

## **History and Development of the Avocado in Chile**

**Francisco Gardiazabal Irazabal**

*Dept. of Agronomy Catholic University of Valparaiso Quillota, Chile*

### **The Introduction of Avocados into Chile**

The Inca Indians of Peru spread the avocado, a fruit they called "palta," throughout the Pacific coast of South America. This fruit was given this name, according to Garcilazo de la Vega (1605), because they came from the province of Palta in Equator. It was from this place that the Indians took the "palta" to Cuzco. This is the name given to avocados in Colombia, Peru, Argentina, and Chile.

It is not clear how the avocado arrived in Chile. Claudio Gay, in his botanical research paper written in the middle of the 19<sup>th</sup> Century, does not mention that the avocado existed in Chile at that time. According to Hogdson (1959), the avocado was introduced into Chile from Peru's coast by Spaniards at the beginning of the 17th century.

There was a theory that only green avocados came from Peru, and the black avocados "suddenly" appeared in Peumo or in Maipo Valley. Dr. R.A. Philippi has stated: "Many people assure me that black avocado appeared spontaneously in Maipo Valley, but I doubt it. What is true is that it grows rapidly outdoors and that freezing temperatures in the provinces of Aconcagua and Santiago did not damage it. Meanwhile, it is believed that green avocados from Peru did not resist winter temperatures". He continues, saying: "People in Quillota believed that it (black avocados) could not be eaten, but it is as delicious as the green one".

What could have happened is that some avocado seed brought from Andean valleys during mid 19th century were planted and these trees produced black fruit. Since black was not the normal color of avocados that originated in Peru, those black fruits were not eaten. Instead they were given to pigs until someone discovered that their taste was similar to the green avocados. Afterwards, people still preferred eating green avocados over the black avocados. Hence, it was difficult for the Hass variety to find acceptance when it was introduced 70 years ago. People were not inclined to eat the 'Hass' variety, which had black skin. Instead they consumed the green skin variety known as the Fuerte. In Chile the Fuerte was known as the "California" variety even though it originally came from Mexico and not from California.

At the beginning of the Chilean avocado industry, avocados were established in several small land properties in Quillota. It is likely that some of the old "Chilean paltas" (Mexican race) were produced from some of these trees since their seeds were taken to La Ligua, Cabildo, Buin, Maipo, and Peumo towns, among others. Later, some of these selections, which showed outstanding characteristics, were multiplied by grafting and became new varieties, which are still commercially grown and are known as "Chilean

paltas."

In the 30's, Don Luis Bastidas, a distinguished agronomist, worked at the Agriculture Board and introduced into Chile about 20 avocado varieties from California. Included were such varieties as Nabal, Queen, Mayapan, Fuerte, Mexicola, Carlsbad and Ryan. At the end of the 40's, a senior producer in Quillota, Don Roger Magdahl A., who was a friend of such great California researchers and explorers as Wilson Popenoe and Robert Hodgson, introduced the 'Hass' variety to Chile. These first plantings in 1949 on his property in San Isidro and were called the California Orchard. These plantations have been and still are very productive. Also, I should mention the teacher Gregorio Rosenberg M., who was a great promoter of these early plantings. He grew avocados in different areas and soil types while doing research and exploring new techniques to improve the avocado crop.

## **Production factors**

### **Soil**

There are two types of orchards in Chile, level areas and hillside plantings. In general, avocados are grown on shallow soils of highly variable textures, low organic matter content, and medium fertility.

For many years, soil topography was an impediment to the establishment of fruit crops orchards. Nowadays, with modern irrigation systems, it is feasible to produce under these conditions. Irrigation has made it possible to incorporate low productivity lands into commercial horticulture.

Avocados are one of the few crops in Chile that can be commercially cultivated on hills economically because they do not have pests or diseases that require frequent control measures. There is also the advantage of less risk of freezing temperatures on hillside plantings. On the other hand, the costs of harvesting are higher on hillsides.

In the last ten years most plantings have been established on hills. However, due to the presence of shallow soils and to avoid root rot caused by excessive winter rains, a significant number of these orchards have been established on "mounds", which are soil accumulations along each row of trees.

### **Climate**

This is the primary factor that determines the yield and fruit quality potential for all of the different avocado growing areas.

'Hass,' the leading cultivar in Chile, has always been considered of low cold resistance, since it belongs to the Guatemalan race. However, studies performed by Dr. Bergh on seeds produced by self-pollination of this cultivar have shown that it is possible for 'Hass' to be 15% of the Mexican race. In our production zones, there could be freezes in some years in lower plains areas; however, most recent plantings have been established on hillsides thus avoiding this phenomenon.

Freezing temperatures are not the only negative factor important to good avocado yields; low temperatures during the blooming season are important as well and should be considered as fundamental in our country, which presents a cool to cold climate in the central area. The presence of low temperatures at bloom depends on the place

where orchards are located. In the attached map, it can be seen that there are 700 km between plantations in the IV and VI Region, but under our weather conditions it is most important to know if these orchards are located close to the coast or close to the Andes mountain range.

Avocado orchards close to the sea produce lower yields since the water temperature of the ocean cools the growing environment. In these areas, yields are about six to eight tons/ha and fruit is harvested up to six months after those orchards located in the pre-Andean foothills. As we go inland, orchards become more productive (about 20 ton/ha), but they must be planted on the hills, to escape from winter freezing temperatures.

Wind is another factor to be considered, although it generally does not cause problems in our plantations except in specific areas, or in those areas close to the sea where cold spring winds cause low yields.

Weather conditions in the Chilean production zones favor the high quality of the 'Hass' avocado. Besides this, 'Hass' is a cultivar suited to long trips, especially in shipments longer than 35 days. Furthermore, the fact that Chile is surrounded by the Atacama desert in the north side, the Pacific Ocean in the west side, the Andes mountains in the east side and the Antarctic in the southern side, has favored a low incidence of pests and diseases which has made Chile a "Phyto and Zoosanitary Island".

## **Water**

This is a fundamental factor to be considered in planning an avocado orchard, since this species is very sensitive to excessive soil moisture. On the other hand, water deficiency would cause a significant yield decrease due to the reduction in fruit size.

Water quality of rivers irrigating plantations on the IV, V and VI Regions is good; however, quality decreases for those rivers used to irrigate the Metropolitan Region, which forces the use of salinity tolerant rootstocks. The amount of water available from these rivers is variable and there are not enough dams to store water during the rainy winters in order to use it during the dry summer in the central and northern country zones.

## **Area and Productions**

In 1955, there were about 2,200 ha planted to avocados in Chile and 70 % of them producing about 3,000 tons/ha.

By 1974, there was a clear prevalence of "Chileans" varieties that had a significant domestic market; even today but in less proportion. In the Quillota La Cruz zone, it was common to see orchards of 'Mexicola', 'Margarita', 'Champion', 'Pájaro Negro' and other cultivars in soils and climates that nowadays are occupied by the Hass cultivar.

'Fuerte' avocado occupied the second place with 33% of total area and 35% of production. In spite of its slowness to become productive and its alternate bearing pattern, this cultivar was very popular due to its fruit size, tolerance to transporting and its facility for marketing, which ended up in good prices.

Finally, 'Hass' occupied the third place with a 10% of commercial orchards and 7 % of yield. It was seen at that time for its advantages in precocity, high and steady yield as well as the season in which it was harvested. However, its high chilling susceptibility (it

only resists -1.1°C) was a headache for many growers.

According to Cirén-Corfo (1993), by 1992 the land cultivated in avocados in Chile had increased to 9,376 ha. This represented an increase of more than 213% in 18 years, with a 4.16% annual increase in average yield (Table 2).

Cultivars	Area		Production	
	há	%	Ton	%
Chileans	2.169,3	49,3	6.990,8	49,3
Fuerte	1.430,1	32,6	4.354,8	34,9
Hass	431,3	9,9	1.020,2	7,2
Others	358,7	8,1	1.223,8	8,6
Total	4.389,4	100,0	13.589,6	100,0

Source: CORFO 1974.

Cultivars	Area (ha)	%
Hass	5.710	59,70
Fuerte	1.362	14,24
Bacon	847	8,86
Chileans	649	6,78
Edranol	476	4,98
Others	520	5,44
Total	9.564	100,00

Source: CIREN CORFO 1993.

Between 1981 and 1987, the area with avocados remained almost unchanged, which corresponded to years of saturation of the domestic market, low prices, and the search for export markets. Beginning in 1988, a significant increase in new plantations occurred due to the successful exporting of avocados, mainly to the North American market.

By 1992, 60% of total area corresponded to 'Hass', 14% to 'Fuerte' and 9% to Bacon. As it can be observed, cultivar distribution was modified significantly during the last years with a sudden increase in favor of 'Hass', something that would continue to be observed in the following years.

The current domestic area dedicated to avocado production has increased to more than 21,000 ha (Table 3). This intense growth, which remains at a plantation rate over 1,000 ha per year, is due basically to low production costs as well as the good prices attained by avocados in both domestic and export markets.

Table 3. Commercial avocado orchard areas by cultivars. Year 2001.		
Cultivars	Area (ha)	%
Hass	14.218	67,0
Fuerte	1.700	8,0
Negra La Cruz	1.486	7,0
Bacon	845	4,0
Edranol	637	3,0
Chileans	424	2,0
Others	1.910	9,0
Total	21.220	100,0
Source: ODEPA 2002.		

Hass is still the most planted cultivar, currently representing 65% of the cultivated area. We should see an increase of Edranol and Zutano cultivars, which are being used as pollinators for the Hass cultivar.

Production of 'Hass' and other cultivars during a decade is presented on Table 4. It is interesting to note that despite the large increase in Hass plantings, Hass production was almost static between 1992 and 1997. This was due to production problems, such as years with low fruit set because of chilling conditions during spring bloom, drought, and winter freezes.

Cuadro 4. Superficie y Producción de Paltos en Chile						
Año	Superficie (hectáreas)			Producción (toneladas)		
	Hass	Otras	Total	Hass	Otras	Total
1992/93	5.710	3.854	9.564	29.520	12.480	42.000
1993/94	6.324	4.172	10.496	26.000	32.000	58.000
1994/95	7.144	4.375	11.519	32.470	17.530	50.000
1995/96	8.336	4.512	12.048	27.689	27.311	55.000
1996/97	8.457	4.831	13.288	36.401	16.599	53.000
1997/98	12.047	4.850	16.897	35.180	24.820	60.000
1998/99	13.247	5.080	18.327	81.940	32.060	114.000
1999/00	15.500	5.270	20.770	40.720	32.280	73.000
2000/01	18.000	3.220	21.220	85.000	25.000	110.000
2001/02*	19.500	3.200	22.700	95.000	25.000	120.000

Fuente: CIREN-CORFO, FEDEFRUTA

\*Estimado

In 1998, Hass yield doubled as a result of increased plantings in previous years. However, the following year, the harvest only was half due to alternate bearing and poor weather conditions during bloom. There was a recovery for the last two harvest seasons; but for this year (2002/03), in which a greater harvest was expected, there

might be a similar or a slightly higher yield than in the 2001/02 season because of low temperature damage to the fruit in June.

### Production Zones

Chile is physically divided in 12 regions plus the Metropolitan Region, being the First Region located in the North side of our country and it has a border with Peru and Bolivia. The Twelfth Region is on the southern side, as it can be observed on the map below.

There are some orchards in the Azapa Valley located in the First Region, some others in the Third Region, but the greater commercial plantations are the IV and VI Regions. The development of these plantations is shown in Table 5. The most productive area is the V Region, mainly in the Quillota La Cruz and La Ligua Cabildo valleys. These areas are characterized for being free of coldness and are irrigated with good quality water coming from the Aconcagua, Petorca and Ligua Rivers. They also are distinguished for having a great number of orchards either on hills or on plain lands.

The Metropolitan Region had a great production peak in 1979/80 and 2000/01. However, during the last decade it has maintained a static percentage, compared to the rest of the country. The main limiting factor for this production area is the high salinity content of the irrigation water, which comes from the Mapocho and Maipo rivers.

A notorious decrease in plantings of avocados occurred during the 80's in the Sixth Region. Because of cold temperatures, this region was mainly used to produce "Chilean" avocado varieties of low exportation value. However, new 'Hass' orchards have been established on hillsides thus avoiding low temperature problems. This region has plenty of good quality irrigation water from the Cachapoal River.

Region	Years					
	1979/80		1989/90		2000/01	
	ha	%	ha	%	ha	%
Fifth	3,600	56.5	4,700	56.9	12,880	60.8
Metropolitan Area	940	14.8	1,928	23.3	4,770	22.4
Sixth	1,510	23.7	1,033	12.5	2,055	9.7
Fourth	150	2.4	460	5.6	1,385	6.5
Others	165	2.6	144	1.7	130	0.6
Total	6,364	100	8,265	100	21,220	100

The Fourth Region has increased its avocado plantings in the last decades, due to the great interest in having early 'Hass' avocado fruit starting in July. However, it faces strong competition from other very profitable crops such as grapes and citrus. Also, this area has a shortage of water for agricultural uses.

### Growers Organizations

The Palta (avocado) Committee began in 1991, a non-profit organization connected to FEDEFRUTA (Chile Fruit Producers Federation) that was created to reach agreements and perform actions to benefit the Chilean 'Hass' avocado industry, especially to

promote exports. During its first 10 years, this Committee has promoted our 'Hass' avocados in Argentina (1994 and 1995), doing the same in the United States, mainly during 1999-2001. It also has increased the local consumption of avocados, has studied new markets (Asia and Europe), and has performed harvest forecast and shipping coordination. Some funding for production research has also been provided.

## **Research**

Along with the avocado industry's development, a full research program has been carried out by universities as well as by private organizations. Research topics are related to clonal rootstocks, new Chilean cultivars, irrigation, plant nutrition, postharvest, pruning, use of plant growth regulators, management of flowering, and so forth leading to a high level of technology in our orchards.

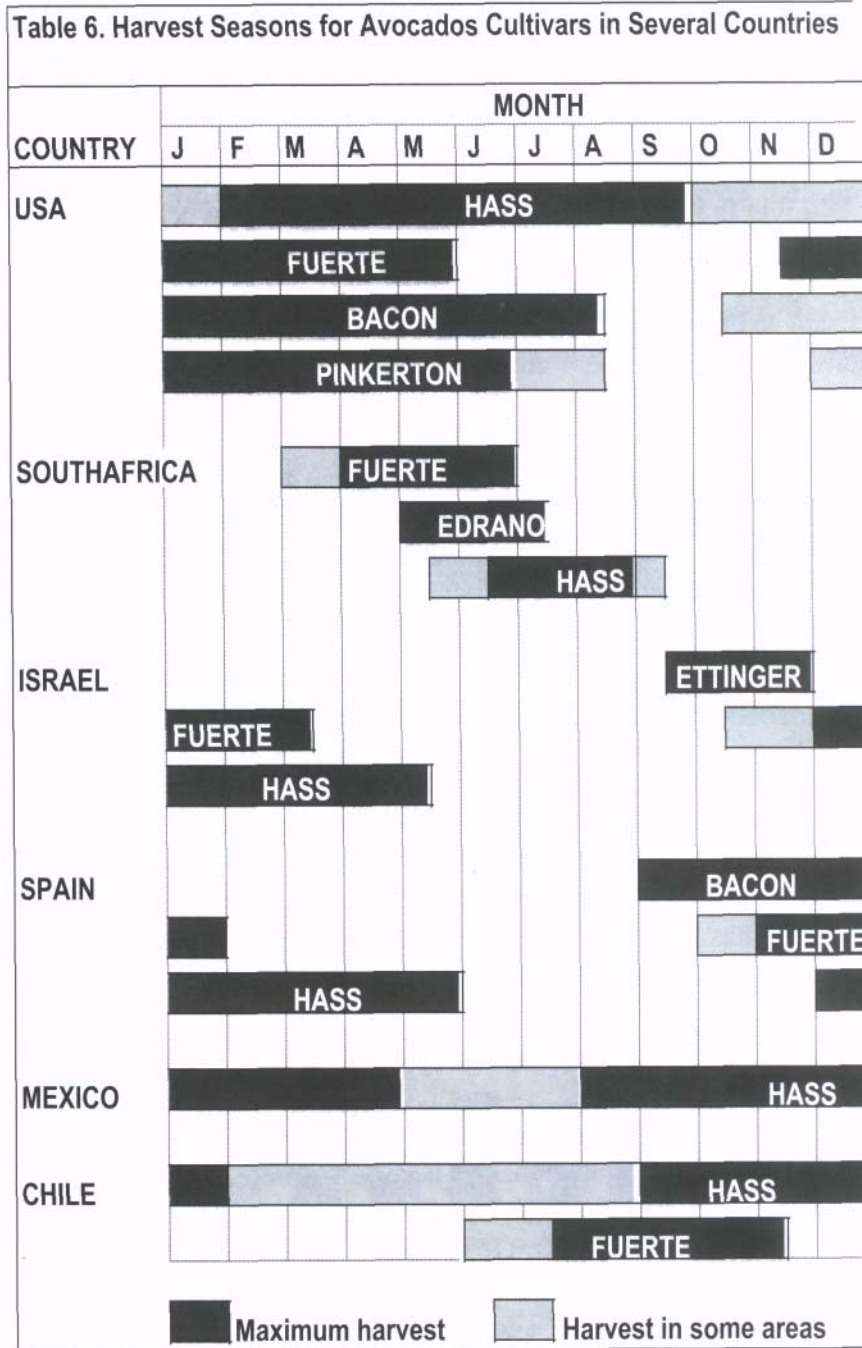
## **Harvest Season**

The harvest season of evergreen fruit trees depends almost exclusively on the orchards' environmental temperatures. Due to this fact, it is not possible that the same avocado cultivar harvested in the Northern Hemisphere would be harvested exactly six months later in the Southern Hemisphere, as is common with deciduous fruit trees. Tentative harvest periods for the main avocado producers are shown in Table 6.

Most of the success of the Chilean's 'Hass' avocado exports can be found in Table 6. Some interesting points follow:

1. October to January is the period of lowest harvest of 'Hass' avocados in the United States about 90% of American corresponds to this cultivar and this is the peak 'Hass' harvest period in Chile.
2. Chile has had permission to export avocados to North America. The first Chilean avocado exports were sent in 1984, arriving in good condition. Mexico, which is a competitor with Chile during the same season, does not have the same authorization to export into North America at that time.
3. From December to July, Europe is well supplied by Israel, Spain, South Africa, Australia, Mexico, and in less proportion by USA (only in high production years). There is a lower supply from South Africa and Australia during August to September.
4. On the other hand, Europe has low quality avocados during the months of September to November such as the 'Ettinger' from Israel (fruit of green thin skin and easily spotted) or the first 'Fuerte' arriving to the market (with low oil percentage and poor taste). Never the less, Mexico can be a great competitor for Chilean avocados in Europe.
5. The first substantial export of Chilean avocados to the European market was done in 1993, with more than two million and four thousand kilos. Besides the distance (33 days by ship), our 'Hass' arrived in excellent condition, showing the good postharvest performance of the Chilean 'Hass'.
6. Argentina is a very interesting potential market for our country, with a low avocado consumption rate (less than 100 grams per capita) and an opposite 'Hass' harvest season. It should be one of our dependable markets due to the short distances and the fact that in our harvest season snow does not limit land transportation. However,

financial conditions in Argentina are unstable. Argentina is a market that Chile has been working on in recent years to replace regional Chilean avocado varieties with Hass.



### Exportations

For many years Chile has stated that its economic system depends on a worldwide



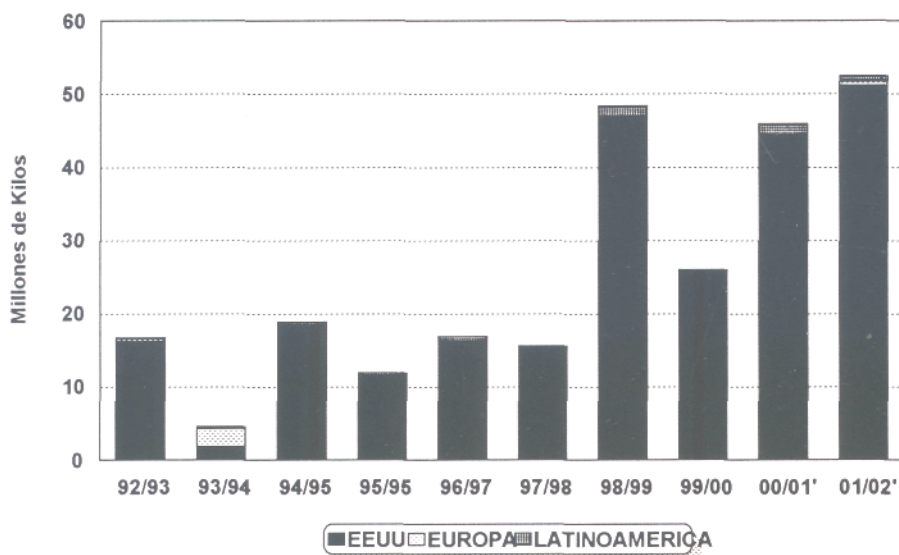
open market economy. Therefore, exports became an important issue. Political, social, and economic stability in our country makes it easy for it to be a leader in South America and to foster our progress toward becoming a developed country.

Avocado exportation has been tried in different markets for many years, especially to Europe. By 1978, 2,864 kg were exported to En gland, increasing just to 11,000 kg exported to Europe in 1979. These first experiences opened export possibilities, even though the European market was not the preferred one. The North American market has been where most export efforts have been made and where most of the Chilean avocado exports are sent.

The North American market has been dominant over the European and the Latin American markets. It has represented more than the 96% of the total avocado shipment in recent years (Table 7). In 1993, when California had a large crop, Chile exported more than 2,400,000 kg to the European market, representing a 53.2% of the total fruit exported in that season.

European market prefers black skin avocados over greenskin cultivars. However, it is a difficult market for us, since there are 'Hass' avocados coming from Mexico during September through January; Spanish 'Hass' avocados arrive in this market in December and in January the ones from Israel. Furthermore, the European market pays less for our fruit while our shipping costs are higher.

**Cuadro 7. Evolución de las Exportaciones de Paltas chilenas.**



Avocado exports to Latin America have been increasing, with Argentina the main receiver of our Hass cultivar. In 2001 this country received more than 1,600,000 kg. However, for the current year Chilean avocado exports will decrease considerably due to Argentina's current financial problems.

The Argentinean consumer already knows 'Hass' as a high quality fruit and it is sold as "blacky" avocados for its color and small size, compared to regional varieties such as

Torres, Linda Tardía and other Guatemalan and West Indian race varieties, as well as hybrids among them. This means that Argentinean market looks for large sized 'Hass' avocados.

Prices paid for Chilean 'Hass' avocados sent to the United States in the 90's decade were high. This happened because this was a period when California and Chile had several years with negative weather conditions, which resulted in low commercialized volumes and a consequent increase in the value. These years of good and profitable avocado exports to North American benefited domestic fruit prices as well, causing a significant increase of new avocado plantings in Chile.

## **Summary**

In summary, these are the characteristics that have made the avocado industry so successful in Chile:

- High profitability.
- Attractive domestic and exportation markets, with high prices.
- Low production costs.
- Easy production management and steps for producing.
- Use of cheap marginal soils with pronounced slopes (hills).
- Perspectives for the national avocado industry are:
- Domestic production should increase due to the expansion of plantings in recent years.
- Last year's profitability should decrease due to the expected increase of fruit supply in the short term.
- Expected increase of avocado production will result in increased competition at both the domestic and export markets.
- New countries have been incorporated to the North American market, like New Zealand and Mexico. Avocado business would become more competitive as more States are allowed to receive Mexican fruit and the exporting time-frame is extended.
- The Hass cultivar will increase in importance, surpassing 70% of the domestic production.
- Low production costs, easy orchard management, and avail ability of inexpensive hillside land will keep the growing of avocados attractive.
- The need continues for a higher investment in production re search to achieve higher productivity.
- The importance of under-developed markets should increase, especially the Latin American markets.
- The efficiency of the avocado production and marketing chain should be improved.

- More funding should be allocated to advertising avocados.

