DOCUMENT RESUME

ED 116 844 RC 008 914

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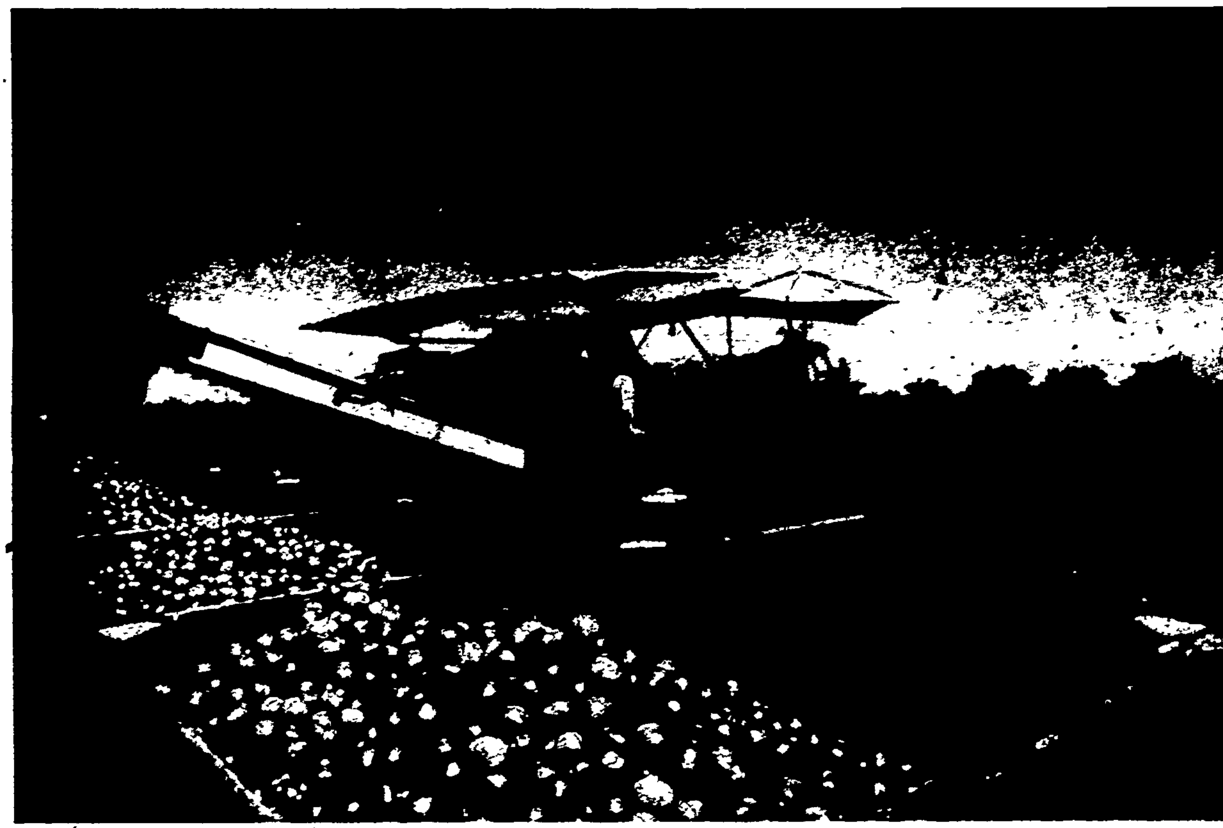
TITLE Destalking the Wily Tomato: A Case Study in Social Consequences in California Agricultural Research. Research Monograph No. 15.
INSTITUTION California Univ., Davis. Dept. of Applied Behavioral Sciences.
PUB DATE Jun 75
NOTE 79p.

EDRS PRICE MF-$0.76 HC-$4.43 Plus Postage
DESCRIPTORS Agency Role; *Agricultural Laborers; Agricultural Production; *Automation; Case Studies; Change Agents; Employer Employee Relationship; *Harvesting; *Job Analysis; Job Skills; Organizational Change; Social Characteristics; *Social Influences; Specialization; Technology; Work Environment
IDENTIFIERS *California; California Tomato Growers Association; Tomato Production

ABSTRACT

The end of the bracero program after 1965 brought about a major change in the growing, harvesting, and processing of California tomatoes which dramatically influenced the structure of the harvesting labor force. In order to determine the social consequences of the transition from man to mechanized harvesting procedures, the following areas of interest were examined: (1) the significance of the tomato; (2) tomatoes from seed to can; (3) the history of agricultural labor in California (a review; (4) the shift to the machine (the actors and the circumstances; post machine problems; and the role of the California Tomato Growers Association); (5) the technological development and job organization of mechanized harvesting (jobs and skills and working conditions); (6) the harvest labor force (identity; recruitment; supervision; and crew types); (7) the social effects of the transition to mechanized harvesting. The social consequences identified were: (1) concentration of tomato production in the State of California; (2) concentration in the number of growers and increased specialization; (3) a geographical shift in California production; (4) the development of price bargaining for tomato growers; (5) sharp changes in the structure of the harvest labor force; (6) introduction of a system of factory-like production while maintaining primitive employment relationships. (Author/JC)

DESTALKING THE WILY TOMATO



A Case Study in Social Consequences in California Agricultural Research

Research Monograph No. 15

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ABSTRACT

With the end of the bracero program after 1965, a major change began in the growing, harvesting, and processing of tomatoes in California. The necessary research for this shift had been conducted over several decades. With the shortage of harvest labor, a dramatic transition occurred in tomato production and in the structure of the harvest labor force.

This study examines the transition in detail and considers the social consequences that resulted. These were: (1) concentration of tomato production in the state of California; (2) concentration in the number of growers and increased specialization; (3) a geographical shift in tomato production within California; (4) the development of price bargaining for tomato growers; (5) sharp changes in the structure of the harvest labor force; (6) the introduction of a system of factory-like production while maintaining primitive employment relationships.

ACKNOWLEDGEMENTS

Research for this project was supported by the Agricultural Experiment Station, University of California, Davis. We are grateful to Dean Alex McCalla for his support and encouragement during our research. We are also grateful to the following people who contributed to our understanding of the changes wrought by the new tomato production system: Clair Christensen, Jack Hanna, Jack Hayes, Lester Heringer, Robert F. Holt, Ray King, Coby Lorenzen, Don May, Michael O'Brien, William Sims, Michael Zahara, Mel Zobel, and the librarians at Higgins Library of Agricultural Technology, University of California, Davis. Brad Austin and Bill Shelton, students at U.C. Santa Cruz, participated in the collection of data used in this report.

This monograph was set by a process involving computer typesetting. We are most grateful to Janet Mangini who typed the text and to Evan J. Schaffer whose skills at programming facilitated a difficult job.

The authors alone are responsible for the contents of this paper.

DESTALKING THE WILY TOMATO

A Case Study in Social Consequences in California Agricultural Research

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June 1975

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PREFACE

This study is the second in a three part research project on the social effects of research in agriculture. The first element, Social Sleepwalkers: Scientific and Technological Research in California Agriculture (Friedland, 1974), examined the lack of reflection on the consequences of research in agriculture and proposed a strategy geared toward developing methodologies to facilitate accuracy in prediction and evaluation of the social effects of scientific research. The Social Sleepwalkers paper argued that, just as agricultural research has made prior contributions in the development of basic and applied scientific knowledge, the time is now optimal for similar developments in predicative and evaluative capabilities.

This second report involves a case study of the social effects of system change in tomato production in California. After being introduced in 1961, as a result of the end of the bracero program in 1964, tomato harvesting shifted dramatically from labor intensive hand harvest to machine harvest. The necessary research that preceded this shift and that subsequently followed was conducted almost entirely through the College of Agriculture of the University of California, Davis. The social consequences of this shift have never been examined in any detail and are reported in this paper(1).

A third report, in progress, considers the case of a commodity in which the basic research for a major shift in production technology is now almost completed. This study will focus on the potential social effects of the mechanical lettuce harvester; the study represents an attempt to develop predictive capability by examining, within the limits of the time allotted to this research, a hypothetical

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(1) Two earlier reports have dealt with other features of the tomato harvester. Schmitz and Seckler (1970) have dealt with the economic benefits of the tomato harvester although without examining who benefitted. Rasmussen (1968) has discussed the technical features of the harvester and of the machine-harvestable variety of tomato.

case study(2). In developing the lettuce prediction, the intent will be two-fold: first, to make some predictions as to social consequences that can be tested if and when the transition to machine harvest and handling is made; second, to implement the intent of the first report by delineating elements necessary to making predictive statements.

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(2) In a more modest way, this third report follows a pattern similar to Salz (1955) who attempted an examination of the process of social change that might develop with the introduction of industrialization to an Indian population in Ecuador.

INTRODUCTION

Years ago, when growers of tomatoes wanted to remove a tomato from its vine, they hired "hands" to move down the rows of plants, inspecting the fruit by eye, reaching over to pluck the fruit, placing it by hand in a box before the contents were carried to trucks, transported to a cannery, processed and sealed in a can. Nowadays, except for a sorting process which still requires human beings to choose between properly ripe tomatoes and immature, overripe or damaged ones, the entire process is handled by machines. This report concerns that machine, the tomato harvester, and the process by which an appropriate tomato and an appropriate machine were developed as counterparts.

Such feats occur all the time in our technological world. But the social consequences that derive from such changes remain largely a mystery except as historical perspective permits an understanding of what really happened.

Despite some attempts in the natural science and social science worlds to develop a better sense of social outcomes (Friedland 1974,4-5), we continue to rely on history to provide the perspective necessary to understand the consequences for the social order of an invention, a technological development, or a series of scientific events. The Wright Brothers were unconcerned about the effects of airport construction in New York City; all they wanted to do was fly. Henry Ford never envisioned the automobile orientation of the city of Los Angeles; he simply wanted to build automobiles efficiently. And Thomas Edison surely never contemplated the environmental consequences of strip mining to the Navaho plateau or Appalachia when he harnessed electricity in a unique and new way.

For each monumental scientific development that has shaped human society and environment there are hundreds of medium- to smaller-scale ones. Some of these developments have been studied; most simply occur, almost unnoticed. The structural effects of such change are, perhaps, finally experienced through accretion, for example, by experts in employment trends. They are also experienced by those who are replaced in employment as personal difficulties or tragedies.

This report deals with one such historical reconstruction--examining the social consequences of a new system of harvesting and processing tomatoes. While studying the conditions leading up to the development of this new system, this report is oriented to specifying social outcomes of this technological transition. Perhaps even more important, this report is intended to be part of a longer-range study concerned with developing a means for predicting social outcomes of scientific and technological research. This long-range goal is met through the present study only in the sense that we believe a better understanding of predictive capabilities is feasible by studying the past and developing a means to assess the factors present in translating scientific and technological developments into reality. The case study, in other words, will hopefully provide grounds for more general analyses.

This report begins with an examination of the ubiquity of processing(3) tomatoes. After showing how important tomatoes are as a crop, we set out the way in which tomatoes proceed from seed to can. Chapter 2 analyses tomato production historically, showing the factors that created the search for a new harvesting system based on a machine. It also studies the actors involved and their motivations, and the role of the tomato growers and their organization. Chapter 3 examines how work is organized and labor recruited for the harvest. Chapter 4 summarizes specific social consequences produced as a result of the transition to the machine; readers interested solely in these consequences are advised to turn directly to this chapter.

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(3) This term is used to describe tomatoes intended to be processed before use by consumers, primarily through canning, although other forms of processing exist. Processed tomatoes stand in contrast to fresh market tomatoes, e.g., those that are consumed in their raw state or processed by consumers themselves. This report deals solely with processing tomatoes and any references henceforth, unless specifically designated "fresh-market", will be to processed tomatoes.

CHAPTER ONE

TOMATOES AS SUBVERSIVE: THEY GET INTO EVERYTHING

The Significance of Tomatoes

Tomatoes are pervasive in the food industry: there are vast numbers of products based predominantly on tomatoes or using them as an ingredient in the final product. Tomatoes are processed for so many different foods that most people rarely consider the quantity of tomatoes they consume. Although it is obvious that tomatoes are in use and immediately recognizable in products such as tomato sauce, stewed tomatoes, catsup, tomato paste, and tomato soup, tomatoes are used in many other foods, enchilada sauce, frozen pizza, frozen stuffed cabbage, and canned lasagna, to name only a few. When buying food extenders such as Hamburger Helper, tomatoes are not the consumer's concern, yet tomatoes are essential to many "easy to prepare" foods. The numbers of foods that show tomatoes as a prime or major ingredients are only a fraction of the products in which tomatoes actually appear.

Consequently, tomatoes have a tremendous economic impact. They are important not just to processors that can them like Campbell, Hunt, Contadina, Ragu, and Del Monte; they are vital to many companies in the food production business. Pizza chains must get their tomato sauce and hamburger franchises their catsup. Food retailers such as Safeway and A&P sell tomato products under their own label that they have purchased from a processor.

Thus the price and volume of tomato production are matters of moment for vast segments of the food production system and involve millions of dollars annually. Tomatoes are, in a word, big business even if they never make _Fortune_'s 500 columns.

The impressive evidence of the financial impact of tomatoes is seen in the role they play in California agriculture. In 1972, tomatoes earned over $153 million for California, second in vegetable production only to lettuce which earned $182 million (California Crop and Livestock Reporting Service 1973, 18). California dominates tomato production in the United States: in the late 1950s, as Table 1 on page 2 shows, California had less than half of

TABLE 1

TOMATOES FOR PROCESSING

YEAR	CALIFORNIA PRODUCTION-TONS	CALIFORNIA ACRES HARVESTED	CALIFORNIA YIELD (TONS/ACRE)	CALIFORNIA TOTAL VALUE ($000)	UNITED STATES PRODUCTION-TONS	UNITED STATES ACRES HARVESTED	UNITED STATES YIELD (TONS/ACRE)	CALIFORNIA TONNAGE AS PERCENTAGE OF U.S.	CALIFORNIA ACREAGE AS PERCENTAGE OF U.S.	CALIFORNIA YIELDS AS PERCENTAGE OF TOTAL U.S. YIELDS
1946	1,330,600	134,400	9.9	38,577	3,393,700	570,770	5.94	39.2	23.5	166.6
1947	1,429,000	142,900	10.0	41,727	3,242,800	511,370	6.34	44.1	27.9	157.7
1948	955,900	87,700	10.9	24,662	2,913,500	400,850	7.27	32.8	21.9	149.9
1949	1,003,400	75,440	13.3	23,279	2,518,700	345,140	7.30	39.8	21.9	182.2
1950	959,100	75,520	12.7	22,539	2,733,860	359,620	7.60	35.1	21.0	167.1
1951	2,210,000	148,300	14.9	66,742	4,267,070	423,830	10.06	51.8	35.0	148.1
1952	1,817,700	112,900	16.0	46,351	3,523,450	376,100	9.37	51.6	30.0	170.8
1953	1,411,000	83,000	17.0	32,312	3,234,910	297,300	10.88	43.6	27.9	156.3
1954	1,343,600	79,500	16.9	27,409	2,697,690	268,550	10.05	49.8	29.6	168.2
1955	1,988,700	116,300	17.1	45,342	3,277,990	330,800	9.91	60.9	35.2	172.6
1956	2,772,400	151,500	18.3	62,933	4,638,300	354,880	13.10	59.8	42.7	139.7
1957	2,020,600	128,700	16.5	44,251	3,314,500	305,020	10.90	61.0	42.2	151.4
1958	2,629,900	152,900	17.2	59,699	4,287,400	345,750	12.40	61.3	44.2	138.7
1959	1,997,400	129,700	15.4	43,543	3,508,800	292,130	12.00	56.9	44.4	128.3
1960	2,249,000	130,000	17.3	52,627	4,043,170	279,350	14.50	55.6	46.5	119.3
1961	2,319,000	146,800	15.8	69,802	4,247,700	303,950	14.00	54.6	48.3	112.9
1962	3,218,000	177,200	18.2	88,817	5,377,000	326,700	16.50	59.8	54.2	110.3
1963	2,463,900	129,000	19.1	62,583	4,070,640	248,060	16.40	60.5	52.0	116.5
1964	3,003,000	143,000	21.0	75,976	4,561,010	270,080	16.90	65.8	52.9	124.3
1965	2,468,300	122,800	20.1	87,378	4,482,240	255,160	17.60	55.1	48.1	114.2
1966	3,136,200	162,500	19.3	94,086	4,660,570	300,130	15.50	67.3	54.1	124.5
1967	3,192,600	186,700	17.1	123,554	5,187,540	327,560	15.80	61.5	57.0	108.2
1968	4,903,600	231,300	21.2	203,009	6,965,860	370,150	18.80	70.4	62.5	112.8
1969	3,372,600	154,000	21.9	122,982	4,897,700	266,940	18.35	68.9	57.7	119.7
1970	3,362,950	141,300	23.8	106,269	5,058,950	245,540	20.60	66.5	57.5	115.5
1971	3,879,700	163,700	23.7		5,552,100	258,130	21.51	69.9	63.4	110.2
1972	4,526,150	178,900	25.3	153,889	5,804,600	265,020	21.90	78.0	67.5	115.5
1973	4,861,400	218,000	22.5	199,804		302,340			72.1	
1974	6,040,441	249,900	24.2	332,000	7,277,639					

Sources: For California—
California Tomato Grower, October 1963, March 1968, March 1971, March 1972, April 1974. For 1974, Holt, February 1975.
For United States—
American Tomato Yearbook.

Yields and California tonnages and acreages as percentage of U.S. tonnages and acreages calculated by authors.

NOTE: In some instances data is for acreages "planted". Data for the total value of California tomatoes for 1972-1973 are from California Crop and Livestock Reporting Service, California Vegetable Crops, September 1974.

America's acreage; in the early 1970s, over two-thirds of U.S. tomato acreage was in California. Similarly, California's share of U.S. tomato tonnages has also increased. As Table 1 shows, California productivity has always been higher than the rest of the United States in this crop, a factor that has contributed to making the state a dominating force in processing tomato production. This domination has probably been consolidated and confirmed by the introduction of the machine harvestable tomato and the mechanical tomato harvester.

Although California as a state is affected by tomato production, significant production of tomatoes does not occur statewide. Tomato production, like so much of other production and particularly agricultural production in California, is heavily concentrated in a small number of counties. Some of the counties involved in the production of processing tomatoes have had their roles and contributions changed since the appearance of the harvester.

The changes in tomato production counties in California are shown in Charts 1,2 and 3, and Table 2 on pages 4-7. These reveal that tomato production was largely concentrated originally in two counties, San Joaquin and Yolo. With the development of the mechanical tomato harvester and its acceptance by growers after 1964, production has shifted. San Joaquin County, originally the largest growing county, declined steadily after 1967 until it became third in rank in 1972. Yolo County, originally an important growing county, has now reached the top rank in production. Perhaps even more interesting, however, have been the changes in Fresno County, originally an area of negligible production, and San Benito County. Fresno County's growth in production has been substantial as the county emerged, largely as a result of the availability of cheap water and the tomato harvester, as an area of enormous acreages. San Benito County, as a result of its weather, has increased continually in importance since tomatoes can be produced there late in the growing season to feed the fruit to the canneries after most other crops have been processed and since these tomatoes are better for canning as whole tomatoes than in other production areas.

Tomatoes, therefore, while an important crop in terms of acreages and dollar value, are also highly concentrated geographically. To this spatial concentration has been added the factor of grower concentration. Prior to the introduction of the tomato harvester, about 4000 growers produced tomatoes in California. In 1972 this number had declined to less than 700 although acreages and tonnages had

CHART 1

TOMATO ACREAGES BY COUNTY BY YEAR
(M'S ACRES)

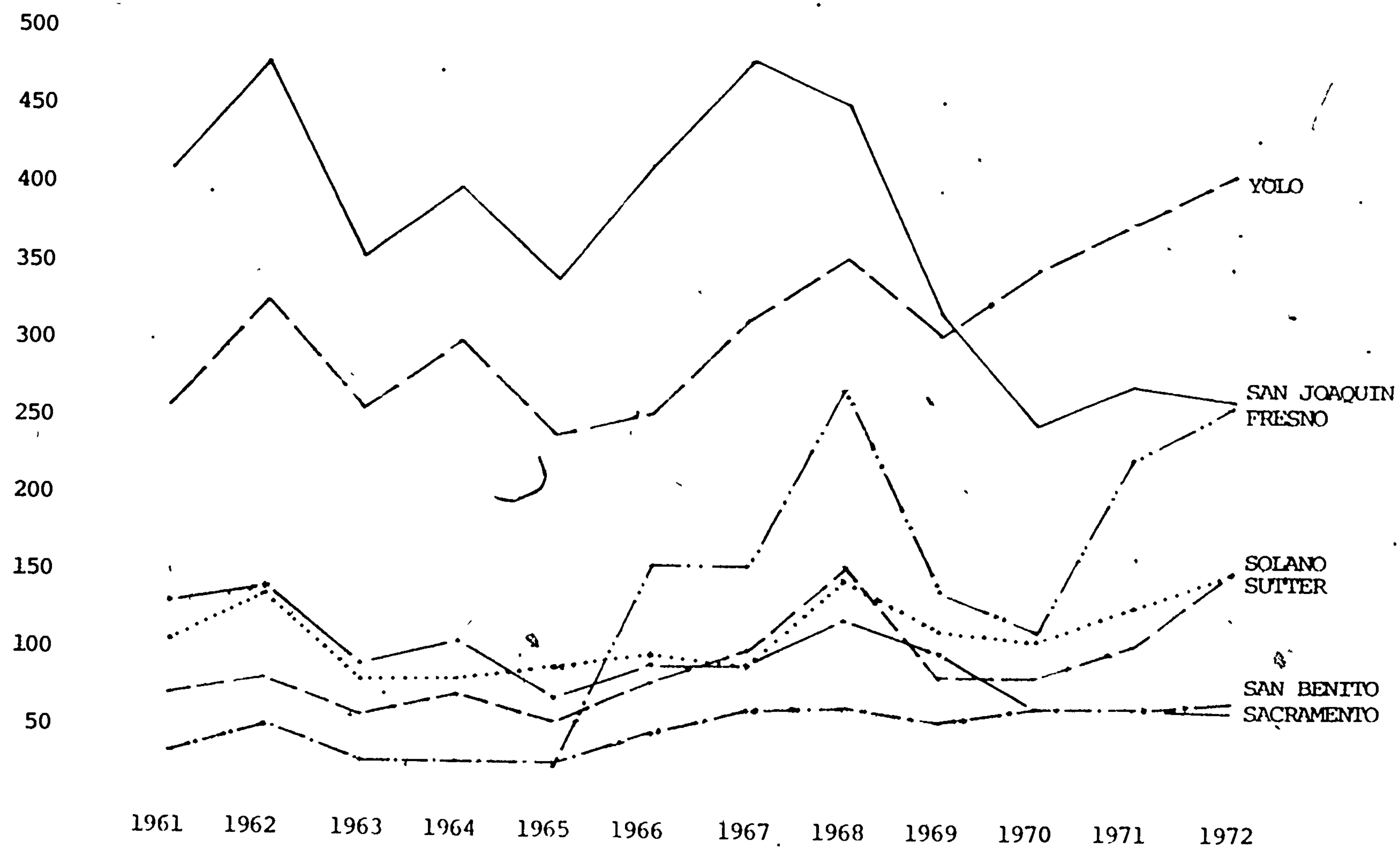

CHART 2

TOMATO TONNAGES BY COUNTY BY YEAR
(000's TONS)

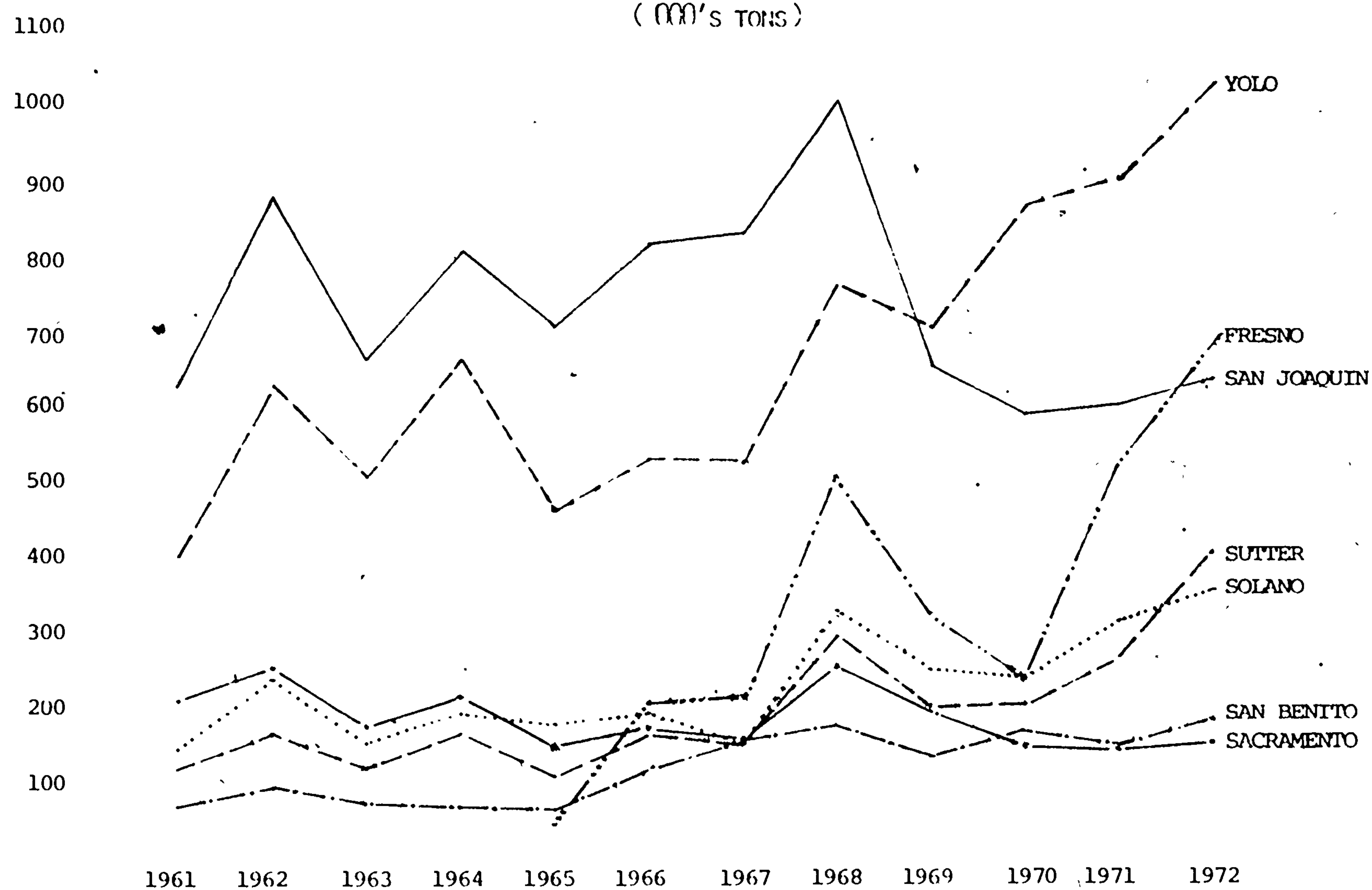

CHART 3

TOMATO YIELDS BY COUNTY BY YEAR

(TONS PER ACRE)

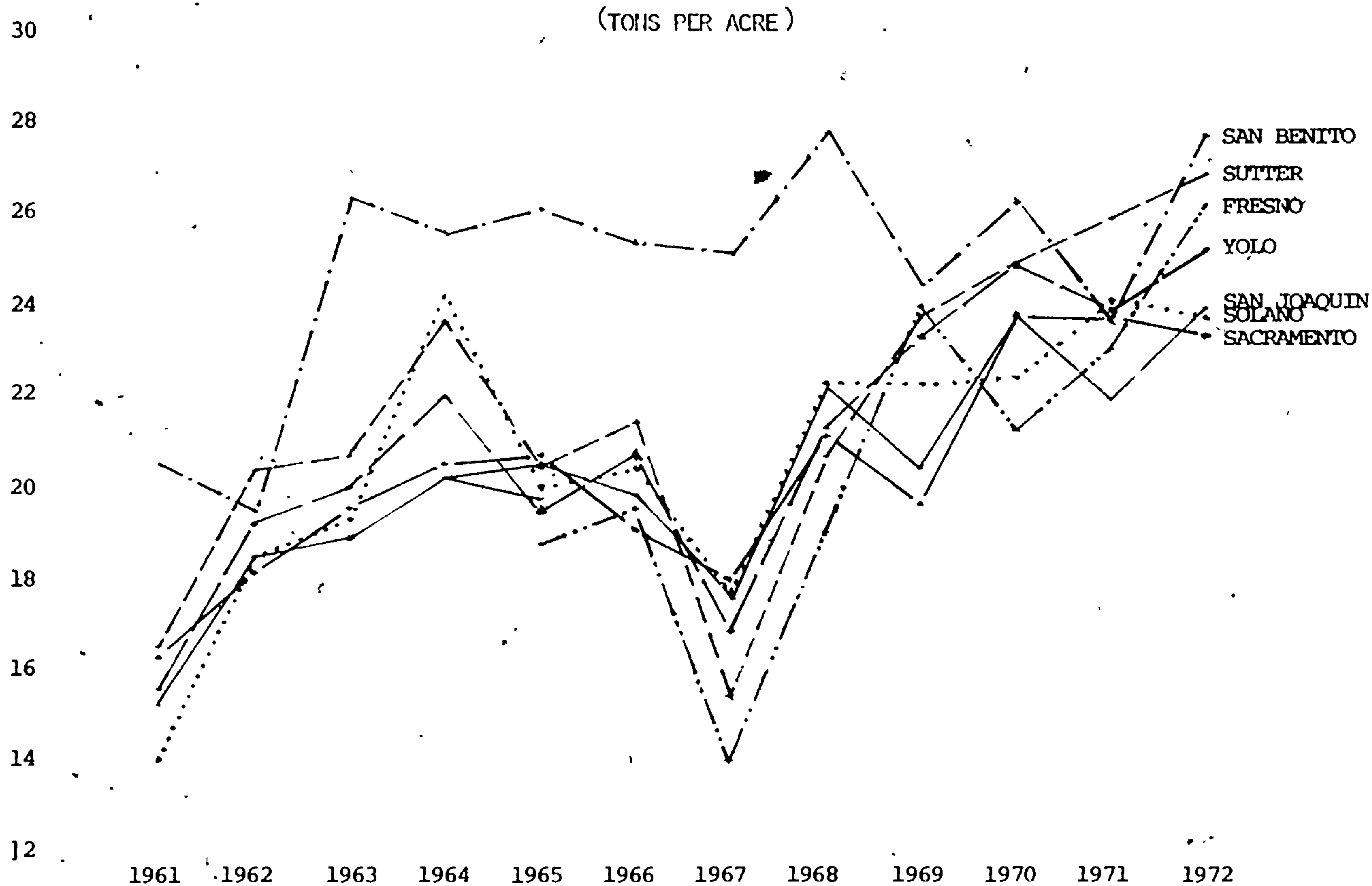

TABLE 2

TONNAGES, ACREAGES, AND YIELDS (TONS/ACRE)
KEY PRODUCTION COUNTIES, CALIFORNIA 1961 - 1974

	SAN JOAQUIN COUNTY			FRESNO COUNTY			YOLO COUNTY			SUTTER COUNTY		
YEAR	TONS (000)	ACRES (00)	TONS/ ACRE	TONS (000)	ACRES (00)	TONS/ ACRE	TONS (000)	ACRES (00)	TONS/ ACRE	TONS (000)	ACRES (00)	TONS/ ACRE
1961	633	413	15.3				401	257	15.6	117	71	16.5
1962	880	481	18.3				634	328	19.3	169	83	20.4
1963	669	355	18.9				512	255	20.1	122	59	20.7
1964	804	398	20.2				664	300	22.1	168	71	23.7
1965	708	342	20.7	47	25	18.8	469	240	19.5	113	55	20.5
1966	821	415	19.8	211	155	19.6	535	257	20.8	176	82	21.5
1967	836	473	17.7	222	157	14.1	530	314	16.9	158	102	15.5
1968	1015	454	22.4	519	270	19.2	765	357	21.4	329	158	20.8
1969	660	321	20.6	333	138	24.1	715	305	23.4	208	87	23.9
1970	597	250	23.9	246	115	21.4	871	349	25.0	213	85	25.1
1971	607	274	22.2	528	228	23.2	915	380	24.1	277	106	26.1
1972	641	266	24.1	694	263	26.4	1035	408	25.4	414	153	27.1
1974	730	286	25.5	901	362	24.9	1320	592	22.3	485	210	23.2

	SOLANO COUNTY			SACRAMENTO COUNTY			SAN BENITO COUNTY		
YEAR	TONS (000)	ACRES (00)	TONS/ ACRE	TONS (000)	ACRES (00)	TONS/ ACRE	TONS (000)	ACRES (00)	TONS/ ACRE
1961	149	105	14.2	212	130	16.3	68	33	20.6
1962	248	134	18.5	256	141	18.2	96	49	19.6
1963	155	80	19.4	178	91	19.6	74	28	26.4
1964	193	79	24.4	216	105	20.6	72	28	25.7
1965	181	90	20.1	152	73	20.8	68	26	26.2
1966	197	96	20.5	175	91	19.2	120	47	25.5
1967	163	92	17.7	165	91	18.1	162	64	25.3
1968	332	148	22.4	260	122	21.3	181	65	27.9
1969	255	114	22.4	199	101	19.7	138	56	24.6
1970	244	108	22.6	155	65	23.9	174	66	26.4
1971	321	132	24.3	148	62	23.9	157	66	23.8
1972	364	152	23.9	159	67	23.7	190	68	27.9
1974	460	225	20.5	161	76	21.2	220	97	22.6

Source: California Tomato Grower

increased continually (Holt, Oct. 1972). In 1973, the numbers of growers dropped again to 611 (Holt, Feb. 1973). Thus, while California's tonnages increased between 1962 and 1973 by 51% and acreages increased by 23%, the number of growers declined to approximately one-sixth of what it had been. This concentration process has been produced in considerable part by the larger investments necessary to enter tomato production, especially investments in equipment since a tomato harvester currently costs approximately $65,000. Concentration is also a product of the increased care and management that mechanically harvested tomatoes require in contrast to the forms of cultivation and harvest of hand harvested tomatoes. Because the harvester operates more efficiently on large rather than small parcels of land, larger growers have been able to remain in tomato production while smaller growers have had to shift to other crops. This feature has also led to concentration of tomato growers.

Tomatoes: From Seed To Can

The Decision to Grow

Agriculture is usually viewed and accepted as a high risk business. When examined closely, however, particularly in the context of its most modern and rationalized forms, although a great many hazards exist, within the broad range of options available in agriculture some options are less risky than others. In addition it might be noted that the character of agricultural risks are fluid in that they manifest themselves at specific periods in the production cycle. There are obvious trouble areas with the potential to erupt in the middle of a crop. These crises include weather, pests, diseases, mechanical failures, human error, or bad luck (e.g., unforeseen circumstances that cannot be planned for).

The most basic gambles taken by growers are those about which crops to grow. Once the decision to grow a specific crop is made the problems multiply and, without skillful handling, can wreak havoc.

There are numerous variables involved in a grower's decision to plant a given crop. A grower who focuses production on tree crops or vines makes a substantial commitment in several ways. From planting to harvest (and therefore to the time when returns begin on investments), time and expenditures will be spent with no return. During the time before harvesting can begin, the market value of the crop may rise or plummet; disease or pests may wipe out sections of an orchard or vineyard; drought, fire, flood, or vandals may lay waste to trees or vines. A decision to grow a crop with the characteristics of fruits, nuts, or grapes is a long-range commitment to a highly inelastic situation. Once planted, there is little going back.

In contrast, there are extremely volatile crops such as lettuce. Grown on a year-to-year basis, a field committed to lettuce one year may be shifted the next and replaced by alternate crops. Or, if returns are good, additional acreages of lettuce can be planted. Adding to the elasticity of lettuce is the fact that it is not "pre-contracted" and is sold in an open market that is highly speculative.

Tomatoes fall between these two extremes--the extreme of long-range commitment to a crop for many years and the highly speculative characteristics of an open market that can change literally from hour to hour.

Although a tomato grower can pull out of the crop at the end of the season or increase acreage of tomato plantings if the demand makes it worthwhile, the tomato grower does not have on-the-spot market control and is faced with the commitment to a very temperamental crop. Most growers therefore grow most tomatoes under contracted terms arranged with processors.

While the public demand for tomatoes as a processed food is great, the growers' customers are not the public directly but the processing companies, organizations such as Del Monte, Cal Can, Ragu, Hunt, and many others. These processors sell to the public or to smaller companies who produce tomato products under their own label. Each processor must predict the tomato volume necessary to fill an expected demand for tomato products six months to a year before the fruit is harvested and the canneries go into production. Once they have estimated their needs, processors begin to negotiate contracts with growers specifying a price per ton for a specific number of acres, with the expectation that each acre will produce a predictable tonnage.

Most contract negotiations are completed and firm commitments are made by the signing of the contracts by mid-January although contracts may not be signed, in some cases, until much later. Field agents of the processors spend the months between the fall closing of the season and mid-January keeping in contact with growers and pursuing negotiations. These negotiations are intricate affairs that remind the observer of the psychology often found in poker and other games of chance and bargaining capability.

Once the contract is signed the grower is committed to planting a specified acreage for a "fair" price. The "fairness" of the price is a subject of much debate and dissension. In the past, with a great many tomato growers and a relatively small number of processors, growers tended to be vulnerable to the superior information system controlled by the canners. The creation of the California Tomato Growers Association (CTGA) represented one device by which growers developed better information sources about the "going price" being offered by processors.

Growing the Tomatoes

Once the contract is signed the grower must begin preparations for planting. This involves a complex planning process related to the delivery schedules specified in the contract as well as decisions about fields. After this comes the actual preparation of the fields, planting, weeding, pest control, and thinning. Throughout the growth cycle, irrigation must be conducted on a schedule determined by weather, the needs of the plants, and the relationship of the growth cycle to the harvest schedule. Before the harvest begins, the grower must have harvest equipment in good condition and a labor supply recruited. Harvesting finally gathers the crop which must be delivered to the processor on a specified schedule. The quality of the crop involves considerable potential for disagreement between grower and processor despite the existence of a state-controlled inspection system and the establishment of inspection criteria through grower and processor committees.

What is perhaps so unusual about tomatoes as a crop is the care and nurture they now require because they are harvested by machine in contrast to many other crops. The technical inputs necessary for maximum production of high quality are substantial. When the harvesting of tomatoes was shifted from a system of using hands to one involving machines, the technical necessities of the crop required growers to increase the amount of attention given the crop.

Production scheduling. Scheduling for tomato production varies depending on the part of the state in which the grower is located. In general, the early planting season extends from late-February to mid-April. This will result in a harvesting period running from late July to mid-August.

Growers from Yolo County south to the west side of Fresno County are in this range and constitute the largest number of growers. Midseason planting, which falls during the period from mid-April to mid-May, results in a harvest beginning in late August and lasting until the end of October, occasionally into November. The area which this encompasses is in San Benito County in the Hollister and San Juan Bautista areas. Some acreages in the King City area of Monterey County also fall into this scheduling pattern.

Field preparations and planting. If the land has not been prepared for tomato planting and irrigation, this work is normally undertaken in the fall of the growing season of the year prior to actual planting. Irrigation requires a gradual sloping of levelled land that is obtained through a process of land planing. Unless irrigation is even and controlled, there will be irregular starts in plant growth producing an uneven crop. Once the land is appropriately leveled and before the grower can begin to plant seeds, decisions must be made about the form and shape of beds and the spacing of rows. Row spacing is dependent on several factors: size of vines, type of soil, and method of planting. The variety of tomato being used, the types of harvesters being used, and the width of other farm equipment must be considered. Most commonly, growers of machine-harvested tomatoes plant in single or twin rows on beds that are moist and prepared for irrigation. Using precision planters, a grower with land prepared as previously described will use a third to one pound of seed per acre. Seeds are planted in depths of three-quarters to one inch and variation in depths can make considerable differences. If seeds are planted too deeply, the plants will not emerge uniformly; if seeds are not planted with sufficient depth, excessive drying will occur (Sims, et.al., 1968, 9).

From the most preliminary operations to the final harvesting operations one crucial factor requires constant attention: uniformity. The plants should be distributed uniformly along the rows if the machines are to harvest the maximum yield of a field. The rows and beds must be uniform if the machine is to move through the field without damaging the plants. The seeds must be planted at proper depths or there will be sporadic emergence of plants. Throughout the growing process, if tomatoes are to be harvested on schedule and maximum yields are to be obtained, the tomato vines must be ready for harvest simultaneously. A large grower with several thousand acres of tomatoes does not want all fields to ripen at once; once ripe, tomatoes must be harvested quickly if quality is to be ensured and waste and spoilage are to be avoided. Within a given field, however, all fruit should reach maturity over a short period. During planting, a grower must schedule plantings so that not too many fields will be ready for harvest at the same time. Not only is the harvest equipment limited in the acreages that can be harvested daily, but canneries can only handle limited quantities of fruit each day. Growers must therefore, deliver the fruit to the processor according to the schedule not only of the fruit itself, but according to the processor's schedule as well.

Weeding, pest control, thinning. The grower's attention now turns to weeding, pest control, and thinning. Most weed control is handled by chemicals since hand weeding is an expensive process but some hand weeding is often necessary. Chemical weed control remains one of the weak links in growing of tomatoes for mechanized harvesting. Although agricultural extension authorities insist that good weed control is possible if chemicals are applied in the proper amounts at the proper times to land which has been properly cultivated and furrowed, growers frequently complain about heavy weeds as well as about weeds so similar to tomato plants that effective weed control agents fail.

Pest control is also maintained by chemicals and there are various pesticides commonly used. When the tomato seedlings emerge, there are about a dozen different insects that can cause serious damage to the plants. Once the fruit appears, fruit and vine damaging insects become a serious problem. Our field interviews indicate that it is far more common for a grower to suffer from inadequate weed control than from inadequate pest control.

Plants are thinned when they are still small seedlings with two or three "true leaves" exposed. If the tomato beds and seedlings are very uniform, mechanical thinning devices can be employed, and the expense of hand thinning makes it worthwhile for the grower to strive for such uniformity. When planted in twin rows to each bed, the clumps of tomato plants are usually spaced nine inches from center to center. These clumps usually consist of two to four plants. Thinning consists of cutting out the excess plants. When emergence takes place with irregularity, mechanical thinning becomes impossible and the more expensive process of thinning by hand--e.g., with a crew of laborers using hoes to chop out excess plants--must be undertaken.

The uncertainties of growing. Agricultural specialists have devised a multitude of procedures, pesticides, herbicides, and other devices to assist growers. However, human error is a large factor in any enterprise especially where assessment of climatic fluctuations can be so critical. To have a successful harvest the grower must be aware at all times of the conditions of the fields, the tomato plants, and of the effects of climatic changes. Tomato growing, in other words, is a continuous operation. While agriculture has always been a demanding occupation, the growing of crops often becomes more delicate with the introduction of mechanized harvesting and precision; skill and attentiveness become even more necessary.

Tomatoes represent a challenge to growers because they require constant attention and the cultural practices leading to successful harvest are intricate and precise. Not only are considerable economic investments involved but growers must command skills that were not known in tomato production a decade ago.

Because of their need for such care, the requirements of careful planning, watchfulness to control growth and to keep to a schedule, either the grower or some person representing the grower must become a specialist in tomato production. This person must be able to recognize problems and deal with any crisis or potential crisis immediately. If trouble is discovered, or if trouble seems likely, quick decisions must be made. Each decision must be made not just in terms of immediate activity, but should reflect a continuous awareness of the whole growing process. Each step in growth is contingent on previous activities and each step affects future decisions and actions.

In many respects, the complex integration of different elements of the growing process make the growing of tomatoes a concrete implementation of systems analysis since each phase is contingent on all previous phases. The grower must keep the immediate situation and all immediate problems in mind while paying attention to contracted delivery dates and the need for maximum production of a high quality product.

<u>Harvesting</u>. Once cultivation and growing are accomplished, the next phase is harvesting.

At any specific geographical location the harvest season ranges in length from four to six weeks. In some areas, because of the extensive acreages planted and the different planting schedules, the harvest period will be spread over a longer period of time. This is particularly true in the Yolo County area where the harvest begins in mid-July and can continue until November with heavy harvesting in July, August, and September.

Harvesting moves in a temporal sequence from south to north. Early tomatoes are brought in in Riverside County in June. Although the acreages here are smaller than further north they are important because they begin the flow of tomatoes to the canneries. The harvest then moves to the Bakersfield area and to the west side of Fresno County. In Fresno County the season normally peaks in late July. The main producing areas in Yolo, San Joaquin, Sutter, Solano and Sacramento Counties conduct the harvest from mid-July until November. The harvest season ends in San Benito County where the harvest does not begin in seriousness until September and continues for a month or more.

The harvest begins at a slow pace and then moves toward a more intense period of activity. While peaks can sometimes be controlled by careful planting and cultivation and scheduling, they are often brought on through a combination of climatic conditions. If the crop is slow in "coming on," the season will last longer and the length of the working day will be short. A crew can be expected to work anywhere between seven and ten hours on an average day under such conditions. Once the season peaks, the length of the working day may extend to twelve hours.

In some areas where acreages are extensive and where conditions bring on the crop rapidly, harvest operations will run around the clock using two shifts of workers during the peak. Most growers prefer to avoid 24-hour operations and care in planning and scheduling helps to reduce these needs. In some cases, however, round-the-clock harvesting becomes necessary involving a new set of problems for scheduling the servicing and repair of machines as well as the coordination of two shifts of workers.

At this stage, large numbers of workers are required to staff the harvesting machines as sorters. The sudden surge in demand for workers invariably puts strains on the supply situation. To help relieve these needs experiments were undertaken to develop a sorting process requiring fewer workers than the hand sorting done on the harvesting machines. These experiments involved "central sorting" in which sorting was done in sheds rather than on the machines. The machines were run through fields with only a few sorters to pull out the weeds and heavy debris. The tomatoes were trucked to a sorting shed where they were dumped into large water-filled tanks. In theory, the green tomatoes would float and the ripe tomatoes sink as they flowed with the water down chutes to sorting belts where a final hand sorting process took place. This procedure was not found to be effective. Tanks were too small to allow for effective water sorting, and consequently there was an increase in the number of sorters needed. Processors were dissatisfied with this system because the increased handling caused fruit damage. Most growers have dropped central sorting because the promised labor savings were not as high as promised and the capital outlay to build the shed, tanks, and conveyors was so high. Central sorting is still occasionally employed to bring rejected loads up to acceptable standards.

Since the failure of this method of sorting, growers have been resigned to their dependence on farm labor to get their crop in during the short and extremely active harvest period. They feel continually threatened that their labor supply will disappear. Every year growers worry about having a sufficient labor supply to complete the heavy harvest during a short time. If they begin the harvest with adequate labor, they are afraid that the labor force will move on before the end of the season if the season is delayed in any way. They feel that workers have no commitment to completion of the harvest and will move according to personal schedules or economic needs. Research is currently underway to eliminate dependence on an uncertain labor supply through electronic sorting. This process, if successful, will reduce labor requirements to a still-unknown degree.

Harvesting is currently being affected by another technical transition developed in the last few years. This involves a shift in the handling of the tomatoes, once harvested, from bins to bulk handling. When tomatoes were harvested by hand, they were placed in lugs, boxes holding fifty pounds of fruit. With the development of the machine, lugs became too small a unit to hold the volume of fruit produced and a procedure was introduced in which the tomatoes were deposited from a conveyor belt into a number of bins hauled on a trailer that ran alongside the harvesting machine. The bins were shuttled to a staging area from which they were stacked by fork-lift on tractor-trailers for haulage to the canneries. Recently a new change took place as bulk gondolas were introduced. These are full sized trailers pulled behind regular over-the-road trucks. Shaped somewhat as a rectangular tray with a sizeable indentation in the bottom, the gondolas are driven into the fields to run alongside the harvesters. Once loaded they move onto the highway to the processing plants.

While bulk handling has cut labor costs and handling, some drawbacks to this method of hauling exist. The gondolas must be filled more carefully than bins since the distribution of their weight can affect the balance of the trailers when they move at highway speeds. If there is any delay in movement, the heat held by the tomatoes has greater consequences in the bulk gondolas than in smaller units. And, unless tomatoes are distributed appropriately, the weight of tomatoes can crush those at the bottom of the gondola. Despite these drawbacks, the increased advantages of gondola hauling makes the prospects for more of a shift to this method likely in the immediate future.

Grading the crop. Before a grower is paid by the processors according to the contract signed at the beginning of the year, the quality of the tomatoes must be determined. If there has been strain between grower and processor during the period in which negotiations occurred over prices, it is after the harvest has been completed that growers can sustain significant losses if the quality of their crop is judged to be below standard. The grading of the crop, therefore, creates tension between growers and processors. To resolve these tensions, a grading procedure has been developed, conducted at grading stations distributed throughout the tomato producing areas. Grading is conducted by officials representing the State of California with graders trained at a special tomato grading school (4). Graders are trained to sort a subsample selected randomly from a load of tomatoes for defects including mold, worms, sunburn, sunscald, and rot. Tomatoes must also be graded for color. Inspectors must pay careful attention to the color of tomatoes, testing the fruit to see if it is too green or too ripe for processing. In addition to a visual inspection of individual tomatoes for color, a separate technological system exists to determine whether the overall color of the load is correct. A red-green ratio is determined by pulverizing a sample of tomatoes in a blender-like apparatus. The juice is then strained and its color is graded.

The grading procedure creates a continuing controversy between the three elements involved -- growers, processors, and graders. Growers and processors will have expected

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(4) Following a procedure developed by Michael O'Brien, an agricultural engineer at the University of California, Davis, scoops of tomatoes are removed from the center and sides of randomly selected bins brought by trailers to the grading stations. The tomatoes contained in the scoops are then judged individually by graders on the assumption that the random selection represents the entire population of tomatoes in the load (O'Brien, et.al., 1969)

disagreements about the quality of the pack; graders, who stand between the two other parties, frequently catch criticism because of the different expectations of the two other parties.

Basically, differences develop in two major areas: the "objective" quality of the pack; and the differences that may develop in tomatoes between the time they are harvested, graded, and delivered to the cannery (5).

**** Differences of opinion about quality may develop, for example, over the sampling process when a load is rejected as not being up to proper quality. The grower may believe that the quality is good and rejection a function of how the tomatoes were sampled. At times growers may suspect that a load is deficient but may hope, through rearrangements, to get the load through inspection. This can be done by shuffling bins around once a load has been rejected in the hopes that in the new sampling procedure a sample of acceptable quality will be chosen.

**** Differences in the quality of the pack between harvest, grading, and the cannery can develop for a number of reasons. When tomatoes are harvested in the afternoon,

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(5) The following discussion of differences between growers and processors is itself controversial. This report on differences is based on field observations and informal discussions with various parties involved in the grading process. Growers and processors formally deny the existence of differences or that some of the practices referred to below exist at all. We heard enough discussion of these practices to believe that they must exist to some extent and that considerable strain exists between growers and processors over the grading procedure despite the existence of an ostensible "neutral" grading system supervised by the State of California.

This report does not attempt to assess the <u>amount</u> of difference in the sense that no attempt has been made to assess the degree to which the practices reported actually exist. Robert Holt, General Manager of the California Tomato Growers Association, informed us that only about 1.5% of all loads are rejected. Growers may report more rejection than actually exists; but there can be little doubt that inspection and rejection is a continuing source of grievance to tomato growers.

the heat they hold is significantly higher than when they are gathered in the morning. Heat produces a deterioration in the quality of the pack. Thus, a shipment that may be satisfactory at the time of harvest and at the grading station near the fields may be rejected at the cannery. Since the average length of haul is 90 miles and the average lapse time is seven hours, deterioration in the quality of the pack is possible through natural conditions.

Deterioration may also occur when a truckload arrives at the cannery on schedule but may have to wait before the crop can be unloaded. In such cases, growers will seek to hold the cannery responsible for the delay in acceptance of the load.

Finally, growers complain of unreasonable rejections of loads by processors -- or the setting of arbitrarily high standards -- when the peak of season puts overload requirements on the canneries. At such times, growers state their beliefs that the canners reject loads not because their quality is, in fact, too low, but because the canners are seeking an "out" from their inability to handle the crop because of volume while avoiding payment to the growers because the canners contend the crop is below acceptable quality.

The grading process and the disagreements implicit therein reflect interesting elements in the organization of tomato production and the relative degrees of power present between the contending parties. Basically, the grading process has tended to be dominated by the relatively small number of processors, each of whom commands considerable technical knowledge and who can communicate amongst themselves with relative facility. Thus, the processors know what prices they have to offer different individual growers, the state of the market, etc., better than do the growers. They also know what the flow of fruit will be to canneries. In contrast, individual growers have not been able to command this level of information and traditionally have not been in close contact with each other with respect to price and other factors related to the delivery of their crop. Growers have partially resolved their problems through organization and the California Tomato Growers Association (CTGA) serves the function of a communicating and coordinating agency to some degree. The Association is, however, a weak instrument in that growers have hesitated to allot it any serious and significant functions such as price bargaining, of which more will be said later. However, CTGA has been able to pressure for the creation of adjudicative instrumentalities such as state grading procedures. State grading at least removes from the canner the unilateral determination of quality. Thus, while grading does not resolve the controversies between growers and processors, it places it in an organizational context through which growers have slightly more power but still less than the processors.

Once accepted at the cannery, the final procedures that peel, chop, slice, squeeze, strain, and cook the product are of little concern to the present report. From the decision to plant to acceptance by the cannery, all of the procedures discussed have been largely affected by the development of the machine harvestable tomato and the harvest equipment itself. While we did not study the consequences of the machine harvestable tomato for the canneries (6), knowledgeable people have indicated that the changes have resulted in reduced labor requirements within the canneries.

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(6) What the effects of the machine harvestable tomato have been for the reduction of the number of processors from 54 in 1958 to less than 30 in 1973 are, at the moment, unclear (Holt Nov. 1973, 4-5).

CHAPTER TWO

IT WAS NOT ALWAYS THUS

Neither tomatoes themselves nor the process by which they are gathered were always as they are today.

Tomatoes, indeed, were regarded as a suspicious fruit only a short time ago. Although long acceptable in southern Europe,

> It took hundreds of years for the English and the French to learn to love the tomato as food... And it took years for Americans to do likewise... Tomatoes first gained U.S. acceptance in the South... The denizens of Maine were among the first to make catsup at a time when most Americans regarded the tomato not only with suspicion but with hostility. (CTG Dec.1971, 9)

The difficulty of their cultivation, the short period of storability in fresh condition, the problems of bottling or canning them, led many people to view tomatoes with suspicion despite their flavorful and colorful characteristics. Many people older than fifty will remember their parents pressing the ends of tomato cans for bulges created by gases that had developed after canning. Those that went in for home bottling can recall the noise from the cellar when a bottle of canned tomatoes exploded -- and it seemed more often to be tomatoes than most bottled vegetables.

The change in orientation by Americans towards tomatoes can be seen in per capita consumption of the fruit. In 1930, consumption was only ten pounds per year. This increased in the 1950s to about 16 pounds per year (CTG Nov. 1958, 7). By 1970, however, consumption reached 50 pounds per year (CTG Sept. 1970, 10; King, et.al., 1973, 23). The increased production to feed these changing tastes have been the result of changing organization of the planting, cultivation, and harvest of tomatoes. Tomatoes have been very much affected by the changing agricultural labor pool. They are a labor intensive crop, highly susceptable to spoilage if there is a delay in harvesting.

Agricultural Labor in California: A Review

California's solution to the problem or agricultural labor has always been based on an approach requiring extensive importation of large volumes of labor that could be readily and cheaply exploited. Aside from the original Californians, the Indians, a succession of ethnic and racial groups were imported from outside the country and the state to provide cheap and plentiful labor (Heizer and Almquist, 1971). Subjected to a genocidal policy, the Indian labor pool was lost. It was followed by successive waves of ethnic importation: Chinese, Japanese, Filipinos, and Mexicans, culminating in an importation policy or southern American whites before settling on Mexico as a source of continuing supply of cheap, hardworking labor.

The importation of Mexican labor was begun most systematically to meet World War II emergency agricultural labor needs. To sustain this policy, Public Law 78 was adopted in 1951 which created what became known as the "bracero system" (Galarza, 1964). This program permitted importation of Mexican workers upon certification to the Secretary of Labor that a labor shortage existed and that domestic labor would not lose jobs due to the importation of Mexican farm laborers. Bracero labor was cheap and abundant and represented a "solution" to the problems of agricultural labor supply that California growers enthusiastically favored.

In 1959, a study by the Department of Labor found that the Bracero Program hurt domestic labor and the inevitable end of the bracero program became clear. In 1960, James P. Mitchell, then Secretary of Labor, called for amendment of PL 78. The growers, on their part, wanted the bracero program to be turned over to the Department of Agriculture, a branch of government where their influence was more strongly felt, or at least that consultation take place between the Secretaries of Labor and Agriculture.[5] While the bracero program was extended, the demand to end the program in 1964 when it was due to expire was great and growers began to seek resolutions to their problems.

This change was not an easy one. Grower attitudes towards labor had become thoroughly fixed over the decades. Traditionally used to having cheap, abundant, and docile labor, most growers felt that agricultural labor required little skill, but lots of muscle and docility. Most growers (like most people) had distinct ethnic prejudices, and agricultural hand labor has always been highly ethnic.

Because growers tend to be tradition-bound, few looked to mechanization as a possible solution. This was probably particularly true with tomato growers since the fruit is delicate and bruises easily.

The main approach of growers, therefore, to the problems of the tomato harvest remained directed almost entirely to maintaining the supply of bracero labor from Mexico. While a few growers and others in the California Tomato Growers Association began looking to mechanization as a solution in the 1950s, the bulk of the growers and the CTGA itself struggled, to the last minute, to renew PL 78 and maintain the flow of braceros.

The Shift to the Machine

The Actors and the Circumstances

The development of a system for mechanized harvesting, in retrospect, is seen as a singular success for agricultural research (Rasmussen, 1968). While the search for a mechanical system to displace the hand harvest is now seen as one involving conscious and deliberate policy on the part of researchers, the entire process began instead as a result of the stubborn interests of a single person who was often regarded as a maverick within the agricultural research establishment. Appropriately honored by the tomato industry today is G.C. "Jack" Hanna as the person who "saved the tomato for California." But when Hanna first began to consider the possibility of mechanized harvest, the entire idea was believed to be ridiculous. Once joined by his co-worker Coby Lorenzen and the first developments of prototypical equipment were undertaken, the early demonstrations were considered by most growers as naive and impossible.

The development of the mechanized tomato harvest system(7) predates World War II. The sequence leading to

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(7) It is vital to recognize the systemic character of the research necessary to develop a machine harvested tomato. Three distinct and separate elements had to be developed, two of them in tandem. The three elements comprise: 1) the tomato, 2) the harvesting machine, and 3) the cultivation practices. The tomato and machine had to be developed together; the cultivation practices were developed once the basic problems with the first two elements had been resolved.

its development began when Jack Hanna started to worry about the labor supply in asparagus, a crop in which he was then working. Hanna reports (interview, June 1974) that he realized the significance of the different ethnic groups and their necessity for agricultural production. He came to a belief that the United States would eventually exhaust the foreign labor pools from which it had drawn the successive waves of ethnic recruits for agricultural labor. Nor did he see any solution domestically to the labor supply problem. Hanna was ripe for a new approach to the problem of labor supply and a discussion with a grower friend stimulated the idea of taking tomatoes as a subject on which to concentrate the approach to mechanized harvesting. Hanna reports that a key motivating force in his work was not primarily to save labor but to develop a system that would be acceptable to American workers.

In the academic department to which Hanna was attached, Vegetable Crops in the College of Agriculture of the University of California, Davis, this idea was regarded by his academic collegues as eccentric. According to Hanna, various attempts were made to undermine his interests by department members who believed not only that the project was bizarre but that experimentation in this direction would damage the department and its reputation.

Hanna is, by personality, a strong-minded person and he decided, despite a lack of formal departmental approval, to pursue his interests in a machine harvestable tomato as a matter of personal commitment. During the wartime period, Hanna experimented with various breeding attempts to see if a tomato could be developed that would be tough enough to be harvested by a machine. In 1947, Hanna devoted six weeks of leave to touring areas where different types of tomatoes were grown and discovered a Redtop variety in Geneva, New York, that had a number of characteristics that looked promising. Hanna was concerned with developing a tomato plant and fruit that had four characteristics:

1. The plant should have a concentrated set, e.g., it should produce flowers that would develop as tomatoes in a concentrated period of time.

2. The fruit should be firmer than existing varieties of tomatoes.

3. The tomato should be easily detachable from the vine.

4. Tomatoes should ripen uniformly.

Hanna brought back seeds from these promising plants and continued his plant breeding experiments. Despite continued objection from some of his Vegetable Crops colleagues, Hanna persisted in his efforts. By 1947 developments had proceeded to the point where the chairman of the Agricultural Engineering Department assigned one of the faculty members, Coby Lorenzen, to working with Hanna in developing a harvester.

In the discussion which followed between Hanna and Lorenzen, the salient characteristics of the machine were delineated (Lorenzen interview, 1974). First, it was recognized that the only feasible approach to harvesting would require a once-over operation. This represented a sharp break with existing practices in which fields were harvested two and three times with workers selecting only ripe tomatoes in each pass through the field. It was recognized that the machine would destroy the vines as the crop was harvested so that the tomatoes had to be uniformly ripe at the time of harvest. Second, the specific features of the machine were delineated. The machine had to cut the vine, elevate the plants after cutting, separate the fruit from the vine, dispose of the vine, sort the fruit, and incorporate a handling procedure for the fruit.

While Hanna continued with his plant breeding efforts, Lorenzen began work on the different elements of the machine. He attempted several experiments with different types of knives mounted on tractors. These attempts revealed that the tough stem would have to be cut below the surface where the stem was moister and softer and where the resistance of the soil would help cut the vine. After working with rotating knife disks and vibrating knife blades for a year, Lorenzen turned to problems involved in elevating the vine after cutting. Elevation was necessary to separate the vine and fruit from the dirt clods that would be picked up ~~when~~ the vine was cut below the surface of the ground. This led to various attempts at developing belts, arms, and other devices to carry the vines upward.

When Lorenzen turned to the next problem, the separation of the fruit from the vine, he confronted what was probably to be the most difficult technical problem. Research on this element of the problem occurred over a number of years and involved studies of the amount of energy necessary to separate the fruit from the vine, dealing with the problem of separation at the node (a joint in the stem) rather that at the crown of the tomato, use of high speed cameras to study how tomatoes responded when vines were shaken, determination of the pendulum effect during shaking, development of several different approaches to shaking the fruit from the vine.

By 1956-57, Hanna and Lorenzen were making significant progress with their joint research. Hanna had a tomato he felt could stand up to mechanical harvesting and had reacted well in test plots. Lorenzen's machine was beginning to take shape. At the same time, discussions in Congress about the bracero program were creating increasing worry in grower circles in California. Around this time, the growers and processors with whom Hanna and Lorenzen met began to express a sense of urgency in place of their former skepticism. It was also around this time that Hanna began explorations with a personal friend, Ernest Blackwelder, a manufacturer of farm machinery, about production of the machine. At the same time, support was forthcoming not only from processors but from Lester Heringer, an active member of the California Tomato Growers Association.

During trials of the prototype machine in 1958 and 1959, despite considerable wastage of usable tomatoes, Heringer continued to provide support. As a tomato grower himself, Heringer believed it crucial that machine capability be developed; as an activist in CTGA, he brought considerable support to Hanna and Lorenzen when most growers remained openly skeptical. Heringer offered test plots of his own tomatoes and drummed up other test plots so that the machine could be tested.

The 1959 trials demonstrated that a new method of handling the fruit would have to be developed once it had been harvested if the machine were to be economically feasible. Existing practice involved stacking harvested tomatoes in lugs (wooden boxes) holding approximately 50 pounds of fruit. Handling lugs on the harvester proved to be too slow a system, e.g., machine capacity was already greater than handling capacity. Michael O'Brien, one of Lorenzen's colleagues in the Department of Agricultural Engineering, was brought in to work on this problem and through his efforts a system was developed in which a tractor pulled a row of four large bins alongside the harvester. O'Brien determined the maximum depths to which tomatoes could be loaded (24-25 inches) without damaging the fruit at the bottom of the bin. He also developed a two tractor system which permitted continual filling of the bins so that there would be no delay in the movement of the harvester itself because of fruit handling problems. O'Brien's bin system continues to dominate the handling process although change is now taking place to a bulk-gondola system discussed in Chapter One.

In the next few years, the tempo of development and implementation accelerated as the discussions in Congress revealed the impeding demise of the bracero program. Contracts were negotiated between the University of California and Blackwelder for the production of the first tomato harvesters, test trials were conducted on an increasing number of sites, pressures were being experienced by all of the actors involved. 1961 is often referred to as the "baptism in blood" of the new harvesting system since it brought together the new Blackwelder machine and the tomato that Hanna had developed, the VF-145. While traumatic(8), the baptism was basically successful in that labor costs were cut in half.

Table 3 shows the numbers of machines and the percentage of the crop harvested by machine since 1961. Today, virtually all processing tomatoes are mechanically harvested.

An examination of Table 3 demonstrates the interrelation of politics, agriculture, and labor. Until 1964, despite the existence of the tomato harvester and the machine harvestable tomato, there was little pressure for tomato growers to adopt the new system. Acceptance of the innovation was dependent on the existence of the bracero labor supply. Until the bracero program was cut off, growers had little interest in adopting the new innovations. Many growers continued to believe that when the crunch came in 1964, Congress would weaken and renew PL 78. They were to be disappointed. Despite the howls of pain that emerged from grower circles in California and elsewhere, Congress and the Department of Labor stood firm. Growers continued to believe into 1965 that Congress would renew PL 78 and growers refused, on the whole, to make the transition to the machine harvesting system. While some braceros were admitted in 1965 and 1966, it soon became clear to growers that the time for transition had come. That transition is reflected in the percentages of the crop machine harvested

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(8) The issue of how many machines Blackwelder should build, how much they would cost, occupied all of the proponents of the new system. Once operational, many of the machines broke down. While there is no agreement about how many machines were actually used, Lorenzen reports that of 25 machines produced, 18 broke down very quickly. Of the seven remaining machines, only one successfully completed the entire season.

in 1966 and 1967.

TABLE 3

NUMBER OF TOMATO HARVESTERS AND PERCENTAGE OF CROP HARVESTED, CALIFORNIA, BY YEAR

YEAR	NUMBER OF MACHINES	PERCENTAGE OF CROP MACHINE HARVESTED
1962		1.0
1963	66	1.5
1964		3.8
1965	224	24.7
1966	736	65.8
1967	1065	81.8
1968	1461	95.1
1969	1510	99.5
1970	1521	99.9

Source: California Tomato Growers Association

Post-Machine Problems

With the basic solution of problems relating to the development of the tomato and the machine, new sets of problems emerged. First, it rapidly became clear that machine harvesting of tomatoes would require an entirely different set of cultivation practices. Second, new and complex information about the machine, cultivation practices, handling, etc., would have to be dispersed to the thousands of tomato growers in California. At this stage, identification and delineation of the research problems involved in the new cultivation practices began with two agricultural extension agents in the main producing counties, Mel Zobel (Yolo County) and Ray King (San Joaquin County). As the machine harvestable varieties spread to Fresno County, Don May, an extension agent in Fresno, joined in the research. William Sims, an agriculturist based at Davis, also joined in the research efforts.

The distinctive feature of the once-over harvest which cuts (and therefore destroys) the vine required the development of precision in planting, irrigation, and cultivation that was hitherto unknown in tomatoes or, indeed, in most other crops. Unless seedlings emerged uniformly, plants grew homogeneously, a set occurred in concentration, and fruit reached maturity simultaneously, the new machine would be useless. Zobel and King therefore turned their attention to a host of problems involving the production of a uniformly ripe crop at a determinate time period to meet the scheduling problems necessitated by limited capacity of the canneries. These studies involved research on the time required for seedling emergence under differing temperature conditions as well as developing techniques to influence such temperatures. Plant populations had to be studied to determine the optimum densities affecting the production of fruit on the vines. The effects of irrigation and its scheduling had to be studied as did controls over thinning and weeding, fertilization, bed formation, and (with entomologists) pest controls. These studies continued over several years as increased sophistication was developed on cultural practices to fit the requirements of the machine harvest.

Once the knowledge of cultural practices had been garnered, its dispersal to the many tomato growers could be facilitated through the long-developed systems of agricultural extension. Zobel, King, and Sims wrote various informational bulletins and articles, met with growers, circulated through meetings of the CTGA, and provided a constant flow of information on cultivation practices. Over the years, as sophistication grew, this information changed and increased in volume. In the first year that a bulletin was produced, 1962, it consisted of five pages of instructions. This evolved into a 28 page manual by 1968 (Sims and Zobel 1962a; Sims and Zobel 1962b; Sims, Zobel, and King 1968). The continuing sophistication is reflected in the hectic development of new tomato strains, continuing studies on plant populations and effects on bearing, introduction of ripening elements such as ethrel, and other experiments and studies.

In historical retrospect, the development of the tomato, the machine, the cultivation practices, and the dispersal of information can be viewed as "sleepwalking." The actors involved were rarely conscious of the systemic elements involved in their research. Hanna began his work as a stubborn individual conscious of a problem and refusing to be influenced by pressures brought by others in his department. Lorenzen was assigned to work on machines as a matter of deliberate policy. In working together, he and Hanna delineated some elements of what is now called a "systems approach," in that they set out the specific elements of the tomato that would be machine harvestable and the machine that would have to harvest a soft fruit. Neither had the time -- or the methodological approach -- to consider other elements that would have to be involved. Nor did Lorenzen give any attention to a vital issue involved in tomato harvest, the character of labor. Technical and mechanical issues occupied his energies and it was not until the machine was actually working in the fields that some of the more immediate problems involving labor began to be conceptualized (e.g., shading workers from the burning sun of California's Central Valley).

This does not mean that the researchers involved were oblivious of the consequences of their research, social and non-social. Hanna reports, for example, that numerous discussions took place between Zobel, Lorenzen, and himself on the need for cultivation research. It was recognized, however, that such research could not begin until an appropriate tomato variety and harvesting machine existed. Similarly, while Lorenzen was aware that various subsidiary problems would have to be resolved, he felt it necessary to concentrate his energies on the basic elements of the machine. Refinements (such as awnings) could be introduced at a later stage after the machine had been proven. The researchers were aware that there would be social consequences in the form of labor savings -- indeed, this was a conscious and explicit goal of their research -- but there was little concern about how social consequences might extend in areas other than labor savings.

Thus, the researchers were aware of the existence of future research subjects and that there would be some social consequences. That they did not address themselves systematically to these problems is not surprising; indeed, few researchers anywhere, let alone in agriculture, have given much consideration to subsidiary elements of research or the social consequences of their work. Neither their training nor the institutional constraints make such considerations an integral part of their work. In fact, training and the institutional constraints act just the opposite: encouraging researchers to define their problems as narrowly, and therefore to make them as manageable, as possible. Thus the designation here of the specific researchers involved in the tomato project as "sleepwalkers" is not intended to fault them as individuals. Rather the point is to emphasize the systemic qualities of scientific and technological research in ignoring the fact that social consequences inevitably follow from such work and that the study of such consequences should be an integral part of the research endeavor (Friedland 1974).

The Role of the California Tomato Growers Association

CTGA played a significant if not vital role in the development of the machine harvesting system of tomatoes. While the delineation of the problem and the actual research came from other sources -- indeed, CTGA seemed largely oblivious of the problem for a long time -- once serious pressures developed about the bracero program, leadership elements within the Association began to support studies to effect the transition to the mechanically harvested tomato.

Formed in 1947 (Holt Feb.1972, 8), CTGA represented the attempt by tomato growers to grapple with the superior power of processors in the bargaining over the prices of commodities. At the same time, CTGA has been, at least until recently, a weak reed on which to lean. Given the structural features of tomato production with thousands of growers dispersed over considerable distances dealing with a small number of processors, basic influence over the industry has rested with the latter. Growers were not in sufficient contact nor able to develop organizational relations in which sufficient trust could emerge to create a powerful organization. Thus, various attempts at price bargaining (e.g., growers bargaining over prices collectively with processors) have ended disasterously until the first successes were registered in 1974, a development that will be argued in Chapter Four is, at least to some degree, a product of the harvester.

The structural features of tomato production yield insight into what might be called the sociology of commodity organization, e.g., the social organization of the production system of a single agricultural commodity (9). These structural features include the following elements relevant to tomato production:

1. Production of a delicate crop.

2. Production of a crop intended for processing (e.g., the "market" consists of processors rather than consumers).

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(9) That different technological processes produced different forms of social organization has long been recognized by industrial sociologists. See, for example, Blauner (1964).

3. Consequent determination of the vital conditions (e.g., acreages) before planting occurs.

4. Production of a crop in which little specialization existed until recently (e.g., tomato growers also grow other crops unlike growers in many other commodities such as lettuce or grapes).

5. The existence of large numbers of growers growing (at least until the machine was developed) many scattered plots of relatively small acreages.

6. A crop which was very labor intensive and which still is, even it to a reduced degree, at harvest time.

As a result of these structural features, the organization of tomato growers reflects certain distinctive characteristics.

First, the CTGA was initially most successful in standardizing the contracts between the growers and processors. Until grower organization facilitated this standardization, any sort of contracts might be written between the two elements concerned depending on individual circumstances. Over the years, a standard contract form has developed and been revised which provides a standard set of terms.

Second, despite several vigorous efforts, CTGA was disasterously unsuccessful in price bargaining. Several early attempts were made to establish collective negotiations between growers and processors. Each attempt resulted not only in failure but, indeed, a weakening of the Association. Grower-members were unwilling to trust fellow growers or the CTGA in the determination of prices, preferring instead to negotiate individually with processors despite their recognition of the superior power of the latter. This situation changed to a limited degree and 1974 marked the first year in which price bargaining occurred successfully in limited areas of California production.

Third, CTGA has served as a relatively successful determiner of prices paid to labor although successes in this area have declined since the development of the machine. This has not been as a result of the machine but of the increasing scarcity of labor and the need for growers to pay "market value" for workers based on their availability and the growers' need. Over the years, the CTGA magazine would regularly publish a "scale of pay" for the different tomato producing areas and, to the extent that information is available, it would appear that the scale was followed by growers. Publication of the "scale" served to keep wages low and prevent growers from competing with each other to drive up the cost of labor. While the bracero program operated and while labor supply was satisfactory after some dislocations in 1964, the scale of pay continued to hold meaning. Once labor became scarcer, the significance of the scale of pay dropped. Thus, the CTGA served a coordinative function amongst growers to limit labor costs as long as labor was in considerable supply; this influence declined under conditions of scarcity.

Fourth, despite an attempt to undertake the funding and support of research, CTGA has not been influential in the research process. As has been shown, the organization played only a small role in the development of the machine harvesting system. Even here, the influences at work were those of a small number of leaders of the organization acting more as individuals than as representatives of the organization. Subsequent to the development and acceptance of the machine, CTGA decided to create its own research organization to be funded through membership production dues. The demise of this effort after years of experience indicate that other sources of research are more potent. The Association continues to encourage research through existing agencies such as the College of Agriculture of the University of California but it does not play a key delineating role with respect to research or the diffusion of technical information about tomato production.

Fifth, the organization appears to play an important role for its members in diffusing information on business and market conditions. Despite reluctance for many years by most of its members to entrust price bargaining to CTGA, tomato producers continue to need information about the state of the market, the demands being made of processors, the prices being offered to other growers, the "carryover stock" (volume of tomato products from previous seasons being held in stock prior to sale), and other commercial and market information. CTGA offers this information through a monthly magazine, The California Tomato Grower, and a network of field agents employed by the Association. Thus, for relatively small dues based on tomato production, growers can keep tapped into a communications network on the business end of production. For technical information, reliance rests primarily on the county agricultural extension agents specializing in tomatoes as a crop.

Finally, CTGA is an "open" organization. Despite the fact that it has, until recently, closely guarded the size of its membership and the percentage of acreage they represent of California production, the Association is far more open than many other single-commodity organizations in California agriculture. Not only is information dispersed through its magazine but its General Manager, Bob Holt, is available to outsiders, providing information, giving figures on acreages and tonnages and prices.

CTGA as a commodity organization stands in sharp contrast to other commodity organizations. Perhaps a brief comparison with lettuce is appropriate. Because lettuce is a highly concentrated crop (e.g., grown by a relatively small number of growers with national production being dominated by about twenty growing organizations of large size) produced for an unimaginably volatile fresh market in which prices change drastically from day to day, grower cooperation within the industry is rare. When it occurs, it takes strange forms. Thus, lettuce growers form a tight-knit social group effectively hiding internal mechanisms to outsiders. Despite attempts at cooperation amongst growers, these have been effectively limited to the weekly volume of production and data on buyers who are not paying their bills on time. Business information is not only closely held but misinformation is released to confuse competition. Organizationally, lettuce growers engage in little internal cooperation with each other yet they maintain one of the most closed social groups in California agriculture.

CHAPTER THREE

WORK ORGANIZATION IN THE HARVEST OF PROCESSING TOMATOES(10)

Of necessity, with hundreds of individual growers involved in the production of tomatoes and with the enormous variation in their size, many different practices are found in the way in which the labor force is recruited and the work is organized on the job(11). This chapter deals with varying practices found and the consequences that follow in terms of the effectiveness of work crews. The chapter begins with a discussion of technical aspects of the operation of the machine and the jobs that have developed as a result. Throughout this section, comparison with practices that existed before mechanical harvesting are made so that perceptions of the changes wrought in work organization can be obtained. The second section turns to a consideration of different forms of recruitment of the labor force and the types of crews that have developed as a result. Finally, some preliminary assessments are made of comparative crew organization and effects on efficiency.

Technological Development and Job Organization

In the years prior to 1964, the tomato harvest entailed the employment of large numbers of field laborers to perform the task of hand-harvesting. The number of workers was necessarily large to meet cannery deadlines and to prevent the crop from spoiling on the vine. In terms of job organization, with the exception of supervisory workers, swampers (loaders), and truck drivers, the entire labor

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(10) This chapter is drawn substantially from Chapter 4 of Thomas (1974).

(11) In attempting to assess the wide variation of practices found in California, it has been necessary to construct a variety of typologies. Such typologies have the strengths and weakness of all typologies: they summarize reality well but reality can never be fully encompassed within a limited number of types.

force consisted of undifferentiated pickers who moved down the rows harvesting the ripe fruit.

The mechanized harvest is much more involved, requiring the orchestration of numerous pieces of machinery, most of which are auxiliary to the harvesting machine itself. Once the fruit is picked and sorted on the machine, it is transferred to either 1) a trailer loaded with palletized bins or 2) one of two large "bulk bins." From that point, in the field, a tractor moves the bins out of the field for transporting to the cannery.

The operations of the machine, as a harvesting tool, are far more complex than the process of hand-picking, although the end result is much the same. Figure 1 on page 36 depicts an overhead view of one variety of machine. The harvest process involves:

1. Severing the vine at the stalk using either scissor-like or rotating blades.

2. Elevating the vine onto the machine through an upward conveyor that carries vines and tomatoes from the blades and drops them on to the shaking arms.

3. Shaking the vines along a series of arms mounted on an eccentric drive so that the tomatoes drop through while the vines are dropped behind the machine.

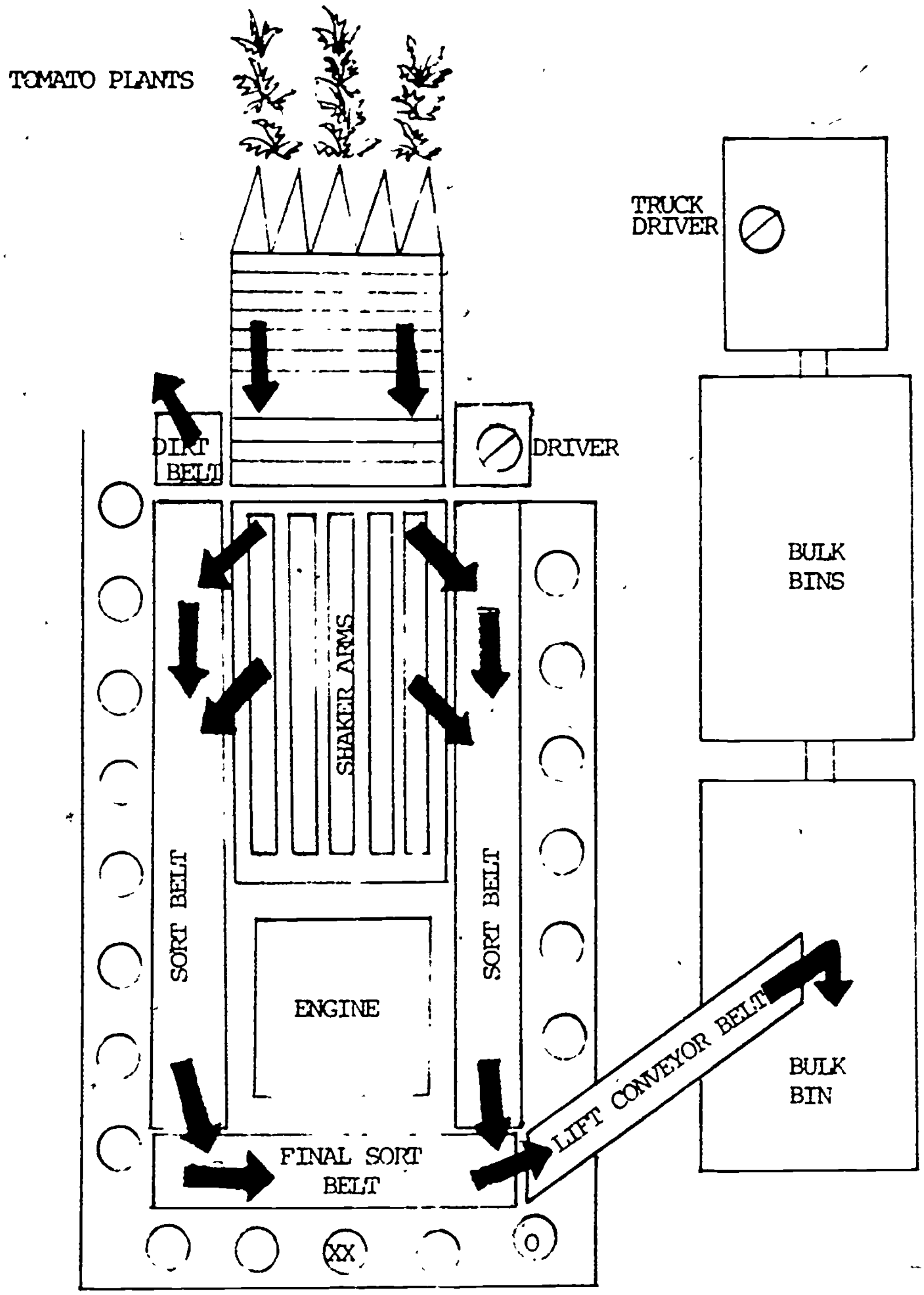
4. Dropping the tomatoes on to conveyor belts where they can be sorted by workers, separating good fruit from bad and from debris, clods, twigs, etc.

5. Conveying tomatoes along a series of belts to a conveyor boom which drops them into bins or gondolas being hauled alongside the machine.

There are many variations on machines and designs with equipment being manufactured mainly by four machinery companies: Blackwelder, Button-Johnson, FMC, and Hume. Most machines are relatively equal in work capacity and speed. Originally they moved at a rate of one to one and a half miles per hour and utilized between ten and twenty workers. Machines nowadays are capable of moving about two miles per hour and can hold as many as twenty-eight sorters. Originally, the machines had a capacity of harvesting about 75 acres per season, a figure that has increased to approximately 250 acres each season.

FIGURE 1

OVERVIEW OF A TOMATO HARVESTING MACHINE



◯ —Human Sorters

(O) —Lift Conveyor Operator

(XX) —On-Machine Supervisor (Most Common Position)

Jobs and Job Skills

Little variation existed in jobs or job skills in the hand harvest when compared to the machine. Hand laborers, paid predominantly by piece-rates, depended on their own ability to move rapidly and gather as many tomatoes as possible. Because individual workers controlled their own pace, there was little emphasis on supervision other than concern about the quality of tomatoes picked. Aside from some supervisory workers, swampers, and truck drivers, the skills involved in harvest were homogeneous.

The introduction of the machine created a gradation of skills that are reflected in training, pay, and in some cases, responsibilities. Aside from general supervision off the machine, on the machine itself the following jobs now exist, each involving different sets of skills and responsibilities.

The machine operator exercises responsibilities in three areas: 1) he must maintain direction of the harvester and the level of the cutting blades at heights that will not cause excessive dirt to be thrown on to the conveyor belts or to cause the machine to malfunction; 2) he controls the pace of the sorters by virtue of the speed which he controls of movement of the machine; 3) he maintains responsibility for a piece of equipment worth about $65,000 whose inoperability can seriously damage a production schedule and/or affect the incomes of the sorters. During the 1973 season, operators were paid at a rate ranging from $2.25 to $2.75 an hour(12).

The head sorter, whose primary responsibility is supervisory, maintains the proper mixture of tomatoes and communicates to the operator any conditions which might necessitate altering the operation of the machine. He/she is not confined to any one position on the machine, and frequently moves in order to better observe the sorting

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(12) Wage rates are contingent on a variety of factors. For example, higher wages may be paid in certain geographical areas where the better pay is designed to attract sufficient numbers of workers from other crops in that area. Or, the amount of pay may be reflective of the urgency with which the harvest must be completed, (e.g., to meet a cannery deadline or to avoid an approaching weather front). The rate of pay may also fluctuate within a single job category, according to the experience of the worker or whether the worker is a year-round or seasonal employee.

process, or fill in the gaps when a heavier than usual flow of tomatoes occurs. The head sorter received on the average from $2.00 to $2.50 per hour during 1973.

The _lift conveyor operator_ directs the flow of tomatoes into the bins or gondolas in such a manner as to achieve the maximum filling of the receptacles with a minimum of damage to the fruit. The lift operator may also sort if the flow of tomatoes is greater than the sorters can handle, but can only do so for short periods of time. The lift conveyor operator received between $1.80 and $2.30 per hour in 1973.

Truck, tractor and _fork-lift operators_ must be able to drive their vehicles and follow verbal instructions of the harvester operator or foreman. In most cases, there are two rigs per machine for receiving tomatoes, maintaining an orderly flow of work; while the number of fork lifts depends on the size of the operation. Pay rate varied in 1973 from $2.00 to $2.50 per hour.

The _sorters_, numbering from 10-28, depending on the size of the machine, stand on platforms facing the conveyor belts, usually on three sides of the machine. They must separate the undesired debris from the desirable tomatoes. Little, if any, training is given the sorters, although tomato specialists and processors recommend that sorters be given instruction so as to make the harvest efficient. The physical properties necessary for the job are, however, distinctive. The sorter must possess a relatively high degree of manual dexterity and eye coordination to remove the proper matter from the conveyor belts at a pace sufficient to keep up with the rate of the belts and the flow of the fruit. The wage rate for sorters varied in 1973 from $1.65 to $2.30 per hour.

While, in terms of numbers, sorters comprise the bulk of the labor force, the new harvesting system has introduced a greater differentiation in the occupational structure which more closely resembles the job hierarchy found in industrial circumstances. In addition, it might be noted that a small number of ancillary occupations have been created involving people who repair and service the new harvesting equipment.

Working Conditions

To pick the fruit at a rapid enough pace, the worker in the hand harvest needed to stoop over the vines throughout the day. The strenuousness of the position was accentuated by constant exposure to direct sunlight and the practice, in some cases, of carrying sixty-pound lugs out of the field for stacking. Such conditions still exist in other fruit and vegetable harvests, e.g., melons, broccoli, and cucumbers.

The sorters' job in the mechanized harvest more closely resembles factory work, but with significant differences. The work pattern for sorters on the tomato harvester is machine-controlled, with workers performing a single task for up to 12 hours(13). The sorters must stand while working, facing the conveyor belts, in close proximity to one another. This proximity, coupled with the rapid movement of the conveyor belt, restricts the actual movement of the sorter to arms only. Since the conveyor belt is situated in front of the sorter, at or about waist level, the sorter is afforded little opportunity to gain support for either the back or neck, which can cause extreme physical fatigue after lengthy periods.

Rest periods vary in length, depending on the grower or work situation, but usually involve 15 minute breaks at mid-morning and mid-afternoon, with 30 minutes at lunch. The only other rest periods occur when the machine maneuvers a turn at the end of a row, when it malfunctions due to mechanical failure, or when it requires servicing during harvest hours.

In the sorting process, the least desirable positions are at those points on the machine where the work is heaviest and where the dirt clods appear. These points are at the "dirt belt" and/or where tomatoes fall out of the shaker onto the conveyor belts. At the rear of the machine, work tends to be lighter, since most culls and clods have already been removed. Equity in the distribution of work requires that sorters rotate through various positions so that each can have the benefit of lighter work and suffer the deficiencies of the heavier work; as will be discussed later, such rotation does not always take place.

High temperatures often accompany the peak harvest season in many areas and are increased by the heat generated by the engine which propels the machine; in some cases,

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(13) The length of the work day is determined by one or a combination of factors, including field conditions (e.g., the danger of rain or a high percentage of unripe tomatoes can curtail work) or the approach of a cannery deadline. Some growers also prefer to run day and night shifts.

heat and exhaust may blow directly in the faces of sorters. Canvas awnings have been adapted to most machines to protect workers from exposure to the sun, but are often inadequate, especially in the early and late parts of the day. The movement of the machine through the field, shaking vines and uncovering noxious weeds, forces many workers to cover nose and mouth with bandanas and eyes with sunglasses for protection from dust and pollen. Constant contact with the conveyor belt, and the rocks, water and squashed tomatoes on it, necessitates the use of rubber dishwashing gloves to protect the sorters' hands. Gloves also prevent the tomatoes from being bruised or cut by sorters' fingernails.

Chart 4 on page 41 offers a comparison of various factors in the organization of work and working conditions between the hand and machine harvests.

CHART 4

COMPARISON OF WORK ORGANIZATION:
HAND V. MACHINE HARVEST

	HAND HARVEST	MACHINE HARVEST
Number of Workers	50,000 (1964)	18,000 (1972)
Machinery Used	Trucks (hauling)	Harvester Tractors or Semi-trucks Forklifts
Job or Skill Gradations	Supervisors Pickers Lug Counters Swampers Drivers	Supervisors Harvester Operator Truck/Tractor Drivers Lift Conveyor Operators Head Sorter Forklift Operator Sorters Repair and Service Workers
Rate of Pay	Pickers/Piece Rate All Others/Hourly	Hourly
Length of Working Day	8-12 Hours (Conditions Permitting)	8-12 Hours (Conditions Permitting) Night Shift Optional
Working Conditions; Posture	Stoop	Standing Restricted Movement
Pace Control	Individual	Machine-controlled
Special Clothing Used	None	Rubber Gloves Bandana Sunglasses

The Harvest Labor Force: Identity, Recruitment and Crew Types

Identity of the Labor Force (14)

Until 1964, the harvest force in tomatoes was composed overwhelmingly of male Mexican workers imported to California for the harvest season as braceros. Comprising an estimated 50,000 workers, there were occasional other workers involved in small numbers: U.S. nationals, often of Mexican extraction; women, particularly the wives of such workers; Anglos, particularly alcoholics, etc. This latter group constituted at best only a small percentage of the total number of workers employed as tomato harvesters.

1965 represented the last year in which significant numbers of braceros (10,000) worked in the harvest; after that year, the character of the labor shifted dramatically so that by the end of the decade of the 1960s it was composed heavily of women, often of Mexican extraction whose husbands worked in more skilled occupations around the tomato harvest or in piece-work in other crops. Non-Mexican women are also found in some numbers now as are other types of workers including males, of Mexican extraction as well as Anglos, and students, both males and females. The harvest labor force is therefore more heterogeneous now than it once was in terms of ethnicity; in terms of sex, it has shifted from overwhelmingly male to predominantly female. In terms of origins, it has shifted from Mexican nationals migrating for a season to a predominently settled population working local harvests without migrating.

Growers almost uniformly express a preference for women workers as sorters on the harvesters. They express beliefs that women are best suited for the requirements of the job being possessed of attributes such as better manual dexterity than men, greater eye coordination, as well as endurance of boredom and physical fatigue.

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(14) The following discussion is based on interviews with individuals -- growers, personnel with experience in providing labor for the tomato harvest, and others -- and with direct observation in numerous locations during the harvest season of 1973. No objective data exist, to our knowledge, based on any systematic examination of the character of the tomato harvest labor force either before or after the introduction of the mechanical harvesting system.

In terms of the types of workers found, the following typology summarizes the various types with the first category comprising the bulk of the sorter group, possibly as much 65-80% of the sorters:

<u>Seasonal workers</u> -- <u>women</u>. Made up of non-farm workers for whom the tomato harvest constitutes the bulk of their exposure to farm labor.

<u>Farm workers</u> -- <u>single area</u>(15). Fulltime farm workers who live in one area and do the greatest portion of their employment in that area.

<u>Migrants</u> -- <u>primary</u>. Workers who follow the tomato harvest and for whom tomato harvesting is a primary source of income.

<u>Migrants</u> -- <u>auxiliary</u>. Migrant farm workers who will occasionally work in the tomato harvest, whether planned or not, but for whom tomatoes are not the primary source of income.

Recruitment, Supervision, and Crew Types

<u>Recruitment</u>. Practices in the recruitment of harvest labor crews not only vary considerably but different patterns emerge in different tomato growing areas. Basically most crews are recruited by growers themselves although in some areas, particularly on the west side of Fresno County, crews can be recruited by labor contractors. The basic patterns found in 1973 were:

- Grower-recruited crews
  - Informal recruitment
    - Operator/foreman recruitment
    - Head-sorter recruitment
  - Formal recruitment
    - Pick-up crews, day-haul
- Contrator recruited crews
  - Local
  - Mobile-migrant

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(15) "Single area" has been used in a study commissioned by the California State Assembly Committee on Farm Labor (<u>California Farm Labor Profile</u>, 1965) defining a single area as all counties contiguous to the one in which the worker lives.

Amongst crews recruited by growers the prevailing pattern that was found involved the maintenance of extensive informal networks. Thus the primary recruiter might be the grower himself, in the case of small operations, and/or one of the grower's employees -- a foreman or a tractor driver -- who passes the word that the harvest is drawing nigh to wives, acquaintances, and friends. Another variant is for the wife of a permanent employee to serve as head sorter and to recruit a crew through a personal network of relations and friends. Informal recruitment through personal networks appears to prevail most heavily with smaller producers although some of the larger growers also utilize such informal systems, depending on year-round employees to serve as primary links in recruitment.

Some growers, especially larger ones, maintain more formalized systems of recruitment, utilizing formal employment agencies such as the Human Resources Division, e.g., California's employment service, and other organized recruitment organizations. Some growers use the offices of HRD to recruit workers for a season; others may recruit on a daily basis through day-haul pick up points maintained and supervised by HRD.

Labor contractors have been a standing feature of the agricultural labor scene in California for many years although their numbers and significance continues to decline. Most contractors are unspecialized with respect to crops, providing crews to growers for whatever crop is necessary at whatever time required. Thus, there appears to be little or no specialization in tomatoes as a crop although occasional contractors, migrant or local, may tend to provide crews for tomato harvesters more regularly than other contractors. Local contractors are those that provide crews only within a specific locality, normally the county of residence and/or adjacent counties, and usually within a radius of not more than 50 miles. Migrant contractors are those that move with their crews over considerable distances with workers being housed on ranches, most often, of the growers for whom they work.

Mobile-migrant contactor crews appear to be, at present, a still negligible factor in the tomato harvest although there are some possibilities that, as harvesting emerges as a specialized practice, more such crews may become a more important feature of the harvest situation.

The recruitment patterns stand in sharp contrast to those that existed before the mechanized harvesting system was introduced. During the bracero period practically all recruitment was handled on a highly formalized basis originating, at the local level, in the formation of labor recruitment organizations of growers and involving, at the highest level, inter-governmental negotiations between the United States and Mexico.

Thus, in terms of changes resulting in recruitment practices as a result of the new system there has been a change from a highly formalized system involving governments to a more complex system depending much more on the maintenance of informal networks of communications.

Work Supervision. During the harvest of any given grower's fields, there can be six levels of supervision present at any moment: grower, field supervisor, foremen, contractor, harvester operator, and head sorter. The possible combinations of authority figures and responsibilities are numerous, and certainly beyond an attempt to describe in depth.

Two factors influence the manner in which supervision occurs on the job. First, all growers reserve the right to interject themselves at any level of supervision they believe to be necessary. Thus, while some growers may pass orders down the chain of command they are just as apt to intervene directly on the machine in many cases. Some growers pay a great deal of attention to the hierarchy of supervision and will pass orders down through the chain of command even if they see something that requires immediate change; most growers, however, are more prone to immediate involvement, bypassing the chain of command. A second factor, is the size of the growing operation. The larger the size, the greater the complexity of the organization and the greater number of levels of supervision that will be necessary. Growers with thousands of acres of tomatoes and a large number of harvesting machines will be less able (or concerned) to intervene at field operational levels; growers of a small crop, operating a single machine, will be able to provide intense supervision on the machine itself.

As for immediate operational supervision on the machine, four basic patterns were found with key supervision being provided by one of the following four elements: foreman, harvester operator, head sorter, or contractor.

The strong foreman represents a situation of general control of harvesting operations under a single man or small number of men, usually year-round employees. The foreman may be assigned singular or multiple duties, but will have frequent and direct contact with the truck drivers, harvester operators and sorters. Foremen may ride on the machines or move between them, supervising the operator and the sorters and circumventing the need for a head sorter. In the temporary absence of the foreman, the harvester operator may assume control of the sorters, maintaining an adequate flow of tomatoes, and the truck/tractor drivers, maintaining maximum filling of the receptacles and continuous work flow.

In some cases, the machine operator is vested with greater control over the operations of the machine; where, in addition to a responsibility to coordinate the truck/tractor drivers, the harvester operator oversees the work of the sorters. In this situation it is often the case that the operator is a year-round employee experienced with the harvesting operations of the grower.

In a number of cases observed, the head sorter emerged as the de facto supervisor on the machine either because the grower was too busy elsewhere and had no foreman and because the operator defined his duties as focusing on the operation of the machine alone. This does not mean that formal supervisory responsibilities fell to the head sorter; rather that, in a vacuum created by failures to provide supervision by others the head sorter became the key supervisorial figure on the machine.

Occasional situations were also noted where the grower specifically allocated to a labor contractor, or permitted such an allocation to develop, where the contractor became the effective supervisor of workers on the machine. This situation does not always prevail where labor contractors provide crews since growers will often utilize their own supervision with contracted crews. In some situations, however, growers may make contractors into operating foremen of the crews they have provided.

Crew Cohesion and Efficiency. An accurate determination of "efficiency" is beyond the scope of this paper since no reliable data exist on productivity. In addition, experience with growers and workers indicates that different definitions of efficiency would be utilized if a thorough examination were to be made. Growers are most concerned about productivity factors while workers are more concerned about elements of job satisfactions -- which can be reflected in productivity(16).

The major factor that appears to be present in crews that growers consider to be efficient is job commitment. The most important elements involved in job commitment are 1) attachment to agriculture as a year-round or lifetime pursuit, and 2) the availability of alternative forms of employment in agriculture or elsewhere. It is for this reason that growers evidenced preference for the braceros in an earlier period, and with green-carders and wetbacks currently. Such workers spend themselves in the pursuit of maximum earnings, since agriculture is their only source of income and their alternatives are negligible. The same is evident, albeit to a lesser degree, of the dwindling numbers of migrants. The harvest season presents to them the only opportunity to earn substantial amounts of income to sustain themselves during the dead periods when little or no work is available.

The influx of workers without significant agricultural pursuits outside the harvest season, particularly housewives and students, has changed this situation dramatically. They feel less commitment or attachment to the job since it is not their primary source of livelihood; they exhibit a greater sensitivity to working conditions and supervisory arrangements than more committed farm workers.

By far the least committed of workers in the harvest are the day laborers, skid-row types and transients. Their only real attachment is for one day at a time, if that long.

Another aspect of job commitment manifests itself in the homogeneity of the crew members in two important aspects: 1) kinship and 2) work experience. Those crews composed mainly of members of the same or related families and/or who have shared work experience as a group often exhibit means of internal regulation with regard to work. Crews composed of random individuals must establish a common plan for job rotation or have one imposed on them when, for

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(16) In making preliminary assessments about efficiency, we are reporting impressions provided primarily by growers for whom such matters involve considerable attention. In not reporting the views of workers we are not overlooking the importance of such views; rather, the capability we had of conducting a systematic study of workers' views was less possible. While grower views were not studied through any random process, we believe the expressions we obtained represent a fair segment of grower opinion.

example, a family group or experienced group does not. In family groups, a hierarchy of authority is intrinsic; in experienced crews, such arrangements have been worked out in the past. In such cases, when individuals are mixed in with either of the two elements, a higher degree of supervision is necessary to insure work sharing and rotation.

Thus the greatest degree of internal regulation is exhibited by crews consisting of experienced, well-acquainted crews, thereby necessitating the lowest degree of external supervision. A moderate, flexible amount of internal regulation and external supervision is warranted by crews with mixed kinship and/or experiential ties. Crews which exhibit the least homogeneity and experience manifest the highest need for outside supervision and are capable of the least internal regulation.

The delineation of supervisory duties indicates that interstitial areas exist where strain can develop, particularly with regard to the supervision of the crew and how, if possible, it is disciplined. While in most cases, the grower will not discipline workers directly (e.g., for doing a bad job, having a load of tomatoes rejected by the processor), he does deal with the field supervisor/foreman and the contractor. They, in turn, translate the discipline to the operators and head sorter and sorting crew.

If the crew is assembled by the head sorter of the machine on which they work, the basis for strain is inherent in their structure. Although the head sorter is the <u>de facto</u> supervisor of the sorters, the operator is the <u>de jure</u> head of the entire operation. Thus it is possible for disagreements to develop over machine speeds between the work group and the operator, especially when the crew and head sorter are recruited separately.

A converse of that situation is possible when the role of the contractor is not clearly defined in the supervisory process. If a grower or supervisor directly disciplines workers, then strain develops between the contractor who is the <u>de facto</u> supervisor and the company representative who is the <u>de jure</u> supervisor. Such a conflict can be translated into confusion for the workers and loss of control for the contractor.

A similar, and perhaps more frequent, point of stress is found in the question of disciplining a crew tightly knit by experience or kinship. A dilemma faces the grower or supervisor when he feels he must discipline a crew member who has been recruited through such a network. The grower risks the deterioration of the crews should the family or work group members interpret the act as an insult to themselves. In such cases, it would be likely that if the groups did not leave entirely, then the quality of their work could decline substantially.

In light of the greater relative degrees of internal regulation and efficiency exhibited by crews bound by kinship and prior work experience, it is not surprising that many growers interviewed would prefer families and migrants to work on their machines.

CHAPTER FOUR

SOCIAL EFFECTS OF THE TRANSITION TO MECHANIZED HARVESTING

The account thus far has explained the manner in which tomatoes are grown and harvested in California. This chapter turns to a systematic consideration of the social effects of this transition and the changes that resulted in the shift from a system dominated by hand harvest to one entirely harvested by machine.

Some of the social effects have become explicitly clear while others remain obscure. Some effects can be reported through quantitative data of verifiable quality; others represent speculation.

In summarizing the argument about social effects, the transition to machine harvesting produced the following consequences:

1. Production of processing tomatoes became concentrated in California.

2. Concentration has occurred amongst growers because of the increasing specialization necessary to grow tomatoes efficiently.

3. There has been a geographical shift in tomato production due, in large part, to the introduction of the new tomato variety and the harvesting machine. The shift has been toward the southern San Joaquin Valley, the west side of Fresno County, and away from the previous center of production in San Joaquin County in the Stockton area.

4. The development of the machine has probably contributed significantly to the success of price bargaining in the fringe seasonal production areas, in Ventura, Fresno, and San Benito counties.

5. The characteristics of the harvest labor force have changed drastically: from male to female; from Mexican National to American; from migratory to settled. Complex patterns of labor recruitment have developed involving informal networks of communications. The involvement of the present labor force may have had additional consequences for

family structure and local economies but no evidence could be collected on this matter.

6. A system of machine production has been introduced with factory-like characteristics to which growers are unaccustomed and with which they continue to remain uncomfortable, maintaining many of their former primitive labor relations.

Other consequences may also have occurred but the limited character of this study has precluded their elucidation(17).

Saving Tomatoes for California

One important consequence of the development of the tomato variety and the harvester was the "preservation" of tomato production in California. This consequence is pointed to most often by California tomato growers and by elements within the California agricultural research establishment, most particularly in the University of California's Agricultural Experiment Station and in Agricultural Extension. According to informants, processors were becoming increasingly aware of California's unviability as a producer of tomatoes. This was related to a considerable degree to California's vulnerable position because of the unavailability of a large labor supply of cheap labor for the "flash-peak" tomato harvest.

As long as the bracero program existed, California's production of tomatoes remained unthreatened. As pressures developed to end the bracero program, processors realized that they might get caught without a steady flow of tomatoes. Their search for locations in Mexico for growing areas and for locations of potential processing plants has

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(17) It would have been useful, had resources, time, and cooperation been available, to conduct a survey of workers on tomato harvesters during the harvest season. This kind of study would require cooperation of different government agencies as well as growers. It could not be mounted in the time available to us. Such a survey would have been necessary to develop the kind of data necessary to understand better some of the characteristics of the labor force but, in particular, to elucidate some of the non-work related effects of the introduction of the harvester.

been reported by growers involved in tomato production at the time.

Once the new tomato varieties and the machine had proven themselves and a new source of labor proved to be feasible, processors lost interest in shifting growing to Mexico. Under these circumstances, production not only focused in California but made California tomatoes more competitive with tomatoes elsewhere.

The relationship of the machine to concentration of production in California in contrast to other states is based on the state's greater regularity and predictability of growing conditions. Because weather conditions are unusually homogeneous and predictable, the new varieties of tomatoes tended to produce crops ripe for harvest in unusually rich conditions as compared to other places. Not only was there a better set, the flowering necessary for formation of the tomatoes, but the plant produced large numbers of blossoms at the same time. Once the set occurred, conditions of weather were homogeneous. With controllable irrigation and homogeneous conditions, a crop of tomatoes could be brought to maturity with a significant percentage of fruit mature at the same moment and with consequent high yields.

Thus the research on machine-harvestable varieties not only produced fruit with a tough skin and with a capability of relatively easy abscission (separation) from the vine but also of tomato plants that would produce large volumes of fruit ready for harvest at one time.

It was this feature that made the once-over technique, where the machine cuts the entire plant, feasible. In contrast to other places where weather conditions are far less predictable, the use of the machine has been less feasible since a once-over cutting of a less homogeneous plant with more variable growing rates produces significantly lower tonnages per acre.

Concentration of Growers

Until the new tomato varieties and the harvester were developed, tomato growing was a relatively unspecialized activity by growers who would put in varying acreages of tomatoes depending on price, relationship to other crops grown, availability of labor, and a number of other factors.

Tomato production was not, however, regarded as a crucial growing activity by many of them.

The main reason for this was that few growers thought of themselves as tomato growers *per se*, as tomato specialists. For many growers, tomatoes were a crop requiring no special investment that could be grown with equal facility as other crops. It would be possible to shift to a crop such as alfalfa easily if the price was right and just as easy to shift back. Tomatoes had their own special cultivation problems and harvest labor had to be assembled but there was little need for a grower to develop high levels of skills necessary for extensive production. Many growers had specialities but used tomatoes only as a sideline. In many cases, the acreages of some tomato fields were often equivalent to the space required to turn one of the machines once they were developed.

The machine harvestable tomato variety produced a whole new set of conditions for growers. First, the machine required a sizeable capital investment. The approximate $25,000 price of the early machines immediately began a process of concentration. Where a grower could, before, put in small acreages, it now became necessary to commit oneself to acreages approximating the capacity of the machine. Thus, with the early machines' capacity of about 75 acres, it made little sense to buy a machine if a grower was planting only 25 acres. Since the supply of labor in the form of braceros dried up dramatically after 1964, immediate concentration began.

Concentration has continued inexorably with the improvement of equipment and the increase in machine capacity. The latest models available at the time of writing can harvest approximately 250 acres per season. For a grower to enter tomato production now means that a major commitment must be made, in acreages and in capital. Many growers have been eliminated from tomato production as a result of the increased commitments necessary.

Concentration has not been a function solely of capital requirements. The special character of machine harvest has created conditions in which it is necessary to develop considerable skills and "stay on top of" the growing season to develop a crop which is highly productive and on which the machine can make an effective harvest. As noted by one Agricultural Extension tomato expert: to grow tomatoes nowadays one must "think tomatoes." This is because of the many variables that can affect productivity. Once the set has occurred, irrigation and other cultivation practices are necessary to produce a premium crop. The grower must visit the tomato fields regularly and know them well. Unless able to recognize when a field needs water or has too much, unless capable of scheduling irrigation and cultivation practices, not only will productivity drop but the schedules and delivery can be seriously disrupted. For the grower who enjoys holidays during the growing season, productivity can drop dramatically and the return from the processor can make tomato growing a losing proposition.

Thus, the effect of the new system has been to produce increased specialization. While tomatoes have not yet reached the stage where the levels of specialization are equivalent to those found in commodities such as tree crops (where specialization is necessary by virtue of the long-term investment in plantings) or in lettuce (where specialization is crucial because of the volatile character of the market), such tendencies have increased markedly.

The effects of specialization on the concentration process in manifested most immediately in the numbers of growers of tomatoes in California. There were approximately 4,000 growers in 1962; by 1973 that number declined to 597. At the same time production in tonnages went from 3,218,000 in 1962 to 4,002,000 in 1972.

Specialization has now reached a stage where it is reported that one grower is moving in the direction of vertical integration. By this is meant that this grower has already moved from tomato production into transportation of tomatoes to the canneries. It is also reported, although not confirmed through our own investigation, that moves are being contemplated to develop units for processing tomatoes in the field.

While the evolution of tomato growing into a situation equivalent to lettuce, where the bulk of national production is concentrated in several dozen growing organizations, is nowhere near as advanced, the tendency toward vertical integration of tomato growers is manifested in the development of grower cooperatives that process tomatoes. While processing units are beyond the capacity of most individual tomato growers, the tendency toward developing processing units by growers themselves, organized into cooperatives, is well underway.

The causal process for such a development is related to the smaller numbers of growers and the larger stake they have in production compared to the pre-machine situation when tomato growing was an almost casual process involving small acreages. Now that growers are "thinking tomatoes" they must address themselves also to what happens to their crop after harvest and this leads in the direction of vertical integration.

Shifts in Tomato Production Locations

The development of machine varieties and the harvester has also had significant consequences for the shift in tomato production from its former center in San Joaquin County -- the Stockton-Delta area -- to other locations.

The Stockton area was, until 1968, the prime growing area for processing tomatoes in California. Its nearest competition came from adjacent Yolo County where many similar conditions existed. Charts 1 and 2 show the trends over the years as San Joaquin County was overcome in production by Yolo County in 1969 and by Fresno County in 1972.

Primary among the factors responsible for the shift is the sizeable land units necessary for tomato production under machine harvest conditions. Equally, however, lower harvest labor requirements permitted the west Fresno County area to move into heavy tomato production after 1964. An additional factor is that the new VF-145 variety developed for machine harvest was especially appropriate to the geophysical conditions of west Fresno County. The Stockton area is marked by relatively compact land ownership and the existence of a relatively large number of medium sized farms. In addition, soil conditions are less optimal for tomato growing than for other crops. Thus, San Joaquin area farmers could shift to other crops when the costs of investment in tomato production became significantly higher as a result of the introduction of the machine. Where there were approximately 500 tomato growers in the early 1960s in San Joaquin County, that number declined until, by 1972, there were less than 600 tomato growers in the entire state.

The shift in production can also be seen by examining trends in Fresno County. Until the development of the tomato and the machine, tomato production in Fresno County was minimal. As charts 1 and 2 illustrate, it was not until 1966 that a significant rise in acreages and tonnages occurred. The dramatic development of production on the west side of Fresno County, while partially a product of the construction of widespread irrigation networks as a result of the construction of the California Water Project, is more a consequence of the introduction of the machine and the machine-adaptable variety.

West Fresno County is an area of very low population densities. Prior to the California Water Project, most of the land was given over to dry farming although irrigation from wells permitted some growth of other crops. With the availability of vast quantities of cheap water from California's north, a dramatic shift in agricultural production has occurred to crops which require substantial water requirements such as tomatoes, rice, fruit and nut trees, and grape vines. The towns of this area were scattered over enormous distances with almost no settlement in between. Since the arrival of the water, population has grown but remains concentrated in the towns with little or no settlement between them. Despite the growth of population, the manpower requirements for the manual tomato harvest were unavailable once the bracero program ended. Braceros could have harvested tomatoes prior to 1964 but water was limited since the CWP was then under construction. When water became available, the braceros were no longer around. The machine, however, permitted harvesting extensive acreages with small amounts of manpower. Thus, the machine facilitated expansion of a crop in a new area where it had hitherto only been a minor factor in agricultural production.

Fresno County has also served as a "safety valve" in tomato production. While San Joaquin County has decreased production over the decade 1963-72 and Yolo County has increased, Fresno County has been marked by great variation. In 1968, the first boom year in tomato production after the harvester was in full use, much of the expansion of output as measured by acres planted and tons harvested were contracted in Fresno County. With a heavy surplus of tomato stocks carried forward in 1969, Fresno County also had the steepest decline in production. After 1970, once the 1968 surplus was dispersed, Fresno County again had the sharpest rate of increase.

Success in Price Bargaining in Cannery Tomatoes

The role of tomato growers <u>vis-a-vis</u> tomato processors has been one of continuous vulverability. The large number of growers and their inability to develop a strong organization, the inability to maintain close and immediate communications, has put the grower at a disadvantage in dealings with processors.

As shown earlier, the decision to grow tomatoes is made during the winter when growers negotiate the price of tomatoes with representatives of the processing firms. The weakness of the grower in bargaining is the normal weakness of the single individual who is part of an aggregated mass dealing with a small number of centralized agencies. Unless the individuals develop means to represent themselves with a single voice, coordinated authority dominates the situation. Workers learned this many years ago and have surrendered individual bargaining rights to unions to negotiate with employers. Similar practices have developed only fitfully with farmers. In the case of California tomatoes, this development has been attempted and aborted and only succeeded in part in 1974. This partial success appears a function, of the introduction of the tomato harvester and <u>its</u> consequences for the change in the tomato growing season.

The California Tomato Growers Association made a major attempt at price bargaining between 1958 and 1960 (Holt Nov.1973, 6). This attempt was a disaster not only in the failure to develop bargaining rights but for the membership of the Association itself. While CTGA leadership remained committed to the notion that bargaining was important if growers were to get a "fair price" for the crop, they recognized their inability to convince the growers.

A new strategy by the CTGA has emerged recently. This strategy has been based on the fact that the tomato growing season has been extended with the introduction of the machine harvesting system. Thus, three major new centers of tomato production have been added to the former production centers concentrated in the agricultural counties that surround the junction of the Sacramento and San Joaquin Rivers around California's Delta. The three new centers are Fresno County representing the early season and San Benito County and Ventura County at the end of the season.

The special feature of the early and late counties is that they can harvest tomatoes at periods that will feed the canneries before and after the peak harvest period. Thus, these new production areas have extended the season and thereby permitted less of the "flash-peak" flood of harvest that overtaxes the capacity of the processing plants. Several researchers including Lorenzen continue to work toward the development of a system in which tomatoes would be preprocessed directly in the field and stored in aseptic containers. The fruit could be moved to the canneries for final processing after the flash-peak and thereby alleviate the blockages that develop in the receipt of the tomatoes.

An additional feature should perhaps be noted in the characteristics of the three counties. In each place, although in differing degrees, the sheer numbers of growers are smaller and the capacity for localized organization is stronger. On the west side of Fresno County, for example, tomatoes are produced by a small number of growers, each of whom produces very large acreages and tonnages of tomatoes. While there may not necessarily be a great deal of trust between growers, in such a context it becomes easier for individual growers to learn about the contracting practices of others. And it becomes easier for an organization such as CTGA to make the case for collective price bargaining. In San Benito County, while acreages are small -- especially when compared to Fresno County -- the numbers of growers are small and relationships are relatively well developed.

Still an additional factor makes processors more vulnerable to price bargaining at the ends of the season. When processors must take tomatoes in heavy volume, they can pick and choose amongst growers and they encourage competition thereby undermining prospects for bargaining. At the ends of the season, however, with plant capacity unutilized, processors must decide whether to pay a high price to growers to establish the flow of tomatoes at the beginning of the season and extend it longer at the end than in the central segment of the growing season.

Finally, external market and commodity situations can create preconditions for strength in price bargaining. When prices for commodities that compete with tomatoes for growing decisions are low, the stance of growers vis-a-vis processors will be weak; when prices of alternate commodities are high, growers can shift from tomatoes to alfalfa and other field crops with ease. During the 1973 harvest, it became apparent that these external market and commodity conditions had come into existence. Tomato growers were receiving premium prices for uncontracted (e.g., speculative) acreages of tomatoes. At the same time, with heavy increases in the prices of competitive crops such as alfalfa, growers were more than willing to shift away from tomatoes. CTGA had prepared for such a situation by organizing growers into districts and consulting with them on a district basis rather than statewide. The early and late districts voted for price bargaining and were able to resist the pressures of processors to sign individual contracts. Because of the favorable conditions existing in

1975 and the successful experience of bargaining in 1974, CTGA undertook state-wide bargaining for the 1975 growing season after signing up over 65% of its membership under price bargaining arrangements.

The role of the mechanized harvest system was central to this new development although a set of auxiliary conditions was necessary before this outcome could occur.

Changes in the Structure of the Harvest Labor Force

Before the tomato harvester, tomatoes were harvested largely by braceros. The bracero workers were entirely male, recruited from rural villages in Mexico that regularly sent economically active men to the United States to earn what was considered by rural Mexican standards unusually good wages. Braceros were rarely recruited solely for the tomato harvest but would work a variety of crops contracted by the various groups that recruited them. At the end of the season, they were returned to Mexico where they would spend the winter before possibly returning to the United States for the next season.

There was a second group of tomato harvesters consisting of a substantial number of "singlemen." The "singlemen" phenomenon is fairly widespread in agriculture although it is possibly more pronounced in some areas of California. The singlemen are generally older males, many with only tenuous social relationships, who have generally broken from family, friends and neighbors, and who have taken on an essentially nomadic life (Adelman and Durant, 1973; Durant and Ragster, 1970; St. John, 1974). Many are semi-alcoholics, especially when they have enough money to buy alcohol. Generally referred to as "winos" by those in agriculture that utilize their services, these workers congregate in seedy downtown areas that serve as the pickup areas for contractors that recruit day-labor.

In cities such as Stockton and formerly in Sacramento, large numbers of singlemen have worked the tomato harvests. Largely Anglo by ethnic origin, there were also sprinklings of Blacks, Mexicans, Filipinos, and other workers mixed in with them. This category of worker was and is exclusively male.

The singlemen tended to appear dominating in the harvest labor force because of their great visibility. Because they often hang around the center of Central Valley towns where their presence was tolerated because of their contribution to the harvest, the impression has often developed amongst those unfamiliar with agriculture that the bulk of the agricultural labor force consists of alcoholics and derelicts. This impression has been buttressed by the comparative "invisibility" of other farm workers -- braceros, Mexican-Americans, Filipino farm workers -- who, by living in grower-housing on the ranches and having little to do with cities and towns, have gone relatively unappreciated. In terms of their contribution to the agricultural labor pool, however, the singlemen have constituted a relatively minor element although one which has been considered useful, particularly in the "flash-peak" harvests more characteristic of agriculture in the past.

Before the machine, then, the overwhelming bulk of the harvest labor force in tomatoes was male. The shift in the structure of the harvest labor force after 1964 has been quite dramatic. In a sense, the shift was augured by the need to develop a new set of harvest workers at a time when there was no existing category that could be drawn into the tomato harvest. The solution was worked out in a myriad of small-scale adaptations by individual growers in the San Joaquin and Yolo County areas when they recruited women to work on the machines. Thus, the machine arrived when it was necessary to find additional sources of labor for the tomato harvest. Those sources have probably developed from elements of the population not regularly in the labor force, e.g., housewives. Housewives have the convenient (for employers) capability of "finding time" for employment if conditions are appropriate. The arrival of the machine permitted the enlistment of women who would not normally work in tomatoes, lifting the sixty pound lugs.

The major problem involved in bringing women out of the house onto the harvester is one of developing recruitment networks. As near as can be determined through interviews, recruitment networks are organized on an informal basis using male farm workers. In some areas, Fresno County for example, where tomato production is distant from centers of population, recruitment has been given over, to a considerable degree, to specialists, e.g., labor contractors. The contractors maintain extensive networks of contacts through which they recruit labor.

The degree of shift in the sex ratio of tomato harvesters has not been established by any agency, at least publically. Our own estimates, based on observation on numerous machines and through interviews is that the harvest labor force is now between 65-80% female, probably leaning toward the higher end of this estimate.

Two additional subconsequences of the sex ratio shift should be mentioned. The first is based on reasonable inferences about the recruitment process; the second has been reported by some knowledgeable participants and observers of the tomato production scene. We feel reasonably certain about the basis for the first and very uncertain about the second.

First, the present system of labor recruitment developed, according to inferences made as a result of interviews, out of personal networks in which farm workers were asked by their employers to bring wives, friends of wives, and others to join the harvest crews. Much recruitment of labor is conducted in an informal fashion through personal networks and social linkages. While the existence of such networks is fairly clear, neither the dynamics of their operation nor the consequences of adding on economic and political relationships to existing social relationships are clear. Consider, for example, a Mexican-American farm worker who is regularly employed by a grower and who becomes the driver of a harvester; he brings his wife to work as head sorter; she brings the wife of his compadre and several of her comadres as part of the sorting crew; several other friends and relatives may be recruited. The network of relationships between these workers is social, economic, and political. Even though little has been studied about fictive kinship relations amongst Mexican-Americans in the United States, indications are compadre-comadre relations involve all of these elements. A new dimension may be added by virtue of the effective foremanship of the driver (the husband) and the immediate supervisorship of the head sorter (the wife). How supervisorial functions operate on the kinship and fictive kinship systems is unknown but it is reasonable to assume that there will be some consequences. None of these effects could be studied during the present research effort but they represent possible effects of some significance.

The second subconsequence is based on beliefs expressed by some observers that the development of employment opportunities for women who has previously been largely limited to housewifely activities has produced some increase in family instability. Several people interviewed felt that divorces and other marital difficulties had increased as a result of the employment opportunities offered through the tomato harvester. On the surface, this appears to be a reasonable conclusion but the earnings potential to a woman working in one area just for the tomato harvest is insufficient to support a family. At hourly rates of $2.00 an hour in a 50 hour week and a ten week season, a long season in most tomato growing areas, only $1000 income is grossed. The degree to which a woman can be "independent" of her husband on such relatively small earnings is limited. It is possible, of course, that the additional earnings made feasible through working on the tomato harvester has improved the earning potential of women already in employment and thereby increased their ability to earn enough money to contribute to marital instability. On the whole, the assessment of an increase in marital instability is impressionistic and, while specific research is necessary to test this hypothesis, the authors are dubious that the new harvesting system helped to increase instability.

Technological Sophistication and Primitive Labor Relations

The mechanized tomato harvest has produced a shift in California from an unsophisticated production system accompanied by primitive employment relationships to a highly sophisticated and complex production system with essentially unchanged employment relationships.

Pre-machine technology, compared to present day techniques, was extremely primitive. The new system of production with its calculated rationality and planning and with a mobile factory -- the harvester -- represents a genuine "factory in the field." But social relationships between employee and employer have been and continue to be feudal in character with employers believing that they "know" what is best for their employees, wanting to use employees only when necessary and then discard them, and to remunerate such employees only at the minimum required.

The harvesting machine is little more than a mobile dissembly and assembly line. Certainly, from the point of view of the labor force involved, the machine reproduces factory conditions in most respects. While it is often hotter, dirtier and more uncomfortable than most assembly lines, the essential feature of the work is very much like that found on industrial operations. The work is delivered to workers on conveyor belts, they perform their operations on the materials and require supervision and direction particularly with respect to the quality of the product. As in factories, different work positions have differential benefits and disadvantages so that some system is necessary to determine equitability of job assignments. Physically, the work is identical to that on most assembly lines. In contrast to most industrial assembly operations, work on the harvesting machine places heavy burdens on the upper portion of the body while the bottom half of the body is immobile. Unlike finer assembly operations where movements are small and relatively fine, tomato sorting involves gross movements of hands and arms. Vision is important but touch, according to sorters, is equally, or possibly even more, important.

In assembly line operations, supervision represents an important element of managerial control. When the harvester is compared to industrial operations involving assembly lines, what is most striking is the comparative lack of supervision and direction. As has been pointed out in the earlier discussion of work organization, no clear delineation of authority is present on most machines. Different patterns exist in which authority on the machine rests in different hands at different times. Whatever supervisory system exists on the machine can be instantly superseded by the arrival of a field foreman, the grower, or some person supernumary to the machine itself.

In such circumstances, a great deal of direction as to what actually occurs on machines is worked out by the workers themselves. It appears that informal arrangements are worked out in which different factors influence the manner in which jobs are distributed and the work is performed. The influence of kinship and friendship networks, for example, play a role in a number of situations. Similarly, age factors, the relationships between the machine operator, the head sorter, and other personnel can affect the way in which work is performed.

The creation of a factory type of technical system in agriculture does not always produce concomitant changes in the way in which the production system is organized; indeed, the opposite is often the case, with culture lag developing as technological change occurs but social arrangements fail to keep abreast (Ogburn, 1922). This pattern exists with the tomato harvester where a technological system has been introduced while retaining a supervisory and manpower control system that reflects previous times. Supervision is given little thought; training of workers, such as it is, occurs more as rapid break-in procedure with little follow-through. In many cases where direct observations occurred, even with fairly obvious "scoop-sorting," there was no follow-up training activities. Growers in California, like growers elsewhere, pay a great deal of attention to the recruitment of labor and, in most cases, little or no attention to the supervision and the management of that labor (Friedland and Nelkin 1971, Chapter 4). With direction abdicated, it is left to workers themselves to create their own forms of organization. This is manifested in the varying types of informal work arrangements discussed earlier.

In one respect, work relationships on the machine reproduce the prevailing relationships in industry; the superordinate-subordinate relations of factory life. For most growers, workers are simply pairs of hands employed to perform a job. Little or no consideration is given to the idea that the hands are attached to bodies, brains, vital organs, or to social entities. In this respect, American industry is more advanced even if it treats workers as human beings only for the manipulative ends of improving output. This sophistication is not yet present in agriculture. The prevailing ethos of most growers -- and there are some exceptions -- is that workers are a necessary evil that must be endured.

Despite grower rhetoric that contends that farm workers bring important skills to their work, few growers believe such argumentation. The skills of farm workers are, indeed, important; the capability of selecting a good tomato and keeping it in the pack while removing a bad tomato involves a complex variety of skills that even the most remarkable engineer has not yet succeeded in reproducing(18).

Further, the capability of performing this labor in an unstable and uncomfortable environment for extended periods of time is very much taken for granted except in cases where labor is in very short supply.

The approach of growers, therefore, remains geared to producing labor surpluses rather than in dealing with the creation of conditions in which the skills and capabilities of existing workers are recognized and given appropriate recognition, economic and moral. Industry, in this respect, has only a slightly better record so it should perhaps not be expected that growers would manifest strikingly different

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(18) Research is currently underway to develop a mechanical sorting system based on color. If successful, this new system will eliminate the need for most of the sorters on the machine.

attitudes than prevalent with most employers. The vulnerability of their labor supply, however, in contrast to that of industry, might have led growers to seek other and new solutions to their problems in dealing with workers. In their adherence to strategies geared to producing surpluses of cheap labor, however, growers continue to reflect the practices of the past. In this respect, then, while the sources of labor to work the tomato harvester are structurally different from the sources that worked the hand harvest in tomatoes, the basic orientations toward labor, its supply, management, and direction, have remained essentially unchanged.

It is perhaps worth noting that there is a handful of growers who manifest different attitudes, who pay attention to ensuring a stable supply of workers, training them at the beginning of the season, and supervising them with an orientation that recognizes their skills. In the experience of our observation, such growers tend to be small in number and in scale. The larger the size of the production entity in tomatoes, if generalization is possible, the more growers are separated from their labor force and the less interest they have in it.

The current characteristics of tomato production indicate that the likelihood of union organization of tomato workers will improve in the future. The introduction of increased technology and its accompanying division of labor always provided impetus to unionization of workers (Friedland and Nelkin, 1972). Although the tomato season is a short one and many of the workers are women who enter the labor force for the harvest only, other workers -- particularly those with skills other than sorting -- are employed for lengthier periods in agriculture. These workers will provide a good recruiting ground for unionism. Because of the relative shortness of the harvest season, many farm workers spend much of their year involved in other agricultural operations: driving, pruning, irrigating, etc. The probability is considerable that it will be in the context of work other than tomato harvesting that such workers will be recruited into unions. However, the characteristics of the tomato industry, with its increased division of labor and heavy technological inputs, will contribute to encouraging such workers to join unions.

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