



**Figure 1.** Trees have been girdled with a hand tool to enhance fruit set.

# Israel's dynamic citrus industry

By Stephen H. Futch and Ariel Singerman

**A**s home to three of the world's major religions, Israel is one of the most diverse countries in the world. Besides its cultural diversity and historical importance, Israel is also a major citrus producer and exporter.

Israel's citrus industry began in 1882. As new immigrants moved to the country, they established many very small orchards. These plantings were generally in agricultural settlements organized under collectivist principles called "kibbutzim."

Currently, the area devoted to citrus in Israel is 44,500 acres. There are approximately 2,800 growers, but a single grower manages one-third of the industry. Most of the citrus properties (86 percent) are located near the coastal areas along the Mediterranean Sea.

This article summarizes observations while visiting Israel's citrus industry in November 2018.

## MARKETS AND EXPORTS

Approximately 34 percent of the fruit goes to the domestic market, a similar percent to the export market

and the remainder to industrial uses. The mix of varieties is as follows: 35 percent easy-peel mandarins, 32 percent grapefruit, 17 percent oranges, 14 percent lemons and 2 percent other varieties.

The main export market is France, accounting for nearly 29 percent of total exports, followed by various European countries at 29 percent, Asia at 16 percent, Russia and the Baltics at 15 percent, and the United States and Canada at 11 percent. Marsh and Star Ruby grapefruit have been increasing in export volume to the Asian markets in the last few seasons. Much of Israel's increase in exports is attributed to the decline of Florida exports. The main fruit exports are Sunrise grapefruit, Orri mandarin and Sweetie orange.

Orri was developed in Israel nearly 30 years ago. Its demand has been increasing steadily across Europe, Asia, South America, and more recently in China and Japan. Israeli growers are not required to pay royalties to plant Orri, and the country is the largest exporter of the variety. However, Orri has become so popular

that growers in Spain, South Africa, South America and the United States are willing to pay the royalties to plant it in their countries.

An issue of concern for an industry that exports such a large volume of its fruit is reliance on foreign markets and their economic conditions. Israeli growers are dependent on foreign consumers' purchasing power and willingness to pay to be profitable. The objective of Israel's marketing board is to create a reputation for Israeli citrus to reap a price premium for the fruit. However, it is difficult for a small citrus industry like Israel's to make large investments in marketing.

## WATER AND IRRIGATION

Some regions of Israel are very dry and, therefore, irrigation is required to produce a successful crop. Rainfall varies each year but ranges between 10 and 20 inches annually and occurs mainly from November to April. However, having more than six months without any rain is not uncommon.

To endure the dry conditions, growers rely on both reclaimed water (a byproduct of waste water treatment) and desalinated sea water. With a price of \$0.50 per cubic meter (264 gallons) and an irrigation need of 8,000 to 10,000 cubic meters per hectare (31.5 to 39 acre inches), irrigation water accounts for up to 20 percent or more of the production costs (\$1,618 to \$2,023 per acre per year).

## FRUIT SET

Many citrus trees in Israel have been girdled to enhance fruit set in the spring during bloom. Girdling requires the use of a hand tool to cut a small incision around 50 to 80 percent of the limbs, depending on flower intensity (Figure 1). While girdling is not practiced in Florida, previous studies on easy-peel varieties in the 1960s provided evidence that girdling increases fruit set and yield in Florida conditions.

## PACKING

The packinghouse we visited was very modern and had significant automation. The packing lines utilized electronic grading for external quality and ultraviolet scanning to aid in determining internal quality. These

electronic scans ensure only high-quality fruit reaches the export market.

Early in the season, fruit packout is about 80 to 85 percent. As the season progresses, the packout may decline to around 75 percent.

The packinghouse utilized both hand and machine packing of cartons. Hand packing yields about 70 to 80 cartons per hour. Machine packing yields upwards of 200 to 380 cartons per hour.



**Figure 2.** Selective branches are removed by hand in the internal canopy to improve light penetration and spray distribution.

## GROVE DESIGN AND PRUNING

Most of the groves visited were planted at an in-row and between-row spacing of 10 by 20 feet for oranges and 13 by 23 feet for lemon trees, resulting in 217 and 145 trees per acre, respectively. Trees are planted on raised beds due to high clay content that limits drainage during the rainy season. The soil pH can range from 7.5 to 8 in many locations.

Maximum tree height is maintained at 8 to 13 feet tall. Pruning is done by machine, and then selective branches are removed by hand in the internal canopy to improve light penetration and spray distribution into those areas (Figure 2). Trees will also have skirts raised to minimize phytophthora-infected fruit from entering the packinghouse.

As in Florida, Israeli growers are looking at increasing planting densities

# The Cavalry Has Arrived

By Rick Dantzler

As I write this, I am returning from the International HLB conference in Riverside, California. I was blown away by the number and quality of scientists who are working on solving HLB, but the trip began ominously.



On the flight out, the woman next to me was crowding into my space. This was bad enough with five hours of airtime ahead of me, but then she started drinking jiggers of Jack Daniels, buying two at a time. The plane took off at 6:35 in the morning, so she was starting early.

Then she passed out, slumping onto the shoulder of her friend. Thirty minutes later, she awoke and proceeded to become sick to her stomach all the way to Los Angeles. There were no other seats on the plane, so I had to tough it out.

This conference was the largest gathering of scientists around one topic in the history of science. By my count, there were 125 speakers and workshops, with Florida very well represented. University of Florida Institute of Food and Agricultural Sciences, Agricultural Research Service and Florida private sector scientists all had prominent roles.

When it was my turn to speak, I explained why it's important that we find a cure for HLB. I shared a wonderful autobiographical story Peter McClure recently told when he was inducted into the Florida Citrus Hall of Fame. I tried to make the point that citrus is not just a business but a way of life, and that researchers aren't working to save *an* industry, but *the* industry, the one that has given Florida its identity for more than 100 years.

I discussed how important it is for citrus to stay profitable because when a grove owner is forced to quit, the land usually becomes filled with rooftops. The next stop for citrus acreage that is no longer farmed is usually development. With 1,000 people moving to Florida every day, we need to save every agricultural acre we can.

I then explained the political situation we are facing as we seek research funding. This includes how legislators and other funders are insisting that our research get out of the lab or greenhouse and into the field.

I closed by saying the Citrus Research and Development Foundation would continue its march toward trees with greening resistance or tolerance, fund research that focuses on squeezing more and better fruit from greening-infected trees and participate in programs that help growers get new trees in the ground. I explained why we are placing an emphasis on applied research instead of basic research.

As the conference ended, I felt confident we are getting closer to the day when the existential threat of HLB is in the rearview mirror. With this much money and scientific horsepower attacking the problem, it is just a matter of time when we eliminate it or learn to live with it well enough that all good citrus growers can grow a profitable crop. Indeed, the cavalry has arrived.

And the airplane gods smiled upon me on the way home. The seat next to me was the only empty one on the plane.

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Column sponsored by the Citrus Research and Development Foundation

to improve returns per acre, especially in the early years of the planting. One experimental orchard we visited was planted with 837 trees per acre using a trellis system. It is used to test new technologies to mechanize both care-taking and harvesting practices.

## HARVESTING

Since the majority of the crop is for the fresh market, harvesting usually involves several trips through the grove. The first harvest is based upon fruit size. In the second harvest, remaining fruit from the tree are picked. Most of the harvesting labor is domestic and is also in charge of performing other tasks in the multiple crops the farm might grow. The average cost for harvesting and transporting fruit to the packinghouse can be as high as \$5 per box.

*Israel does not currently have citrus greening or citrus blight but does have “stubborn disease.”*

## PESTS AND DISEASES

Growers apply multiple sprays per year for control of both insects and diseases. Because all fruit is intended to be marketed as fresh fruit, the number of



**Figure 3.** Trees infected with stubborn disease are stunted and have small leaves.

pesticide applications is like Florida’s fresh fruit production programs. However, with Israel’s drier climate, fungal pathogens are usually lower.

In many areas, growers must perform practices to deal with the fruit fly. Such practices include placing bait traps, conducting area-wide sprays and/or releasing sterile males to control the population. These programs are paid for with a box tax (75 percent of the cost of the programs), while the remaining cost is paid by the government.

Israel does not currently have citrus greening or citrus blight but does have “stubborn disease” (Figure 3) caused by a viruslike agent, *Spiroplasma citri*. Stubborn disease is a systemic disease primarily affecting young trees in hot and arid regions, including California

and the eastern Mediterranean Basin. The disease is spread by leafhoppers or transmitted in infected budwood. Trees infected with stubborn disease are stunted, have small leaves, off-season flowering, deformed fruit, and production of 10 to 20 percent of a normal crop. Some of the symptoms could be confused with citrus greening.

## VARIETIES AND ROOTSTOCKS

Many blocks are planted on various citrange rootstocks and C-35, Troyer, Volkameriana and US-812. To ensure that the grower is receiving good budwood, a citrus budwood program was started in 1989 and now has over 150 varieties in enclosed structures. All trees are checked for viruses and diseases like psorosis, citrus variegated chlorosis and viroids.

As researchers develop new varieties, they will patent them to manage supply and support development of new varieties. There is no charge to the grower to plant a patented variety when planted in Israel, but fees are imposed when the variety is taken out of the country.

Just like so many places around the world, consumers demand seedless fruit that is easy-to-peel and tasty with acceptable peel color and desired size.

## LABOR

Labor, like in many developed or developing nations, is difficult to obtain and usually has a high cost per hour. Programs do allow labor to be imported from various countries for a period of three to five years. Cost for general labor can exceed \$12.50 per hour.

## CROP INSURANCE AND RISK MITIGATION

Crop insurance can be obtained for yield losses due to frost, freeze, drought, hail, etc. The premium is subsidized by up to 35 percent by the government.

In many areas, it is common to see entire Orri blocks covered with a protective net to minimize potential hail damage from October to January (Figure 4, page 19). The protective net also minimizes sunburn to fruit. The material cost is approximately \$1,500 per acre and \$500 per acre for annual installation and removal. Growers

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**Figure 4.** Protective nets minimize potential hail damage and sunburn to fruit.

using the nets get a discount on their insurance premium.

## NURSERY TREES

The cost for a tree ready-to-plant in the grove is around \$8. Like in Florida, all citrus trees in nurseries are grown in enclosed structures to prevent the spread of diseases and pests.

## FUEL

Cost for fuel was \$6.84 per gallon for gas and \$7.89 per gallon for diesel. The high cost of fuel significantly impacts the cost of all production and harvesting activities and varies with market conditions.

## NUTRITION

The fertilizer rates for various nutrients are similar to those in Florida. However, Israeli growers have developed specific rates by variety, whereas Florida growers have rates for two types of citrus: oranges and grapefruit. When Israeli growers collect leaf samples, they collect leaves from fruiting twigs and not from non-fruiting twigs like in Florida.

## SUMMARY

Israel has a thriving citrus industry devoted to fresh fruit that produces high-quality citrus that meets both local and export requirements. 🍊

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