

The Israeli citrus industry: A SOUTH AFRICAN PERSPECTIVE

JAKKIE (OPJ) STANDER CRI Department of Horticultural Science, University of Stellenbosch jakkie@sun.ac.za

Jakkie Stander, researcher from Citrus Research International, visited the Volcani Agricultural Research Organization and the faculty of Agricultural, food and environment of the Hebrew University of Jerusalem in Rehovot, Israel to attend an international workshop on alternate bearing in fruit trees and travelled with citrus researchers and extension officers from Israel to citrus farms across the country on a technical tour during January, 2015.

Israel is a relatively small Middle Eastern country with a total area of 22 000 000 km², bordering the Mediterranean Sea in the West, Egypt to the South, Jordan and Syria to the East and Lebanon to the North. The country has an estimated population of 7 000 000 people, and an agricultural cultivated area of 350 000 hectares. The citrus industry consists of 19 000 hectares with an annual production of 600 000 tons, of which 180 000 is exported, 200 000 consumed locally and 220 000 processed. The industry consists of three main citrus producing regions from which the majority of fruit are harvested from September-April and exported to the United Kingdom, Europe and Russia via shipments from the cities of Haifa in the North and Ashdod in the South.

Production regions

The earliest production region is situated in the Ezre'el and Golan valleys towards the Sea of Galilee in the North, with soils high in clay content and orchard rows mostly ridged. However, the major production region is situated in the central and coastal areas, in a coastal to inland stretch of 80 km from North to South that experiences classical Mediterranean climatic conditions. Soils are mostly sandy with some areas highly calcareous. A semi-arid production region is located towards the South of the country, bordering the Northern parts of the Negev desert with predominantly sandy soils.

Major constraints

Weather regimes across the Mediterranean

appear to be changing, whereas an annual rainfall of 500-550 mm used to be gradually spread out throughout the winter, in the last two years the total rainfall accumulated within 2-3 weeks. Due to the country's high population density, the cost, quality and availability of land and water for agricultural use is the major constraint to the growth and longevity of citrus producers. Seventy percent of all agricultural water is recycled from urban areas and distributed from reservoirs to rural production areas.

Apart from resource limitation, fruit cosmetic damage from wind and winter hail storms is becoming a major concern and producers make use of a similar temporary net-covering that is being used in California during flowering, for 2-4 weeks during the



Figure 1: Seventy percent of all agricultural water in Israel is recycled from urban areas and distributed from reservoirs to rural production areas. Pipelines carrying recycled water are marked with purple coloring to avoid human consumption.



Figure 2: The Northern production regions in Israel are characterized by soils high in clay content and orchard rows are mostly ridged.

winter. Other significant problems include fruit splitting of mandarins, which, considering their vast mandarin plantings, cause significant losses to their industry. Initial problems with fruit set of late mandarins were overcome by girdling and gibberellic acid treatments during flowering and the Israeli approach to ensure good fruit set, is probably the benchmark for modern citrus farmers. The words false codling moth and fruit fly are unknown to most Israeli citrus farmers and their most important insect pests are aphids, mealybugs and mites.

Cultivars and rootstocks

The Israeli citrus industry is synonymous with the Shamouti orange, a local orange cultivar with a distinct longitudinal fruit shape that is believed to have originated in 1858, as a bud mutation from a Ballady 'common orange' tree near the old city of Jaffa. However, in recent years, production of high quality Navels from Egypt has posed the ma-

jor threat to the sustainable production of Israeli oranges and late mandarins are now the cultivars of choice. Of the 19 000 hectares of total citrus orchards, 45% consists of mandarins, 22% oranges, 22% grapefruit and 10% lemons. Orri is an Israeli cultivar developed by the Volcani cultivar breeders and is the main cultivated late mandarin variety that consumes nearly 4 700 hectares (25%) of the total citrus production area. By applying branch girdling and gibberellic acid spray treatments during full bloom, good fruit set is obtained and fruit are harvested from the end of January until mid-February (End of July until mid-August in South Africa) with an average yield of 40-60 tons and profits of US\$ 30 000-50 000 per hectare.

Due to suspected incompatibility between certain mandarins and trifoliolate rootstocks, as well as the tendency of new plantings to shift towards the central parts of the country where high pH soils predominate, Volkameriana and Sour orange are now the



Figure 3: The Orri late mandarin was developed at the Volcani research institute in Israel and the mother tree is still situated at the breeding facilities in Rehovot.

preferred rootstock options, amid the latter's susceptibility to Tristeza virus.

Interesting cultivars with potential in South Africa include the Odem mandarin, which in Israel, is harvested 2-4 weeks earlier than the Orri (end of June until mid-July in SA). The fruit is characterized by a deep orange rind color, good fruit size (2-1X) and good yields of between 50-70 kg per tree are obtained. Acids tend to drop quickly and will be a problem in warmer, summer rainfall production areas.



Figure 4: Fruit cosmetic damage caused by winter hail storms is becoming a major problem to Israeli citrus producers and temporary net-cover for 2-4 weeks is used to avoid damage.



Figure 5: Girdling is the most important manipulation technique to ensure fruit set of late mandarins in Israel and is applied to trunks of young trees (A) and only to 2/3 of the branches on mature trees. The girdling tool in (B) is used for girdling.



Figure 6: Pruning of trees is mainly done to ensure sufficient light distribution. Trees are manipulated into a V-shaped structure from an early age and thereafter big window-cuts are made in the spring and regrowth control in the summer.

An interesting new grapefruit variety is the Aliza, a cross between Chandler pummelo and Orri mandarin, with a deep, yellow-orange rind color. Fruit size is very good; the pulp is orange with high juice content and a unique, sweet taste. Harvest time is May-June in South Africa and under Israeli conditions fruit can hang for a long period.

Technologies and cultural practices

Under Israeli conditions, Orri mandarin trees do not struggle to flower, however, ensuring sufficient fruit set is the major challenge. Their fruit set strategy was developed by Professor Eliezer Goldschmidt and his colleagues and is based on a combination of girdling and gibberellic acid sprays during full bloom. Girdling is the most important manipulation technique and is applied to trunks of young trees and only to 2/3 of the branches on mature trees. GA³ is applied as



Figure 7: Interesting new cultivars developed at the Volcani research institute include the Odem mandarin (A), which in Israel, is harvested 2-4 weeks earlier than the Orri (end of June-mid-July in SA) and the Aliza grapefruit (B), an orange-like grapefruit that, under Israeli conditions, matures in December-January (May-June in SA).

one treatment of 50 ppm or in years of extended flowering time as 2 x 25 ppm treatments timed 1-2 weeks apart.

Pruning of trees is mainly done to ensure sufficient light distribution. Trees are manipulated into a V-shaped structure from an early age and thereafter big window-cuts are made in the spring and regrowth control in the summer. General orchard spacing is 6 x 3 m, however, in some areas narrow spacing mandarin plantings of 5 x 1.5 m (1 333 trees per hectare) are managed in a tree removal system starting from year 7 or 8. During years 1 and 2, every fourth tree in every second row is removed and in years 3 and 4, every second tree is removed, resulting in an orchard density change from 1333 trees per hectare to 666, over a period of 4 years.

Ninety five percent of all producers make use of fertigation by which the required amounts of fertilizers are continuously applied with a single-line drip irrigation system starting directly after the winter and continuing until 2-3 months before harvest.

Research and extension services

The citrus researchers are affiliated to the Volcani institute, an agricultural research organization of the Israeli minister of agriculture. In addition to solving industry related problems such as alternate bear-

ing, fruit splitting and improving fruit quality with shade-netting, pre- and post-harvest researchers work very close together with cultivar breeders, with the aim of developing improved cultivars that are suited to the country's growing conditions. Preselection using genetic markers for important traits viz. seedlessness, colour, rind integrity and low susceptibility to Alternaria brown spot is the main focus.

In addition to the research organization, the Israeli government also has several extension officers in the three different production areas that provide technical assistance to the producers and conduct some applied research.

Conclusion

The Israeli citrus industry is an important contributor to the global citrus production and fresh produce supply to Northern Hemisphere markets. The country is internationally renowned for its cultivar breeding and development of new technologies. Through world-class research, excellent manipulation techniques and technologies are being developed to optimize the country's limited resources. The importance of a research institute to ensure industry growth and development is beautifully illustrated in a country like Israel, which, without its innovative technologies would not have flourished in the way it currently does.



Figure 8: Local Israeli citrus fruit, from left to right: the Shamouti orange with its characteristic longitudinal fruit shape, the Sammy Navel orange and the Orri mandarin.