, based on crop conditions. In 1929 workers got an average of $1.11 per hundred pounds. In 1932 they received forty-five cents. The rate fluctuated between fifty-five and sixty five cents between 1934 to 1938. Workers along the Rio Grande, particularly in the El Paso area, had the same problems with depressed wages and illegal labor found in the Mesilla Valley of New Mexico.[48]

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[46] Sigurd Johansen, "Migratory-Casual Workers in New Mexico," Appendix A in Migratory Cotton Pickers, by Brown and Cassmore, 83-91; Foscue, "Mesilla Valley of New Mexico," 15-16; Kistin, "Preliminary Report on Migratory Workers," 22, 25-26, 32.

[47] POWs in New Mexico Agriculture Project; "Wartime Wages, Income, and Wage Regulation," 42. This report corroborates the information reported for New Mexico in table 3.

[48] Selden C. Menefee, Mexican Migratory Workers of South Texas (Washington, D.C.: GPO for Works Progress Administration Division of Research, 1941), 27; Saffell, "Working in the Cotton Fields," 116; Gregory, American Exodus, 24; Packard, "Social Welfare Problems," 49-50; Foscue, "Mesilla Valley of New Mexico," 15-16.

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The Texas agricultural industry, like farmers in California, feared the possibility of restrictions on Mexican migrant immigration for the cotton harvests being considered by the federal government in the late 1920s. Customarily Texan recruiters brought Mexicans into the state on contract to pick cotton. With this avenue cut off by 1929, Texans moved to discourage native Mexican Texans and others from leaving to labor in agriculture in other states. In 1929 the state passed the Emigrant Agent Act to discourage transportation of Texas labor out of state. The law required recruiters from other states to post a $5,000 bond, pay an annual tax of $1,000, and pay a graduated tax in any county where they were recruiting. These requirements effectively terminated out-of-state labor contracting of Mexican and Anglo-American residents of Texas. They did not block, however, the kind of advertising that drew many Anglo-Americans of their own accord to Arizona and California as the drought and depression of the 1930s deepened. With this legislation Texas growers effectively developed their own "reserve army of labor," supplemented by Mexicans illegally crossing the Rio Grande to work in the state. This reserve kept cotton-picking wages very low—about fifty to fifty-five cents per hundred pounds through the 1930s, almost the lowest of any of the principal cotton-producing states. The wage rates finally began to rise during World War II (see table 3), increasing to $1.90 per hundred by the end of World War II.[49]

As the nation made the transition to war in the 1940s, the wages paid to cotton laborers were set less by market forces and more by a directed process. The U.S. government organized an Agricultural Wage Stabilization Program as part of various price control programs instituted during World War II. The objectives were to keep rates that would be adequate for retention and recruitment of farm labor, to encourage a general increase in agricultural wages, to reduce the disparities between agricultural and industrial wages, and to prevent agricultural wages from spiraling upwardly out of control because of inflation. State wage boards partly managed wage rates. Only in California did wages for cotton laborers reach a level where the wage board felt the rate needed to be capped—$3.00 per hundred pounds of cotton picked.[50]

[49] Menefee, Mexican Migratory Workers, 30-31; Gonzales Jr., Mexican and Mexican American Farm Workers, 11; "Wartime Wages, Income, and Wage Regulation," 42.

[50] Arthur J. Holmaas, Agricultural Wage Stabilization in World War II, USDA Bureau of Agricultural Economics Agriculture Monograph No. 1 (1950), 8-10, 40-45, 124, 131.

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Under the provisions of the federal Emergency Farm Labor Program, county farm wage boards, one member of which was the county agricultural extension agent, determined the wages for any agricultural work, transportation, and housing. The most important numbers to cotton producers were the prevailing rates for chopping and harvesting cotton. The prevailing wage rate was a principle required in the agreements for using POW laborers and foreign workers. In theory, the "prevailing wage" would ensure that all workers were paid fairly, regardless of who they were or from where they came. The reality may have been the opposite. Since the members of a wage board were drawn from farmers, farm organization representatives, the Farm Security Administration, and other local groups, the board determining the wages was sympathetic to keeping rates as low as possible. Thus, the "prevailing wage rate" became a federally permissive tool in controlling wages and likely kept wages lower than what they otherwise would have been in a free market.[51]

In the case of POW labor, farmers paid the prevailing wage rate to the U.S. Army. They retained most of the wages to cover the expenses of operating the POW labor program and the branch camps. The POWs themselves received eighty cents a day in canteen coupons or credited to a savings program, regardless of the type or quantity of work performed. There was little enticement for many cotton-picking POWs, so in 1944 the Army introduced an incentive of an additional forty cents a day to encourage German cotton pickers to increase their daily output. While this seems to be very little pay compared to prevailing wages in some areas that might be as high as $3 per hundred pounds of cotton picked, many POWs noted in years since that they enjoyed getting out of their camps to work in the agricultural outdoors.[52]

When Congress dissolved the Emergency Farm Labor Program, the local boards disappeared but the concept of the "prevailing wage rate" did not. The Bracero program agreements required that laborers receive a stipulated minimum wage or the prevailing wage. A 1951 Presidential commission found that, typically, farmers met at the beginning of a work season and determined a rate that "they hope they won't have to exceed" but not usually at a rate high enough to attract migrant laborers. As the season got underway, the wage might go higher for domestic workers if a labor shortage emerged, but Braceros only received the

[51] Rasmussen, History of the Emergency Farm Labor Supply Program, 71-72, 173-74.
[52] Schlauch, "Harvesting the Crops," 32; Hoza, PW, 99; POWs in New Mexico Agriculture Project.

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prevailing wage, which federal program officials had accepted and written into labor contracts at the beginning.[53]

The impact of this practice, both during and immediately after the war, was clear in the presidential commission's final report. During the war, in cotton states (including Texas) where Braceros were not used, picking wages rose between 166 percent and 236 percent. In California, however, where Braceros were used extensively, cotton wages had only increased 136 percent. Similarly in 1949 after the war, California was using only 8 percent of contracted Braceros nationwide and picking wages increased 15 percent, but Texas was using 46 percent of the workers and cotton wages decreased 11 percent. The commission concluded that the federal government had "not been successful in protecting domestic farm labor from detrimental effects of imported contract alien labor," which had resulted in depressed farm wages.[54]

Wage rates were influenced, in part, by the proximity to the Mexican border and the availability of "wetback" Mexican workers. Farmers in cotton-growing areas across the border needed seasonal laborers in similar fashion to those in the United States. Thus, there was a natural northward migration within Mexico. At the same time, cotton acreage in the U.S. expanded; the Lower Rio Grande Valley went from having 250,000 acres of cotton in 1945 to over 600,000 just four years later. As a result, the wage for ten hours of chopping cotton in that area in 1947 was $2.25, but it was above $5 in the Rolling Plains and High Plains of Northwest Texas and between $4 and $7 a day in Arizona. In 1950 cotton picking wages in the Lower Rio Grande Valley averaged $1.25 per hundred pounds, while the statewide average was $2.45. At the same time Arizona cotton pickers earned $3.10 per hundred pounds.[55]

There were similar discrepancies for general farm labor. In South Texas and the El Paso area, field workers were paid as little as fifteen cents an hour, but those in southern New Mexico and the Imperial Valley of California received up to fifty cents for the same work.

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[53] President's Commission, Migratory Labor in American Agriculture, 59-60.
[54] Ibid., 56-59.
[55] Ibid., 72-73, 78-79.

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Arizona workers averaged sixty-four cents, while northern California workers were paid eighty-eight cents an hour.[56]

The Presidential commission heard that farm employers in areas where (mostly illegal) Mexican laborers were less widely available believed this "unequal access" was unfair. A manager of an Arizona cotton co-op complained that if enforcement by the border patrol of illegal immigration "is going to be strict in Arizona, we want it strict in other states" to equalize the production costs of labor.[57]

Opposition to the Bracero program—as embodied in Public Law 78—steadily grew for a number of reasons in the late 1950s and early 1960s. Early in his administration, President John Kennedy directed that Bracero wages should be increased. For the first time, farmers (of all crops) were confronted with increasing labor costs that were starting to be beyond their control. Many feared that agriculture as they knew it would be ruined. Among cotton producers, however, the use of Braceros had been decreasing prior to the termination of the program in 1964, so cotton farmers ended up not being as severely affected financially as those in other crops.[58]

Conclusion

This discussion of cotton laborers suggests some vacancies in the historiography that need to be filled. First is the obvious reminder that without all the different types of laborers, there would have been no cotton to harvest in the American West. Previous studies of western laborers have touched on only part of the story of raising cotton, and few have done more than that for any other agricultural industry—wheat, truck crops, or even some processing. Many stories can yet be told more completely.

Second, this examination suggests that the alternative viewpoint from a crop-labor perspective, rather than an ethnic-labor perspective, is equally justified and important. Historians should pursue a similar analysis for other agricultural commodities in the American West. Those individuals will find that, as with the cotton laborers, the labor story

[56] Ibid., 79.
[57] Ibid., 83.
[58] Majka and Majka, Farm Workers, Agribusiness, and the State, 158-166.

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of crop production is much deeper and more complicated than most people have previously considered.

The transitional mechanization of cotton harvesting and the end of the Bracero program mark an end to the traditional discussions about cotton labor in the West. From that point forward, the Cotton West became markedly different from its historical past. With changes occurring in the culture of the traditional southern cotton belt, the development of the Cotton West and the Cotton South became a unified story.

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CHAPTER VI
COMPARISONS AND CONCLUSIONS

As we have seen to this point, the evolutionary development of the Cotton West in the early and mid-twentieth century resulted from many factors. Nearly all of these are in direct contrast with what was occurring in the traditional Cotton South for the same period, particularly prior to the New Deal Era. This chapter will first explore the differences and similarities in American cotton production between the two regions. Once the Cotton West became well established, the differences begin to disappear and both West and South are equally affected by federal regulations, marketing needs, and world competition in cotton and synthetic fabrics after World War II—the signs of a unified, American cotton industry. Finally, I will briefly consider some of the connections between this history of the Cotton West and the studies of other areas of the American West.

The Cotton West in Summary

In this work I have called attention to several conditions that materially influenced the establishment and expansion of the Cotton West. For nearly all of the areas where cotton was and is grown, the introduction of cotton farming often coincided with the establishment of Anglo settlement. That is not to say that no residents lived in these areas previously—often there were American Indian or Spanish communities that practiced forms of subsistence agriculture as much as several hundred years ago. Likewise, one cannot suggest that when Anglos came, so did the cotton. Instead, the new emigrants to an area in the mid- to late nineteenth and early twentieth centuries often were inquisitive, seeking crops that they could produce and that had a market for them. They often found that while they might be able to raise cotton, there were problems with growing, harvesting, or marketing it, thus making it impractical at the time.

Water and irrigation are among the key ingredients in their farming efforts. New settlers produced relatively little in areas like the Salt River Valley, the Yuma Valley, or the Rio Grande Valley until the federal government built a major irrigation system through reclamation programs. Other areas, like portions of the San Joaquin Valley, the Casa Grande Valley of Arizona, and the High Plains of Texas depended on underground water to sustain

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their crops. Until it was economical to pump water from below, the cotton farming in these areas was somewhat limited unless they could make it as dryland farmers (as many did on the High Plains for the first thirty years).

The key players in developing a western cotton industry were the researchers and scientists of the U.S. Department of Agriculture and their partners in state land-grant colleges and agricultural experiment stations. As new settlers developed areas of the West and irrigation sources became available, the USDA and state experiment stations often followed in their wake. As a general rule these government agencies investigated what the best crops were for a given locale, the best ways to raise and irrigate them, and how they could be marketed. But as I have shown throughout this dissertation, the USDA was particularly eager to establish a new cotton industry in the West—one that would not duplicate but instead supplement that of the South and, in turn, contribute to the wealth of new settlers and the American economy. State agricultural researchers may not have explicitly had the same goal, but they acted in concert with the USDA. In the end their efforts proved successful.

While researchers played many roles in investigating crop-growing practices, their most significant chore was the government-sponsored efforts to breed new varieties of cotton specifically suited to each region of the Cotton West. As shown in Chapter Two, much of this involvement can be traced back to the USDA's efforts investigating Mexican cotton plants to combat the boll weevil and introducing Egyptian varieties of long-staple cotton. The evolutionary development of California Acala varieties by federal scientists, along with the breeding work by state researchers behind New Mexico's 1517 and High Plains stormproof stripper cottons, became the basis for much of the modern cotton industry throughout the entire American West.

With stable varieties of western cotton available for farmers, the march toward mechanization became the next important area of study for farmers and researchers alike. Farmers were interested in any method or equipment that could allow them to expand production, cut their costs, and increase profits. Scientists at USDA and state facilities examined every aspect—from economics to the best crop practices (like the ideal location in the ground to place that seed) to how emerging technologies could be applied to cotton farming. Some of the most meaningful work involved the mechanization of harvesting

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cotton. At times this involved simultaneously improving the equipment while making genetic modifications to cotton plants so the two worked well together.

Changes in technology and the available labor force were constant challenges for western cotton producers. The nature of production meant that farmers needed seasonal, often migratory, labor at particular times of the year, especially at harvest time. Federal immigration policy often affected which ethnic groups were available—Asians prior to the Exclusion Act and Mexicans before and after the period of mass deportations in the 1930s, for example. During the Great Depression producer groups recruited Anglo emigrants fleeing the Great Plains, seeking better conditions in western industry as a labor source. As these sources shifted again during World War II, they looked to emergency workers, including urban women and children and foreign Prisoners of War, for help before they increasingly shifted to mechanized harvesting equipment.

Some Points of Comparison

By mid-century much of the Cotton West had become firmly established and fairly stable. But while the early twentieth century marked a period of industry building for the Cotton West, it was a period of industry instability and transition for the producers of the Cotton South. As related in Chapter One, the South did not fundamentally transform from its post-Civil War cycle of sharecropping and tenant farming until the 1930s. Only then did it slowly change and emerge in the post-World War II period as a new Cotton South. These widely varying developments between the two ends of the American cotton industry offer many points for contrast and comparison.

The fundamental difference between the South and the West is climate and irrigation. Temperatures in the South are more moderate, and the frost-free growing season is typically at or above 260 days. In the West the season is typically shorter (closer to 200 days in most areas), but the temperatures particularly in summer are higher. Where the typically average rainfall of much of the West is from ten to twenty inches, in the South it is between thirty and fifty inches. For the humid cotton belt, "The best weather conditions for cotton production are found where a mild spring with light but frequent showers merges into a moderately moist summer, warm both day and night, followed by a dry, cool, and prolonged autumn." In the arid West farmers had generally dry years with hot summer days and cool nights, and

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applied irrigation just when cotton needed it. This continues to be true, even today. One writer cites that the widespread availability of aluminum pipe after World War II was taking an "increasing place in the agriculture of the humid areas." Pipe irrigation became common in many crops where cheap water was available in the United States, principally for berries and vegetable crops, but also to a lesser extent for cotton and other field crops.[1]

Another fundamental difference resulting from geography prior to World War II was the relative lack of pests and disease affecting cotton in the West as compared to the South. The traditional cotton belt was substantially affected by the Mexican boll weevil, but it never became a factor in the West.[2] Producers were not so lucky with the pink bollworm. While it followed a similar track as the boll weevil early in its spread, state and federal officials successfully warded off the pink bollworm for several decades using a system of agricultural quarantines and eradication research. Eventually the pink bollworm made its way into the Southwest via the cotton fields of northern and northwestern Mexico, causing similar actions and research to take place in the West after about 1940.[3]

The roles and actions of the federal government in cotton agriculture in the West are vastly different from what they did in the South. The USDA played a central role in establishing what they considered a new, long-staple cotton industry in the West—one that would not compete with the Upland cotton industry of the South. They and their counterparts in state experiment stations developed that industry by extensive research and breeding work to introduce cotton varieties specifically suited to each region where they were encouraging farmers to grow cotton. Similarly, scientific research in mechanization and equipment led to improved machinery and farming practices. To a lesser extent, their involvement in irrigation projects is what made agriculture possible in so many areas of the Southwest. Lastly, the federal government heavily influenced labor practices through the

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[1] Oliver E. Baker, "Agricultural Regions of North America: Part II—The South," Economic Geography 3(1) (January 1927): 67-69; William L. Cavert, "The Technological Revolution in Agriculture, 1910-1955," Agricultural History 30(1) (January 1956): 21-22.

[2] Not until the 1990s that the boll weevil was able to adapt enough to spread northwest and threaten cotton production on the Texas High Plains—a period of about a hundred years. By 1922 it had spread throughout the furthest reaches of southern cotton fields, taking only about thirty years to complete its journey.

[3] Hae-Gyung Geong wrote about how the system of quarantines for the pink bollworm became a model for fighting and eradicating insect pests for other crops. "The Pink Bollworm Campaign in the South: Agricultural Quarantines and the Role of the Public in Insect Control, 1915-1930," Agricultural History 74(2) (Spring 2000): 309-21.

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exercise of various immigration policies and wage support systems; one can debate whether the efforts were intentional or beneficial.

In contrast, Gilbert Fite suggests that the federal government played important roles in three aspects of southern agriculture: reducing cotton acreage, supporting soil conservation practices, and expanding rural credit. New Deal policies on cotton production, he says, were the initial catalyst to altering the long-established relationships between land and people. Payments through the AAA and soil conservation programs provided needed cash but only to landowners, not their sharecroppers or tenant farmers. These, in turn, helped stabilize credit and capital, which farm owners used to mechanize, diversify, and improve their farm practices.[4]

One can attribute the actions of federal officials and the USDA to different motives. In the West they looked to establish a new industry and expand the opportunities and wealth for new farmers to the region. In the South the USDA sought to break a dangerous cycle of rural poverty and farming practices that proved harmful to soils, marginal lands, destitute residents, and market prices. The problems and goals for each region simply had little to do with the other.

There is also a marked contrast in the results and effectiveness of research and advice dispensed by agricultural colleges, experiment stations, and the USDA. Producers on new western cotton farms appear to have been very interested, if not at times dependent, on what federal and state scientists and researchers learned and reported. These researchers were heavily involved in cotton breeding activities that fundamentally shaped the form of the western cotton industry. Their colleagues in the South, however, were less successful. "The influence of these institutions on the practices of ordinary farmers prior to the 1940s had been meager at best," wrote Fite. Whether by choice or inability to change, most southern farmers had been unwilling to accept principles of scientific farming and management. All

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[4] Gilbert C. Fite, "Southern Agriculture Since the Civil War: An Overview," Agricultural History 53(1) (January 1979): 16-17. This is not to say that the USDA and state agencies were not active in breeding efforts in the South. The impetus in the first place for investigating Mexican cottons was to find strains and varieties with immunity to the Mexican boll weevil. An equally significant partner, though, was private seed companies like the Delta and Pine Land Company in Mississippi, which had the facilities and economic incentives to improve cotton varieties and pass them on to their farm customers. See for example the discussion in C. Wayne Smith et al., "History of Cultivar Development in the United States," in Cotton: Origin, History, Technology, and Production, edited by C. Wayne Smith and J. Tom Cothren (New York: John Wiley & Sons, Inc., 1999).

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along, the recommendations and demonstrations of state and federal researchers were most useful to larger, more commercial operators, and of little help to the more typical small, inefficient cotton farmer. By mid-century, whether by explicit intent or not, only the larger farm businesses operating on a larger scale of economy survived in the South. Since there never were many small farmers in the West, the farms there had almost always been the same—larger outfits able to take advantage of the latest advancements in science and technology to maximize their production. The producers of the Cotton South and the Cotton West had become very similar agricultural businessmen.[5]

Mechanization is a topic that begins as an area of contrast between the West and the South. Eventually, though, it slowly evolves to be a process common to both regions. Economists Moses Musoke and Alan Olmstead wrote a comparative analysis of the California and southern cotton industries in 1982. Their results generally apply as a comparison of the Cotton West and the Cotton South. Overall, they found that California cotton farms adopted tractors and mechanical equipment earlier and in greater numbers than did southern farms. The larger size of cotton operations and more intensive use of tractors were fundamentally different forms of labor use and organization than the traditional system that dominated in the South. The authors also noted that agricultural labor relations in California (but not usually the rest of the West) tended to be more frequent, widespread, and sometimes violent disputes. The tenant-and-sharecropper system of the South probably caused most farmers there to acquiesce to the demands of landowners and merchants. The scarcity of labor provided a reason for mechanization, likely in both areas. In the end, California led the country in mechanizing cotton picking and was the first state to achieve total mechanization. But at any level or type of mechanization, California's "lead" was typically only five to ten years over other states, and never exceeded thirteen years. By all accounts, "California offered an ideal setting for mechanization." While other historians and economists mention smaller production units, relatively cheap labor, and ignorance of farmers as reasons for the delay, Musoke and Olmstead point out that portions of the Mississippi Delta had many early adopters of mechanized technology. Their findings, however, questioned the traditional notion that mechanization of southern cotton production

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[5] Fite, "Southern Agriculture," 20-21.

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was substantially delayed. They called for additional research into these issues. This dissertation shows, at least in part, that the influences of state and federal agencies may have played an important role in helping advance mechanization and the general state of cotton agriculture in the West, one that was retarded for many years in the South by preexisting and continuing economic problems and conditions.[6]

The availability of cheap workers for field labor is another common ingredient in both the Cotton West and the Cotton South, as were the racist overtones and treatment. The ethnic groups were completely different, though. In the South it was African Americans, a native remnant of the antebellum system of slavery. With their freedom after the Civil War they became part of the sharecropper class of citizenry or unemployed farm workers of southern culture and rural life. In the West the largest group of cheap laborers was Mexicans and Mexican Americans, either long-term immigrants or relative newcomers from the country neighboring many of the Cotton West regions to the south. Cotton producers often discriminated against Mexicans, who were more often utilized as day laborers and harvesters, in the wages offered and in their attitudes toward the West's version of second-class citizens.

Both regions also had their share of labor migrations, although the patters were much more pronounced in the West. At several times in the history of the South, notably the 1910s and before and after World War II, African Americans left southern farms for better opportunities in the North, frequently in industry. The West is more noted for having its shifting patterns of migratory labor, often people who harvested cotton as the growing season shifted from one area to another. Like the South, the West saw a large migration of people seeking better opportunities—the so-called "Okies," Anglo-American emigrants from the Southern Plains headed west to California cities during the Great Depression. In both regions the mechanization of cotton production both influenced and was influenced by the presence and departure of these laborers.

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[6] Moses S. Musoke and Alan L. Olmstead, "The Rise of the Cotton Industry in California: A Comparative Perspective," Journal of Economic History 42(2) (June 1982): 394-412. Two other noteworthy and near contemporary studies make broad comparisons of mechanization and progress in the southern and western cotton belts. These are John Leonard Fulmer, Agricultural Progress in the Cotton Belt since 1920 (Chapel Hill: University of North Carolina Press, 1950); and James H. Street, The New Revolution in the Cotton Economy: Mechanization and Its Consequences (Chapel Hill: University of North Carolina Press, 1957).

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Common Problems for an American Cotton Industry

A key tenet of the thesis and timeline of this dissertation is that similar practices and problems identify and differentiate the new Cotton West as a region from the traditional Cotton South. As cotton farming in the West became a permanent institution and southern agriculture began transitioning from its entrenched sharecrop-and-tenant system of cotton production in the 1930s and 1940s, the problems and influences equally affected the industry of both regions—one that analysts and producers increasingly identified as an American cotton industry.

In identifying the first matter that has an effect on the entire industry with uniformity, one likely would conclude that it was the national agricultural programs of the New Deal. Earlier I described how New Deal economic programs affected and even instigated many of the changes in the Cotton South. Efforts made by federal authorities through the Agricultural Adjustment Act, the Soil Erosion Service, and other agencies transformed cotton farmers everywhere; their immediate influence was more notable in the South, though crop-reduction and parity-pricing programs had long-term ramifications for farmers throughout the country.

Overproduction, under-consumption, and low market prices influenced President Roosevelt and Congress to adopt the original Agricultural Adjustment Act in 1933. The law paid farmers to reduce their acreage and production of several commodities, including cotton. They could only receive commodity checks if they complied with the program's full provisions. Since the law was signed after the cotton planting period had passed, the first year saw 10.4 million acres of cotton plowed up, mostly in the South. Congress soon modified the program through the Soil Conservation and Domestic Allotment Act, authorizing the Agricultural Adjustment Administration to pay farmers for enacting soil conservation or soil-building practices. Subsequent amendments to the Agricultural Adjustment Act provided crop insurance, marketing controls, and price-support loans. These provisions became the foundation of American agricultural policy, largely unchanged until the Freedom to Farm Act in 1997.[7]

The cotton reduction programs associated with the Agricultural Adjustment Administration were more successful in the South than in the West. Producers signed up

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[7] R. Douglas Hurt, American Agriculture: A Brief History (Ames: Iowa State University Press, 1997), 288-291.

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over 70 percent of cotton acreage in the South, whereas California came in last at 20 percent. Most individual growers only agreed to contract somewhere between 25 and 50 percent. In 1934 the Bankhead Act, more commonly referred to as the Cotton Control Act, authorized compulsory limitations of cotton crops and provided crop and marketing quotas for states and growers. Any cotton grown in excess of the set allotment was taxed. Although farmers took marginal cotton acreage out of production, improved methods of cotton culture meant that cotton production remained relatively high. The onset of World War II and post-war marketing programs eventually helped alleviate and mitigate the problems of cotton surpluses and market prices.[8]

In the 1940s synthetic fibers like rayon and nylon became a major competitor to the cotton industry. Rayon is a manufactured fiber produced from the cellulose fiber of wood pulp or cotton linters, the small fragments of thread removed from cottonseed during the delinting process. An extruded material can be formed into thread and fabric very similar to cotton. Nylon is derived from chemicals in coal, water, petroleum, and agricultural by-products. Nylon, too, can be formed into fibers and fabrics, and many consider it superior to natural fabrics. In 1942 world production of rayon alone was 3.4 billion pounds, the equivalent of over 8 million bales of cotton. At that time American cotton production totaled about 1.7 million bales. In 1943 rayon represented 10.6 percent of the fiber market. The price per pound of synthetic fibers was constantly getting cheaper, so they were slowly taking over the textile fabrics market. In the mid-1950s when rayon cost twenty-six cents to produce and cotton cost thirty-two cents, rayon had a six- to ten-cent market advantage in price. At the same time the amount of research money being spent on development and expansion synthetic fibers (like nylon) exceeded research on cotton by more than four to one. Because of this shift, many textile mills switched from cotton to the man-made substitutes.[9]

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[8] Timothy Curtis Jacobson and George David Smith, Cotton's Renaissance: A Study in Market Innovation (Cambridge, U.K.: Cambridge University Press, 2001), 87-94; Franklin C. Erickson, "The Broken Cotton Belt," Economic Geography 24(4) (October 1948): 265-67. Several historians have examined the impact of the AAA cotton program. These include Keith J. Volanto, Texas, Cotton, and the New Deal (College Station: Texas A&M University Press, 2005); Henry I. Richards, Cotton and the AAA (Washington, D.C.: Brookings Institution, 1936); and Fred C. Frey and T. Lynn Smith, "The Influence of the AAA Cotton Program Upon the Tenant, Cropper, and Laborer," Rural Sociology 1(4) (December 1936): 483-505.

[9] Gilbert C. Fite, "Recent Progress in the Mechanization of Cotton Production in the United States," Agricultural History 24(1) (January 1950): 19; Gilbert C. Fite, Cotton Fields No More: Southern Agriculture,

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American cotton producers were also concerned about their eroding position in world markets. In 1911 the United States had supplied 72 percent of the world's cotton production. By 1941 that had fallen to 38 percent. India, Brazil, and China were becoming the larger and more significant cotton-growing countries. While U.S. farmers grew more cotton per acre, foreign countries simply had more acreage. At almost the same time, between 1932 and 1938 American cotton consumption dropped 46 percent. Thus, more of America's cotton supply was going to world rather than domestic markets. With production costs lower in foreign countries, American growers increasingly faced unfavorable competition.[10]

Cotton growers began organizing to create a stronger voice in public policy and marketing. They founded the National Cotton Council (NCC) in 1938 as their first nationwide trade association and political lobbying group, an organization which also included ginners and marketers. In addition to funding research for mechanization and sponsoring the first Beltwide Cotton Mechanization Conference in 1947, the NCC supported fibers research and promotion. They focused on three factors: price, promotion, and quality. Toward that end the NCC advertised extensively and pioneered the early campaigns touting cotton's favorable characteristics and connotations compared to other fabrics. The NCC also stepped up efforts to promote and improve foreign exports. Marketing American cotton to domestic and foreign producers became a major focus of cotton producers throughout the country in the decades following World War II.[11]

Concurrent to marketing efforts, American cotton producers sought to cut their production costs by completing the process of mechanization. As discussed briefly late in Chapter Four, Congress aided the efforts through the passage of the Research and Marketing

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1865-1980 (Lexington: University of Kentucky Press, 1984), 175; Jacobson and Smith, Cotton's Renaissance, 117-20.

[10] Fite, Cotton Fields No More, 175; Gilbert C. Fite, "Recent Progress in the Mechanization of Cotton Production in the United States," Agricultural History 24(1) (January 1950): 19-20.

[11] Jacobson and Smith, Cotton's Renaissance, 34-35, 110-120. In the same vein cotton growers later formed the Cotton Producers Institute (1960), the Cotton Board (1966), and Cotton Incorporated (1970). The Cotton Producers Institute was a "stopgap defense" in the fight against synthetic fibers. Cotton Incorporated eventually took over as the advertising arm of the industry with its famous white-on-brown cotton logos and the "Fabrics of Our Lives" campaign in the 1970s. In addition to Jacobson's and Smith's comprehensive history of cotton marketing, see D. Clayton Brown, "The International Institute for Cotton: The Globalization of Cotton since 1945," Agricultural History 74(2) (Spring 2000): 258-71. Brown is working on a book-length treatment of the same topic due out in 2008 or 2009.

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Act in 1946. The legislation provided special appropriations in addition to the regular appropriations to state agricultural experiment stations for a wide range of research projects. Further funding was available for endeavors involving more than two states. For cotton representatives from fifteen states in the fields of agricultural engineering, soil science, and plant science met to develop a research program called the National Cotton Mechanization Project. The headquarters for the program was at the Delta Branch Experiment Station in Stoneville, Mississippi, which oversaw specific research projects in every cotton state from California to South Carolina on every phase of cotton mechanization. Supported by the National Cotton Council, cotton researchers began meeting annually in 1947 in the Beltwide Cotton Mechanization Conferences to share and review their findings.[12]

Although the South continued to progress and improve on mechanization, it lagged behind the West until the 1960s. Weed control was a particular problem in the South, where producers also tried using flame cultivation (as discussed in Chapter Four). Cotton farmers nationwide began utilizing chemicals to increase production and to control insects and weeds. Somewhat hindered by its need to transform an old system, the South's total cotton production continued to fall until it was surpassed by that of the West in the early 1970s. By that time cotton production was so efficient that backlogs built up at the gin, leading to the development and implementation of the cotton moduling system in the mid-1970s. The nationwide adoption of moduling marked the final step in mechanizing American cotton production.[13]

Cotton in Western History

In the opening chapter I suggested that this comprehensive history of the western cotton industry fills a void left by the array of smaller, mostly state-based accounts of cotton growing. Building upon those secondary works and filling in details from numerous

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[12] Gilbert C. Fite, "Mechanization of Cotton Production since World War II," Agricultural History 54(1) (January 1980): 200-201.

[13] Ibid., 201-6; Cameron L. Saffell, "When Did King Cotton Move His Throne (And Has It Moved Back)?", Agricultural History 74(2) (Spring 2000): 303-8. For more about the development of cotton moduling, see Cameron L. Saffell, "From Wagon to Module: New Ways of Handling Harvested Cotton," West Texas Historical Association Year Book 73 (1997): 46-61.

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agricultural extension publications and histories in other subject areas, we can now better understand the introduction and spread of cotton agriculture in the West.

In the preface to Trails: Toward a New Western History, the editors state that the New Western History offers a balanced view of the western past, its failures and successes, its defeats and victories, and the varied ethnic groups and perspectives on settlement and development. In the book's opening essay, Donald Worster goes on to say that the New Western History seeks to confront and understand the radical defects of past histories. While I did not seek to openly challenge particular notions of western history, I contend that this work does offer a broad, comprehensive view of this agricultural slice of the past. Some might criticize western history as being too specific or specialized in a given area of social, political, or economic history, knowing the variety of "new" histories that have emerged since the 1980s. This dissertation transcends those areas by looking at all of them through the lens of cotton farming. The activities surrounding cotton production touch on so many areas of western history—labor, irrigation, federal involvement, and mechanization.[14]

This dissertation did not seek to delve deeply into these areas. Instead it builds a comprehensive view of the establishment and evolution of farming in the Cotton West, crisscrossing these topics using many of the same secondary sources and incorporating additional information from first-hand accounts, extension publications, and government reports. The key point is that these areas are closely related to each other. I suggest that additional research is needed to explore other relationships of these subjects in relation to other crops or areas of the American West.

Of course geographically this dissertation is a contribution to western history. While I do not want to engage in a deep discussion of its association or lack thereof with the "New Western History", one can offer some contrasts to a couple of points in the debates and evolution of the field.

In his 1991 essay, "Beyond the Last Frontier: Toward a New Approach to Western History," historian Michael Malone suggests four "fundamental bonds of regional identity"

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[14] Patricia Nelson Limerick, Clyde A. Milner II, and Charles E. Rankin, Trails: Toward a New Western History (Lawrence: University Press of Kansas, 1991), preface; Donald Worster, "Beyond the Agrarian Myth," in Trails: Toward a New Western History, 16; William G. Robbins, "Laying Siege to Western History: The Emergence of New Paradigms," in Trails: Toward a New Western History, 190.

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for western histories. They are the fundamental aridity of the West; an exceptional reliance on the federal government; the recentness of its frontier experience; and its heavy dependence on extractive industries (including agriculture). Through this study, one can see that the evolution of the Cotton West certainly fulfills all of Malone's bonds of identity, with the possible exception of the frontier experience. The concept of frontier is a keystone in debating the New Western History versus earlier interpretations. I suggest that it simply is not a factor in the development of the Cotton West, unless one considers the "conquest" of new farming areas by Anglo emigrants to the region to start cotton farming as being part of that frontier experience. The settlement of these farmers does not need to be cloaked in mythic stories of conquest or expansion. They simply arrived and sought out a farm crop that suited their needs and the climate of the region. Malone states that little has been done on modern western agriculture; this dissertation contributes to filling that need.[15]

Several western historians describe the West as having a colonial relationship to the East. In an essay addressing the subject, Brian Dippie describes Gerald Nash's body of works as contending that World War II, specifically the year 1945, was a new dividing line in western history. That was when the West was freed from its colonialist shackles and its political, economic, and cultural dependency on the East. Certainly the Cotton West owes much to its connections to the East—specifically to the federal government in Washington, D.C. However, I see little in the Cotton West that is politically, economically, or culturally dependent on the East, or on the South for that matter. One could reasonably surmise that if the USDA helped institute the western cotton industry in order to procure national wealth, then indeed its origins are colonial in nature. The very nature of the scientific work by the USDA and state researchers, however, runs counter to the idea of the East controlling a colonial Cotton West. The idea was to create a self-sustaining agricultural industry. Only through the continued involvement of the USDA in cotton-breeding operations in California, which did not end until the 1970s, or in the Bureau of Reclamation's operation of western

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[15] Michael P. Malone, "Beyond the Last Frontier: Toward a New Approach to Western American History," in Trails: Toward a New Western History, 148-54.

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water projects can we see elements of potential control or colonialism. I believe that, at least in this example, there is no colonialist relationship between the West and the East.[16]

Instead of a colonialist approach, some western history scholars are pursuing comparative regional studies. Ultimately that is where my work falls. There is a need to contrast the development of the Cotton West and the Cotton South. The comparisons and analysis offered earlier provides an insight, but further work may be required. The first need, however, was for a basic history of the western cotton industry. This dissertation opens doors of insight into cotton agriculture, western history, irrigation, labor, science, mechanization, and federal roles in any or all of these areas.

Conclusions

This study provides the first broad overview of the emergence and development of cotton farming in the American West. Throughout the Cotton West, producers dealt with the same common sets of variables—irrigation and aridity, cotton varieties bred specific to the area, technology and mechanization, and labor issues. While the solution applied in California may not have been the same as in West Texas for a given problem, taken as a whole, all these areas put the Cotton West in stark contrast to the contemporary developments of the Cotton South.

In addition this dissertation demonstrates the critical role played by federal and state agricultural officials in introducing and expanding the western cotton industry. Other historians have profiled the federal government's role in the American West, mainly through western irrigation and reclamation projects. This study suggests that, while probably not through an intended, coordinated fashion, federal workers were significant players in at least this agricultural industry (cotton farming), very much supported by their colleagues at state land-grant colleges and experiment stations. This finding suggests that additional examination is needed in other agricultural industries to see if similar intervention can be found for other crops, particularly in the western U.S.

Finally, this study shows there are many interrelated connections between irrigation, agricultural science, labor, and technology. Many historians, particularly of the American

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[16] Brian W. Dippie, "American Wests: Historiographical Perspectives," in Trails: Toward a New Western History, 123.

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West, have examined these subjects within a near vacuum of a single topic. While this is a valid approach, the findings published here indicate that there is still much room to reexamine and explore the interconnections between these topics, particularly from the perspective of a single agricultural industry like cotton farming.

The American cotton industry has deep roots that extend from one coast to the other. This exploration of the introduction and expansion of the Cotton West shows that there is much more work to be done in profiling the history of this fundamental part of American agricultural history.

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Readers will note the initials AES to refer to the USDA's counterpart researchers at the state level, as in the Texas AES. This generally means the state's Agricultural Experiment Station or Agricultural Experiment System; in a few cases it means their agricultural extension system. I have employed a uniform system of referencing all the publications from these state agencies, which may not be strictly what a given pamphlet says. Thus in the notes and in this bibliography, citations will be to the "State AES Bulletin/Circular."

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