



Avocado Brainstorming 2018 attendees. Photo courtesy of Dr. Mary Lu Arpaia.

# Avocado Brainstorming 2018

By Tim Spann, PhD  
*Research Program Director*

**T**he Avocado Brainstorming meeting was held May 28 – June 1, 2018, in Tzaneen, South Africa. Tzaneen, in Limpopo Province in northeastern South Africa, is the heart of South Africa’s avocado industry. This is a warm subtropical climate with average annual rainfall above 40 inches. There also is significant production in KwaZulu-Natal province in the southeast, which is a cooler climate, and Western Cape province, which is a warm dry climate like California.

## **The South African Industry**

The South African avocado industry is currently about 30,000 acres and is growing by about 2,500 acres annually. Hass and Hass-like (Lamb Hass, Maluma, Carmen, Gem) cultivars make up the largest percentage of South Africa’s production at about 40 percent, while Fuerte is a close second at just under 40 percent. Varieties like Pinkerton, Ryan, Reed and Edranol make up the balance of the country’s production. Europe is South Africa’s largest market and as its preference

for Hass has grown, the South African industry has begun to shift its production away from Fuerte and other greenskin varieties. Eastern Europe and the United Kingdom absorb about 90 percent of South Africa's exported fruit, with Western Europe and the Middle East taking the balance. Efforts are underway to gain access to the United States, Japan and China.

This was my first visit to South Africa and I was surprised at the level of sophistication in the industry. Nursery production practices, planting practices and grove management are top notch, and its harvesting, packing and shipping protocols are rigorous. Unlike the California industry, the South African industry is dominated by a couple of large, vertically integrated companies — Westfalia, Allesbeste and ZZ2. For more details about the South African avocado industry, please see the article about Allesbeste in the Summer 2018 issue of *From the Grove* and the articles about Westfalia, and Maluma and Bounty in this issue.

### **Brainstorming**

There were about 80 attendees at this, the fifth, Brainstorming meeting, representing 11 countries. This was the first time the meeting was not held in conjunction with the World Avocado Congress. South Africa had the largest representation at the meeting with 30 participants, followed by 18 people from the United States. The meeting program was divided into eight sessions over 2.5 days, with an additional half-day tour of Allesbeste Nursery and Groves, and a full-day tour of Westfalia Fruit.

The eight session topics were:

- Providing for the Consumer: Health, Safety, Flavor
- New Technology to Improve Avocado Production
- Challenges to Productivity: Diseases
- Challenges to Productivity: How the Tree Regulates Return Bloom and Crop Load
- Where Theory Meets Practice
- Challenges to Productivity: Genetics, Genomics and Biotechnology
- Meeting the Challenges of the Future
- Tying the Loose Pieces Together: Planning for the Future

### **Notable Research Reports**

Dr. Aureliano Bombareley, Virginia Tech University, reported on the accomplishments of an international group working on the avocado genome. He reported that the group will have an annotated genome published by the end of 2018, but if everything goes smoothly it could be published as early as September. The avocado genome was previously reported to have been sequenced by a Mexican group, but it has never been published. A Chinese group recently published an avo-

cado genome, but it is only half the expected size, so it is likely not a good genome.

Having the avocado genome does not, in and of itself, provide anything real and tangible for growers. However, researchers will be able to search the genome, when published, for orthologs — genes with similar sequences to known genes of known function in other species — and thereby begin to identify specific avocado genes and link them to functions. Knowing which avocado varieties/races/species possess different traits can allow breeders to have more focused selection programs, or possibly allow for gene editing through any number of biotechnology techniques.

Dr. Iñaki Hormaza, Institute of Subtropical and Mediterranean Horticulture in Malaga, Spain, updated the group on work he has been doing to understand why so many avocado flowers do not set fruit. With laborious hand pollination avocado fruit set is barely 1 percent, and is well under 1 percent naturally. Dr. Hormaza has been leading a group that has developed a technique to assess the carbohydrate storage (energy) of individual flowers without removing the flowers from the tree. This allows them to know the energy status of a flower and then track that flower to see if it sets fruit. They've conducted their studies with both natural pollination and hand pollination. They have collected very convincing data that suggests the fruiting potential of an individual flower is directly correlated with that flower's carbohydrate storage — the higher a flower's carbohydrate storage, the greater likelihood that flower will produce a fruit. The next step in this work will be to understand what, if any, management practices can be implemented to increase overall flower carbohydrate storage and if this leads to greater fruit set.

In the session concerning new technology to improve avocado production, the topics of remote sensing, image analysis for grove mapping, and trellising for high density plantings were discussed. Remote sensing continues to hold a lot of promise for a lot of different applications but has yet to deliver on many of these. There are many different systems around the world using remote sensing — specifically NDVI, normalized difference vegetation index — for estimating crop water status and calculating crop evapotranspiration. But promises for systems that can detect disease or nutrient deficiencies still have not had much success outside the laboratory and uniform row crop situations.

Zander Ernst from Allesbeste discussed the use of aerial image analysis for grove development. Allesbeste, with its in-house IT (information technology) department, recently developed a new block on a steep slope. The terraced layout and specific grading requirements were all computed using aerial images and computer software. This information was then used with GPS-equipped grading equipment to create the desired contours that were calculated to maximize row





Mary Lu Arpaia addresses the Brainstorming attendees in front of a clone of the Mother Hass tree during a tour of Westfalia Fruit.

spacing and use of the site.

Zander also presented on Allesbeste's trials using vertical and tatura (Y-shaped) style trellises for growing avocados at high density. In their trials to date, researchers have seen up to a 137 percent yield increase on vertical trellises and up to a 321 percent yield increase on tatura trellises. They are currently planting larger scale (several hectares) trials of the tatura trellis system to determine its commercial feasibility.

The disease session included updates on laurel wilt, as well as several other emerging pathogens from around the world. Noleni van den Berg, University of Pretoria, discussed the latest concerning a disease known as white root rot (WRR) caused by the pathogen *Rosellinia necatrix*. This is a root pathogen similar to phytophthora root rot but it is much more aggressive. It is known to occur in Israel and Spain and was recently confirmed in groves in the Nelspruit growing region of South Africa. There is an ongoing breeding program in Spain trying to develop WRR-resistant rootstocks. The project currently has 22 selections that are moving into field trials and it has identified 250 different genes that may play a role in WRR resistance.

Another pathogen that is emerging, particularly in humid subtropical and tropical regions of Australia, is called brown root rot (BRR), caused by the pathogen *Phellinus noxius*. This pathogen has a very wide host range (>200 species) and is very persistent. In Australia, researchers have been able to recover the pathogen from decaying root pieces in the soil four years after tree removal. BRR can be spread easily from tree to tree through root grafts or by using wood chips from infected trees as mulch.

## Summary

As I am still relatively new to the avocado industry, meetings like this are a great way for me to place faces with names

of various people whose work I read. For me, the highlight of the event was meeting Nigel Wolstenholme, retired professor from the University of KwaZulu-Natal. Nigel was a prolific avocado researcher and is co-author, along with Tony Whitley (Australia) and Bruce Schaffer (Florida), of the avocado bible — *The Avocado: Botany, Production and Uses* — now in its second edition. Nigel wrote and presented a fantastic piece at the meeting wrap-up about planning for the future. In it, he highlighted what he sees as the challenges to the world avocado industry (and agriculture in general) looking ahead to 2030 — commoditization, changes in land ownership, sustainable farming and safer food trends, low average yield, alternate bearing, phytophthora root rot, too few elite cultivars and rootstocks, and a lack of best orchard management practices.

Was this a successful meeting? This is a difficult question to answer and it depends, to some degree, on who is answering the question and what they wanted to gain from the meeting. For me, personally, yes, the meeting was a success. I made some great contacts and I learned about who is doing what in avocado research around the world. I took copious notes that I will continue to sift through for months to come.

That said, the Brainstorming and its structure poses some challenges. The Brainstorming was modeled on the Gordon Research Conferences (GRC). GRCs were started in the 1930s by Dr. Neil Gordon at Johns Hopkins University with the intent “to bring together a group of scientists working at the frontier of research of a particular area to discuss, in depth, all aspects of the most recent advances in the field and to stimulate new directions for research.” GRCs are by invitation only and have several guiding principles, chief among them being “no publication.” This policy is to ensure that the researchers present feel free to share ideas within a close group and that conversations will remain private.

As Avocado Brainstorming has evolved, and organizations like the California Avocado Commission and the Hass Avocado Board have become sponsors, the no-publication policy becomes difficult to manage since the funding agencies expect a report in return for their financial support. In addition, the invitation-only policy artificially restricts who attends — some don't attend on principle because they don't believe in the invitation-only policy, and others simply aren't invited.

Lastly, Brainstorming really has been continuing almost exclusively because of the drive from Dr. Mary Lu Arpaia. And I wonder about the long-term sustainability of the meeting and who else in the world avocado industry is willing or able to pick up such a monumental task? In other words, is this meeting self-sustaining? This is the greatest challenge facing the Avocado Brainstorming meeting and its long-term success. 🥑