

THE AVOCADO INDUSTRY IN ISRAEL

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Israel's young avocado industry has less than one-fifth the acreage of San Diego County. The 2500 acres in Israel's industry yields on a par with Southern California's better groves and is an industry anxious to expand and promote the European market. Two-thirds of these acres are planted to trees not yet in full bearing. Most avocado orchards have been planted during the last ten years, primarily between 1958 and 1963. New plantings are increasing.

The reason for this rapid expansion is that avocados have been found to grow satisfactorily as interplants in banana plantations. Approximately one-half of the total acreage is planted in this manner. The climate, soil, and watering conditions are similar for the two crops. Because of this, the cost of establishing an avocado orchard is materially reduced. Bananas are gradually removed over a two- to four-year period. At this point the avocado trees are established and coming into bearing.

During the last two years, 1965 and 1966, the rate of expansion slowed down. To reverse this trend, the Ministry of Agriculture has encouraged growers to plant avocados. As an inducement, loans are offered to prospective growers. It is hoped that this stimulus will double the annual acreage increase which is now about 150 acres per year. There are now about 30 large avocado orchards of 25 to 50 acres each. The remaining acreage belongs to small holders of two to five acres each. In 1965 the industry yield was approximately 5,150,000 pounds. The 1966 yield is estimated between 8,000,000 and 10,000,000 pounds.

The varietal composition of the 1966 crop yield was as follows: Ettinger—42%, Nabal—20%, Fuerte—18%, Benik—8%, Hass—6%, and Anaheim—6%. Four varieties predominate in the plantings: (1) Fuerte, with 35%, is increasing because of new plantings using a higher proportion of this variety. Picking season is from December to February. At the present time the main problem is unsatisfactory and inconsistent yields. (2) Ettinger, a locally-developed variety, which appears to be a hybrid, produces early and is a prolific bearer. It accounts for 27% of the plantings. A short picking season, October and November, and a fruit which cannot be stored on the trees, are the main drawbacks. (3) Hass, is relatively new. It represents 17%, mostly in the new plantings. An early and heavy bearer, it has a tendency to produce small fruit. Harvest period is from March through May. In low Fuerte crop years, the Hass could be harvested early because they mature enough in January. (4) Nabal, an alternate bearer and subject to severe wind damage, has 15% of the total industry acreage. Its season for harvest is from February to May. Along with the Nabal, and used primarily as a pollinizer of the Nabal, is the *Benik* variety. This constitutes only 3% of the acreage. The *Anaheim* is scattered among older plantings. The present recommendation for new

plantings is 40% Fuerte, 40% Hass, 20% Nabal, and enough Benik trees planted as pollinators.

Sources of seed for rootstocks are obtained mostly from Mexican seedlings. Some of them have been indexed to determine whether or not the Sun Blotch Virus disease is present. Recent experience with the West Indian rootstock variety shows it to be more tolerant to high chloride content in irrigation waters, and to high limestone content in soil, than the Mexican and Guatemalan races. Since many prospective areas for avocado orchard development will have to use irrigation water containing 150 to 250 ppm of chlorides, the need for a tolerant rootstock is great.

The climate in regions where avocados are grown resembles the climate of the coast and coastal valleys of southern California. However, there are generally more heat units with more hours of sunshine in Israel and less incidence of frost. In Israel, sites have to be selected which, by virtue of their topography, are less prone to radiational frosts. Rains, totaling over 20 inches annually, are concentrated in the winter months, November to March.

Avocados are grown mostly on medium-heavy textured soils (silty loams) which are well drained. Some plantings are on lighter soils and some on soils with too high a clay content to be suitable for avocados. Some soils contain a high percentage of lime and as a result the trees are chlorotic. The soil pH is generally between 7.2 (slightly alkaline) to 8.0 (alkaline).

Most of the avocado plantings are located in two coastal regions: Western Galilee (North of Acre), and in the Sharon and Shomron (South of the Carmel Range). There are about 400 acres south of Tel-Aviv. Small plantings are found in the Upper Jordan Valley in thermal belts, and near the shore of the Sea of Galilee.

Irrigation is generally done with the use of underhead sprinklers. Approximately 3 acre feet (325,000 gallons or 1,500,000 litres per 1 acre foot) are given annually in about 20 shallow applications every 8 to 14 days depending on the soil type and climatic conditions. In some orchards a heavier amount of water is applied every six weeks in order to wet the entire profile and flush (leach) out the salts.

Most bearing orchards are non-tilled. Weed control with the use of oil or paraquat (Gramoxone) are the usual practices. Recently, the use of Simazine has been increased.

Nitrogenous fertilizers only are used at the rate of 600 lb/acre of ammonium sulfate and applied mostly twice a year. Where iron deficiency (chlorosis) is prevalent, the soil is treated with Chel 138. Leaf analysis to determine nitrogen level in trees has provided a good guide for application of nitrogen. Heavy manure applications to banana plantations where avocados have been inter-set has caused the avocado trees to grow exceedingly fast and large. Also, the deep, fertile soils selected for bananas and avocados result in large avocado trees.

Planting distances are generally 20 x 20 feet for most varieties. In seven to nine years after planting the trees begin to crowd each other and a shaded orchard becomes a problem. Some growers prune to keep trees within bounds. Excessive height of upright growing trees, like the Ettinger, is another problem. Training trees in formative and early

years of the orchard through pinching back, and bending branches down has helped, but no satisfactory solution has been found to cope with the tall, bearing tree problem.

Avocados are harvested in field boxes (40 lbs.) and to a limited extent in bins (400 lbs.). Because of the sensitivity of the avocado skin to bruising, improved handling methods must be developed.

Avocado diseases are not a serious problem. Sun Blotch virus disease is more prevalent than in California. Avocado Root Rot, a serious fungus (*Phytophthora cinnamomi*) disease in California, has not been identified to date in Israel. But there is always a possibility that the disease could become established. *Verticillium* fungus disease sometimes causes considerable damage. Fruit rots, which become noticeable some time after picking, are caused by *Colletotrichum*, *Diplodia*, and other such fungi.

Marketing is handled by the Fruit Marketing Board. The Board is responsible for packing fruit, for the export and domestic markets, and distribution of fruit. A small percentage of the fruit is packed, shipped and marketed by a private packer-shipper. Fruit is divided into three qualities: (1) grade A fruit for export; (2) grade B for local market; (3) other fruit to the Army (softened) and to Kibbutzim.

Export shipments constitute 50% to 65% of total crop, although some varieties, such as Nabal, have a lower percentage of grade A fruit. A large per cent (80%) of the avocados are shipped to France and the United Kingdom. The balance of the fruit reaches markets in Germany, Italy, Scandinavian countries, the Netherlands, Belgium and Switzerland. Consignment is predominantly by ship, though air freight is used when required. Three packing houses, one in the north, one in the central district and one in the south, handle the fruit from the industry's 2,500 acres.

The Fruit Marketing Board also has the responsibility of advertising and promoting the sales of avocados. This involves preparation of advertising materials such as posters, recipe booklets in store display, banners and ads for magazines, newspapers and radio. Promotion abroad is financed up to 50% by the Government.

Most research work on avocados is conducted by the Division of Subtropical Horticulture, under the direction of Prof. C. Oppenheimer, and the Food Storage and Technology Department, under Dr. M. Nadel, at the Volcani Institute of Agricultural Research at Beit Dagon and Rehovot. Some of the major research projects:

- (a) *Salinity Projects*
 - Development of tolerant rootstocks
 - Vegetative propagation of the rootstocks

- (b) *Fruit Handling Projects*
 - Standards - Maturity
 - Cold Storage
 - Transportation
 - Polyethylene wraps
 - Irradiation
 - Waxes

- (c) *Fruit Quality Projects*
 - Partial non-softening of Fuerte fruit
 - Control of fungus diseases on fruit

Projects are combined operations of the respective research departments in cooperation with the Extension Service, the Growers Federation and the Fruit Marketing Board.

The future of the avocado industry in Israel appears bright. The world picture concerning the avocado is just beginning to develop. Many markets for avocados are so far untouched. Israel has the land available, suitable soils and an excellent climate. With diligent work, the water may also some day become available, which will serve an expanded acreage. Above all, Israel has the men and women who believe in this industry and they alone will make it succeed. Finding solutions to the many problems facing a developing industry will take time, money and effort. The Israeli avocado industry will provide many more tons of fruit for the market in the years ahead, and avocados will make a substantial contribution to the agricultural economy of the country.