

THE AVOCADO INDUSTRY OF CHILE

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INTRODUCTORY STATEMENT

The information, observations and conclusions presented in this report are the result of a four-month assignment in 1957 as Consultant in Subtropical Horticulture to the Ministry of Agriculture, Government of Chile, in connection with a University of California contract in that country, supported in part by the International Cooperation Administration. The services rendered under the contract in question comprised an integral part of the technical cooperation program conducted by the United States Operation Mission (USOM) in Chile.

The objective of the study was a survey and analysis of the industry for the purpose of determining the principal problems currently of importance with a view to the formulation of recommendations concerning their solution (1). The survey in question involved field travel which it was estimated covered approximately four-fifths of the commercial acreage.

Deep appreciation is expressed for the invaluable information and assistance provided by the counterpart assigned by the Ministry, Ingeniero Agronomo Gregorio Rosenberg, Chief of the Fruit Research Section.

GEOGRAPHY AND ECONOMICS

The Mexican avocado or palto, as it is known in Chile, was introduced by the Spanish, presumably early in the seventeenth century. Many very large old seedling trees occur, some of which are known to be 100 years old or more, distributed in favor, able locations from the Peruvian boundary southward for a distance of approximately 1000 miles—certainly one of the greatest north-south ranges known to exist in any part of the world and very much greater than occurs in California.

The modern commercial industry, however, dates back scarcely thirty years, when introductions of California-grown varieties were made by the Ministry of Agriculture, and consists of two principle centers of production located in the region which extends approximately 100 miles north and south of the capitol city, Santiago, the latitude of which is 33.5 S. as compared with San Diego, California, with a latitude of about 32.5 N.

Much the greater part of the acreage and production, 75 to 80 percent, is concentrated in the relatively small Quillota-La Cruz area, northwest of Santiago, in the lower Aconcagua Valley, a few miles inland from the port city of Valparaiso and the adjoining summer resort of Vina del Mar. The Peumo-San Vicente district, including Melipilla and

the Mallerauco Valley, comprises the other principal center of production and lies to the southwest of Santiago but farther inland than the Quillota-La Cruz area and with less coastal influence.

The latest official statistics available (2) indicate that in 1955 the total acreage was 4425 of which only 70 percent was in bearing. A severe frost that year reduced the non-bearing acreage somewhat but new plantings and replacements have approximately replaced the acreage lost. The production for 1955, following the worst frosts in years, was reported to have been 5,950,000 pounds (2).

Avocado production in Chile has been and continues to be profitable. Indeed the evidence suggests that on the average it is more profitable than in California. It is definitely more lucrative than citriculture in Chile and is exceeded only by cherimoya culture.

In the Quillota-La Cruz area the holdings average smaller than in the Peumo-San Vicente district. In the former, however, one grower was visited whose orchard properties (in two locations) totaled 90 acres and another with 40 acres. In the latter, on the other hand, one planting of 160 acres was noted and another of 150 acres.

ENVIRONMENTAL FACTORS

The physical environments of the Chilean and California avocado industries are remarkably similar, so much so as to lead to the conclusion that varietal adaptations and cultural problems are likely to be very much alike. Indeed orchards of the same varieties are similar in appearance with the sole exception that the trees are headed and pruned up somewhat higher in Chile. Excellent and highly productive orchards exist in both countries. There are climatic differences of importance, however, which will be given special consideration in a later section.

Both industries enjoy arid subtropical climates of the Mediterranean type with irrigation therefore, a necessity. The average annual rainfall in Santiago and Los Angeles is almost identical at approximately 15 inches. Since the rainfall gradient in Chile is opposite to that in California the rainfall in the Peumo-San Vicente district is considerable higher than that at Quillota-La Cruz.

Both are subject to relatively frequent light frosts, which in Chile are generally "white" frosts because of higher atmospheric humidity, and occasional general frosts or "freezes" which may cause both crop loss and tree injury. In Chile frosts of this latter type occurred in 1945, 1954 and 1955. It seems clear, however, that the frost hazard in the Quillota-La Cruz area is lower than in most parts of Southern California. This is evident from the fact that most of the cherimoya production occurs in that area and also some of the mountain papaya, both of which are highly sensitive to frost. The Peumo-San Vicente district is definitely less favorable than the Quillota-La Cruz area.

The Chilean avocado districts appear to be much less subject to desert winds than is the case in California and the summer on-shore prevailing breezes are milder.

Soils suitable for avocado culture are much more limited in extent than in California but exhibit similarities both in origin and characteristics. They are prevailingly of medium to

heavy texture however, and are easily compacted. They are predominantly basic in reaction and some of them are highly calcareous and poorly drained. On the latter chlorosis is of common occurrence. Other malnutrition symptoms, both of excess—tipburn mostly—and deficiency, are fairly common though the use of correctives is on the increase.

The water supply in the major producing areas is abundant and is received by gravity flow from snow-fed rivers originating in the nearby Andean Cordillera. The principal of such rivers, from north to south, are the Aconcagua, Mapocho, Maipo, Cachipoal and Tinguiririco. Observational evidence suggests that two of the most important to the area southwest of Santiago—the Mapocho and Maipo—are subject to some degree of industrial contamination.

The water is diverted into canals of earth or stone construction, some of which have been in use for 100 years or more.

VARIETIES

While seedling production is still of considerable importance and will remain so for years to come, early in the present century selections of outstanding early, late or productive paltos were made and propagated in the Peumo-San Vicente region. These are known as Peuminas and are the oldest varieties in Chile. The most important of these appear to be Peuminas No. 1 (early), No. 2 (late), and 3 (prolific). All are dark colored.

Somewhat later selections were made and propagated in the Quillota-La Cruz area. The most important of these appear to be Campeon and Cholula.

The introduction of varieties from California dates back to approximately 1930 and had its beginning with Luis Bastidas of the Department of Agriculture, also Professor of Fruit Culture in the University of Chile, who visited California in the late twenties. Additional introductions, both private and governmental, have followed from time to time with the result that many, if not most, of the varieties prominent in the California industry until fairly recently have been established in Chile.

Among Mexican race varieties of which trees were seen are the following: Blackbird, Benedict, Duke, Jalna, Leucadia, Mexicola, Northrop and Peubla. Blackbird is popular and there is some interest in Jalna, both of which bear well. Some of the Chilean seedlings and varieties of the Mexican race compare most favorably with our varieties of that race.

Of Guatemalan race varieties trees were seen of the following: Benik, Carlsbad, Dickinson, Edranol, Hass, Itzamna, Mayapan, MacArthur, Nabal, Panchoy, Queen and Ryan. In general these have borne about the way they do in California. Carlsbad, however, is almost completely free from russet or "cork" and is popular. Ryan and Edranol appear to bear more consistently in Chile than in California and are deservedly popular. Hass was introduced comparatively recently but has borne well and will be heavily planted as more nursery trees become available.

Fuerte is much the most important of the introduced varieties and is still being largely planted. Study of the individual tree yield records made available by Roger Magdahl,

prominent and pioneer grower of Quillota, and reports from other sources support the conclusion that in general Fuerte is a more regular and better bearer in Chile than in California. It alternates pronouncedly in both places but is apparently more erratic in bearing behavior in most parts of California.

At the present time the varieties most in demand for planting are said to be Fuerte, Hass, Ryan and Carlsbad.

CULTURAL PRACTICES

While less standardized than ours, the cultural practices employed are similar to those in California and the orchards are similar in appearance and comparable in performance. At a distance the older Mexican-race orchards resemble walnut orchards in both size of tree and distance of spacing.

Both the flooding and furrow systems of irrigation are employed but principally the latter. The application of organic matter and nitrogen comprise the usual fertilization program, with Chilean nitrate of soda the chemical carrier. A few of the growers use ready-mixed so-called complete fertilizers, apparently with good results. Tillage practice is variable with clean cultivation most prevalent. The insects and diseases are similar to ours but fewer and control measures are rarely necessary. Little or no pruning is practiced and frost protection is confined to the wrapping or covering of young trees.

HARVESTING AND MARKETING

For reasons which will be brought out later, the avocado season is somewhat shorter than ours. It begins with the earliest of the Mexican-race varieties in March (comparable to September in the northern hemisphere) and ends the following summer. There is a period of several months when fruit is scarce or unavailable.

Harvesting the fruit from the large seedling and Mexican race trees presents a difficult problem but fortunately labor is both cheap and competent. Considerable use is made of long forked picking poles. The manager of one of the large properties at Peumo, Senor Tomas Paredes Lema, who is mechanically inclined, has constructed a tractor-mounted, tripple-decked picking platform which has greatly facilitated their harvesting operations.

The fruit is hand-sorted for size and grade and sent to market in wooden containers of approximately the same dimensions as the California field box. In general the handling methods are careless by our standards and the rough treatment to which the fruit is subjected results in excessive losses from spoilage.

Santiago, with its million and a half inhabitants, comprises the principal market, followed by Valparaiso and Concepcion. Avocados are widely used by the Chileans and command surprisingly high prices, being exceeded only by the cherimoya and lucuma.

Limited trial shipments by ventilated storage to New York have demonstrated that Chilean-grown Fuertes can be landed there in good condition, 4 to 5 weeks after picking. Because of the competitive situation, however, it does not appear likely that

export to the United States will be profitable.

THE PRINCIPAL CLIMATIC DIFFERENCES AND THEIR SIGNIFICANCE

While, as previously stated, the climatic conditions of the California and Chilean avocado industries are basically similar, there are at least two differences of importance and significance.

The first, and much the most important, is concerned with the amount of chilling (as contrasted with freezing) weather during the fall, winter and spring months. This is unquestionably much higher in Chile than in California.

With minor exceptions, in the avocado areas of Chile the amount of winter chilling is sufficient to satisfy the rest requirements not only of most varieties of the warm temperate zone fruits (peach, apricot, Japanese plum, and others) but also of many varieties of the strictly temperate zone fruits (apple, pear, prune and European plum). This serves to explain the very much greater degree of orchard fruit diversification which exists in the Chilean avocado areas than occurs anywhere in California. Thus at one of the largest fruit-growing properties (about 750 acres) excellent and highly productive orchards of Phillips and Tuscan cling peaches, Tilton apricot, French prune and Bartlett pear were seen adjacent to 230 acres of citrus and 38 acres of avocados. Not uncommonly avocado orchards are interspersed with peaches or other deciduous fruits.

The comparatively long and cool winter coupled with frost hazard, which characterizes the Chilean avocado regions in general, is the cause of other climatic reactions of interest and importance, among which the following may be noted:

1. The low mean temperature, which is below that in any of our avocado districts, brings about and maintains a high degree of induced dormancy in both avocado and citrus trees with the result that their frost resistance is enhanced and their growth prevented until the advent of warm weather in spring.
2. As a consequence of this delay in growth activity all avocados - Mexican race, Guatemalan race and Fuerte alike - come into bloom later than in most California districts and experience a much shorter period of bloom and a much greater degree of overlap as between races and varieties. In my opinion this difference is primarily responsible for the more regular bearing behavior of the Fuerte variety and a contributing factor to the shorter maturity season referred to earlier.

The factor mainly responsible for the low mean temperature during the fall and winter, and hence high amount of chilling, is day temperature rather than night. The winter weather in the principal districts growing the avocado is characteristically overcast, damp, and disagreeably cold with very few of the bright sunny days so typical of winter in southern California. Climatically there are no comparable avocado districts in California.

The second principal climatic difference relates to the fact that the commercial avocado districts in Chile differ much less in time of bloom and amount of heat during the growing season than is the case in California. As a consequence there are no pronouncedly early or late districts in Chile in contrast to the situation here. This serves

also to explain the more restricted marketing season.

PROBLEMS CONFRONTING THE CHILEAN INDUSTRY

Aside from the economic problems, with which this study was not concerned, the principal problems currently confronting the Chilean avocado industry are believed to be the following:

1. The threat posed by the cinnamon fungus root-rot disease.

Symptoms of this disease were seen in several orchards in both of the major production centers and the presence of the causative organism was recently established in both areas (3). It appears to have been introduced in balled nursery trees from California.

Fortunately it appears to be restricted to only a few locations. The procedures of greatest immediate importance are considered to be (a) prevention of possible further spread from infected nurseries and (b) the isolation of known infected areas and their treatment by soil fumigation.

It would also be highly desirable for the growers to take such preventive and precautionary measures as may be practicable to avoid the occurrence of the unfavorable soil moisture conditions which promote activity of the causal organism.

2. Varietal selection and the conversion of orchard trees to better commercial varieties.

As has been the situation in California since the beginning of the industry, the Chilean avocado orchards contain many trees of inferior or poor-producing varieties. For the most part they are varieties introduced from California but no longer propagated and planted here. Their conversion to better varieties would be highly desirable, as is currently being done in California. While some progress is being made in this direction in Chile, the limiting factor at present is the extreme scarcity of competent topworkers.

Thus far California has been the source of varieties for Chile and because of the remarkable similarity in environmental conditions this seems likely to continue. It would be desirable, and helpful to the Chilean industry however, for an industry-wide variety committee to be established similar to the Variety Committee of the California Avocado Society which has served our industry so well in that connection. This might well be a project of the Association of Chilean Avocado and Cherimoya growers, which has been active in the Quillota-La Cruz area.

3. The occurrence of unfavorable soil conditions of man-made origin.

These consist principally of excessive moisture and soil compaction, both of which are favored by the medium to heavy texture of the soils available and are highly unfavorable for avocado trees.

The former arises from a combination of conditions - bad land preparation prior to planting - leading to poor drainage, defective irrigation installations, and over-irrigation. The latter is mainly the result of excessive tillage or cultivation when the soil is too wet.

In conclusion, it may be desirable to point out that none of these problems is unique to the Chilean industry and that all of them are equally, if not more, important in the

California avocado industry.

LITERATURE CITED

1. Hodgson, Robert W. Similitudes entre las industrias palteras de California y Chile y los problemas de major importancia para la industria Chelena. Departmenta Tecnico Interamericano de Cooperacion Agricola. 10 pages. 1957.
2. Sinopsis de la Fruticultura de Chile. Ministerio de Agricultura, Chile, 1957.
3. Zentmayer, G. A. Report on avocado diseases, cultures and seed collections in Chile. Agricultura Tecnica 16(1):43-46. Junio, 1956.

Note: It is regrettable that the highly interesting and informative article on avocado culture in Chile by Roger Magdahl which appeared in the 1958 "Yearbook, of the California Avocado Society was not available at the time this report was prepared.