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**THE COST OF PRODUCING
CALIFORNIA-ARIZONA LEMONS
FOR THE 1981-82 SEASON**

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Introduction

This report contains the results of a research project being conducted by the University of California and the University of Arizona to develop annual estimates of the costs of growing, picking, hauling, marketing, and advertising California and Arizona citrus fruits. The project is sponsored by the California-Arizona citrus industry through grants from the Orange and Lemon Administrative Committees and the California-Arizona Citrus League.

This current study provides the industry costs of producing California-Arizona lemons during the 1981-82 season and is a continuity of our past reports. It is planned that the next phase of this project will be to develop costs of producing California-Arizona grapefruit for the 1981-82 season.

The research team was composed of staff members of the Cooperative Extension Service, University of California-Riverside, and the Department of Agricultural Economics, University of Arizona, Tucson. In California the project was conducted by Gary Benoit, Staff Research Associate, under the direct supervision of Ms. Etaferahu Takele, Area Farm Management Specialist. In Arizona the project was conducted by Dr. Roger Fox, Economist. The analysis, coordination, and summarization of data were delegated to the California group. All information received was handled in strict confidence and only members of the research team had access to it. The research team wishes to thank the many growers and other sources of information for the fine cooperation extended to them.

Purpose

The purpose of this study was to develop representative annual industry cost estimates for the production of lemons. Realizing certain limitations, such as record availability, the researcher collected figures which would best depict those costs experienced by the industry during the 1981-82 season.

Cost of production data have been developed on a cost-per-acre basis and are summarized by type of citrus. The cost of production is divided into three categories: 1) cash cultural costs; 2) operating overhead; and 3) investment overhead. A more detailed description of these citrus costs is found on pages 6, 7, and 8.

Methodology

Statistical research involves the collection, analysis, and interpretation of data. By learning the facts associated with a small portion of an aggregate, the researcher can then make inferences regarding the total population. Through the years a vast range of methods have been developed to aid the researcher in learning more about the population being studied, ranging from highly complicated analytical models to the

more simplistic judgmental approaches. At the onset of each research project, the primary responsibility is to establish the objectives and determine the optimum means of attaining them. The uniqueness of each situation dictates which methodology is most appropriate.

After careful consideration, it was decided that the objective of this study was to find a representative production cost figure for each variety rather than develop a statistical sample designed to describe the population through central tendencies. There is considerable variability in the factors which determine the cost of producing citrus. Differences in variety, cultural practices, geographic location, age of trees, size of orchards, management practices, and objective functions of the growers are all factors in determining the production costs of citrus. A randomly selected sample stratified by the variables given would have resulted in a multitude of cost figures instead of satisfying the requirement of one per variety. Because this study seeks the representative costs of producing each variety of citrus and the ranges of variations within the population, it was necessary to utilize a methodology where the researcher used informed judgment in the selection of both the participants and the size of the sample.

To be more precise, in this particular study a statistical sample would have given a clearer representation of costs unique to one situation or strata in the total population; but a sample where informed judgment was used would give a more suitable cost figure for the total industry. Use of informed judgment simply suggests the researcher relies on past experiences and personal knowledge of the industry in determining the participants, the size, and the distribution of the study sample.

The total number of growers in the California and Arizona citrus industry was large and widely dispersed. In fact, the actual number was estimated as being over 10,000. For some varieties of citrus a list of growers was available; however, this soon became outdated with acreage constantly being pulled or changing ownership. Because of this, it was impossible to know which grower owned which acreage.

If a research study has a population which can be defined and stratified, the end result will be an average or statistical mean for each category. It has been stated that the objective of this study was to find a representative production cost figure, and not to seek a statistical sample represented by a mean. A statistical mean is irrelevant because it does not represent a real life situation. It is a compromise of all cost data collected. Typical costs are the actual costs of the majority and do represent real life situations. A simplified example follows: Suppose five lemon growers report pruning costs of \$0, \$75, \$85, \$80, and \$81 per acre per year. The first grower maintains a practice of not pruning his lemon trees. The average cost is \$64 per acre per year which does not adequately represent any of the five growers. The typical cost is \$80 per acre per year with a range of \$0 to \$85. This method of reporting costs is far superior at meeting the objectives of this study. It should not be confused with the practice common in the industry where citrus production costs are allocated to a hypothetical situation based on assumed conditions.

It must also be noted that this study is strictly a production cost study and does not include any information on income or yield. This eliminated the need for a stratified random sample because yield and income figures would have been irrelevant unless related to the cost factors listed previously.

Informed judgment accomplishes the study objectives in the most convincing manner and allows the research team greater freedom in the selection of the sample. For appropriate reasons the researcher may eliminate participants from the sample or include them. This is not the case with other methodologies.

Due to financial and time restraints, the research team could not justify a special trip to collect data from acreage located on outlying citrus areas. Certain growers had to be arbitrarily excluded because they were not identifiable or accessible. This made it impossible to utilize a random sample technique where each grower had an equal opportunity of being selected for the study.

A unique situation has developed in the citrus industry in the past few years. The depressed market situation and the encroachment of urban development have caused many citrus growers to sell their groves to individuals or corporations with plans other than remaining in citriculture. These groves are then placed in a short-term program where the minimum of cultural practices are performed. This usually includes only irrigation and management. The question arises whether this type of operation should be included in a citrus cost study.

Because the citrus industry is affected by so many variables such as crop size, weather, economic conditions, etc., we have seen a trend develop over the years. When returns have been good the quality of the cultural practices is improved. When the opposite is true, we see a decline in quality.

With the unfavorable economic situation (high materials and labor costs and low returns), the majority of citrus growers have felt the need to adjust their cultural costs downward. In many cases, pruning has been reduced considerably or eliminated entirely. On the average, the nitrogen rate per tree has been decreased. Foliage sprays of trace elements have sometimes been eliminated. These are just a few of the cultural practices which have been affected.

It has become increasingly difficult to determine which grower intends long-run production and which is in a short-term holding pattern. Therefore, the time has come to define the term "grower." For this study, the grower is any individual, partnership, or corporation seriously engaged in the growing of citrus with the intention of marketing the fruit. Cultural practices should be maintained at a level which is not detrimental to the quality of the fruit and general health of the orchard. By adhering to these guidelines, costs should reflect the grower who expects to remain in citriculture.

Because conservation of time was extremely critical in this cost study, any elimination of obstacles during the sampling procedure eased the collection process. Data collection with irrelevant or unreliable results does not contribute to the study objective. Growers who farm through custom managers and do not keep their own cost records, who are absentee owners, whose costs are a component of a larger conglomeration and are not readily accessible, who are not proficient in keeping production cost records, and who are unwilling to participate in cost studies make up a sizable percentage of the citrus industry and are all potential obstacles. By avoiding or carefully screening these obstacles, the percentage of successful exchanges can be substantially increased.

The total cost of production is composed of the various individual cultural practices listed on page 9 of this report. Cultural practices and growing conditions may be quite homogeneous throughout a citrus region, or they may vary considerably among growers. It is this level of consistency which best determines each area's sample size. The replication of samples should be determined by the variance found in costs representing a cross-section of the industry. If production costs are similar or identical among sources, the researcher may conclude that costs are consistent and there is no further need to sample. If the opposite occurs and there is wide diversity among costs collected, there is an indication that more samples are needed. Some citrus regions with extensive acreage may have consistent costs and require only a small sample; whereas, in regions with lesser acreage the cost variables may fluctuate significantly and require a large sample. The extent in acreage or production of a citrus area is important when weighing the representative costs, but should not be the determining factor in the replication of samples.

A citrus production cost study does not necessarily have to limit itself to data collected from citrus growers. Growers are just one of many sources of valuable information available to the researcher. This study used a methodology which utilized all of the sources listed on page 6.

Characteristics of Population

In the California-Arizona citrus industry there is wide diversity among the growers' citrus production records. Thoroughness of records ranged from excellent (where highly sophisticated computer programs were available) to poor (where growers had to be interviewed and costs pieced together according to the proficiency of the grower's memory). In most instances costs were kept in some form of ledger. However, a uniform cost accounting system, with consistent categories throughout the industry, has not evolved. Therefore, it was necessary for the researcher to devise its own accounting system and to allocate the data received to the category deemed appropriate. In each case the research team collected the information by personally visiting the data source.

For various reasons the structural form of the citrus organization had to be carefully considered when reviewing costs. Because owner opera-

tors rarely establish a value on their own labor, the total cost of producing citrus could fluctuate considerably, depending on the measure of owner participation. It was necessary for the research team to determine and include a value for this type of labor based on the current market.

A sizable number of citrus groves are owned by corporations involved in many facets of agriculture or whose primary business is not agriculturally oriented. There were a number of examples where the citrus operation was allocated expenses which were not necessarily agricultural in nature or citrus oriented. Careful consideration by the research team eliminated part of this problem.

When growers have more than one variety of citrus, it is a common practice to combine production costs rather than allocate them by variety. This problem can be reduced to a minimum if the researcher is conscious of varietal differences in cultural practices. When citrus production costs are combined with the costs of other varieties, such as avocados or deciduous fruit, the task is more difficult.

Although many citrus growers keep their production cost records according to a fiscal or calendar year, it must be noted that whenever possible, they were converted to a growing year in order to be consistent throughout the study.

Even though custom farming operations were counted as only one source of data, it was often possible to receive cost figures for a number of farming operations handled by that firm. Accounting costs were kept separately for each individual citrus grove, allowing a more substantial coverage of the citrus industry.

There are some cultural practices which are performed on a rotating basis or a multi-year cycle. An example would be a grower who tops and hedges one-fourth of his grove each year and prunes the interior of all trees the fifth year. The normal accounting procedure is to divide the total costs of the program by the number of years the program runs.

Sample Size and Distribution

In order to ease the task of collecting and organizing cost data, the research team established seven district citrus regions. Each region has been included because it has one or more characteristics which distinguish it from the other citrus regions.

<u>Citrus Areas</u>	<u>Sample Size</u>
Tulare and Kern Counties	6
Ventura and Santa Barbara Counties	13
Riverside and San Bernardino Counties	10
San Diego County	7
Coachella-Indio Area	5
Yuma County, Arizona	10
Maricopa County, Arizona	6

Production cost figures collected from each of the defined areas have been weighed to compensate for differences in acreage.

Sources of Cost Data

Cost of production data were collected from a number of sources including County Assessors' offices, water companies, agricultural-related businesses, farm advisors, citrus development companies, real estate specialists, certified public accountants, agricultural loan officers and, of course, the growers.

Definition of Cost Categories

Cash Cultural Cost - Total cost of labor, materials, fuel, and repair and maintenance of equipment used in producing the crop. This figure is composed of hired labor, value of the operator's labor, value of work performed by farm equipment, actual cost of contract work, and cost of all materials.

Fertilization includes:

- the application of commercial fertilizers and/or animal manures to satisfy nitrogen requirements,
- the application of minor elements such as urea, zinc, iron, etc., to meet nutritional needs,
- leaf and soil analysis to aid in the selection of a proper fertilization program.

Irrigation water includes:

- the cost of water, assessment fees, and service charges,
- costs associated with the pumping of water from private wells.

Irrigation labor includes the labor involved in:

- the operation of the irrigation system headworks,
- the waterflow adjustment and control,
- the clearance of water passages and irrigation systems,
- the minor repair of the irrigation system.

Pest and disease control includes:

- the application of pesticides to control or eradicate mites, scale, thrips, etc.,

- control of snails, gophers, squirrels, etc.,
- individual treatment of diseased trees,
- initiation and/or maintenance of a biological control pest program,
- application of fungicides used to control rot.

Weed control and cultivation includes:

- spraying of soil-acting and/or contact herbicides to eliminate or control weeds,
- mowing of center strips,
- hoeing of troublesome areas,
- the tillage of soil, construction of furrows and borders, and the working of manure.

Pruning includes:

- hedging and topping of trees,
- the removal of tree trunk growth,
- the thinning of deadwood and water shoots from tree interior,
- shredding or removal of brush.

Frost protection includes:

- operation, maintenance, and repair of wind machines,
- firing, refueling, moving, and repairing of orchard heaters,
- all other practices associated with frost protection such as running water, reading thermometers, etc.

Miscellaneous tree care, replacement, etc., includes:

- pulling, fumigating, and replacing of all trees,
- girdling of navel trees,
- sanding and grading of access roads and drives,
- control of erosion, etc.

Operating Overhead - includes all cash costs other than for labor and materials.

Maintenance and repair includes:

- all costs associated with the upkeep of an orchard, including expenses from vandalism.

General expense includes:

- all professional fees, insurance costs, office expenses.

Management includes:

- all costs involved in policymaking and organization of orchard practices.

Taxes include:

- all taxes assessed on the property regardless of whether it is taxed according to agricultural value or on the basis of its highest potential use.

Investment Overhead - These are the non-cash costs which reflect the capital investment and the annual depreciation of orchards, trees, and improvements. In this report these figures are reported using the current market value.

Depreciation:

- This is an overhead cost placed on trees and equipment which represents annual decline in values due to age or use. It is estimated by dividing cost by probable useful life. Useful life rates for each category used in this study are as follows:

Trees	30 years
Sheds and buildings	20
Frost protection	15
Irrigation system	15
Equipment	7

Interest on investment:

- This is an overhead cost based on capital invested in land, trees, buildings, and equipment. This reflects the expectations for alternate uses of capital resources. In this study a figure of 12 percent of market value was used.

Table Production costs per acre - lemons

Item	Typical Cost	Cost Range
	<u>dollars per acre</u>	
<u>Cash Cultural Costs:</u>		
Fertilization	74	40 - 90
Irrigation - labor	72	58 - 110
water	142	42 - 665
Pest and disease control	225	55 - 330
Weed control and cultivation	72	48 - 100
Pruning	150	0 - 246
Frost protection	88	0 - 142
Miscellaneous tree care, including replacement	40	21 - 76
	863	
<u>Operating Overhead:</u>		
Maintenance and repair	55	25 - 76
General expenses	52	32 - 80
Management	54	36 - 78
Taxes	72	28 - 195
Total Operating Overhead	233	
Total on-tree Cash Costs	1,096	
<u>Investment Overhead:</u>		
Depreciation	246	
Interest on investment	1,290	
Total Investment Overhead	1,536	
Total on-tree cash and investment overhead costs	2,632	