Micropropagation of Avocado in California

Because avocado trees are a clonal crop — produced from a single source through asexual reproduction — the market is dominated by just a few varieties and rootstocks. The lack of diversity in the trees' genotype can make them susceptible, as a group, to emerging pests and diseases. Further, avocado clonal propagation is very slow and labor intensive, which places limits on the trees' availability and increases the costs of new trees. To address these challenges, the California Avocado Commission partnered with The Huntington Botanical Gardens to explore how clonal micropropagation can be improved in order to increase plants' availability and decrease their cost.

The Huntington recently released its final report, "Opening Roads for Micropropagation of Avocado in California," to the Commission. The report, which outlines tissue culture protocols developed during the three-year project, can be found online at: CaliforniaAvocadoGrowers.com/sites/default/files/California-Avocado-Commission-Avocado-Micropropagation-Final-Report.pdf. Below is a summary of its findings.

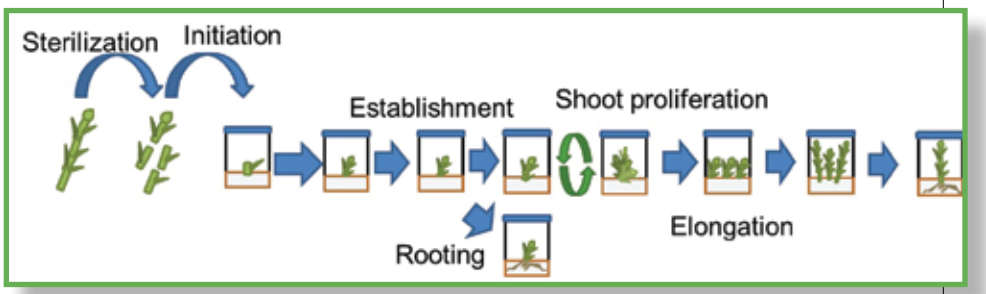

Figure 1. An illustration of the avocado micropropagation system developed by the Huntington Botanical Gardens. Illustration by Dr. Raquel Folgado, HBG.

During the past three years, researchers carefully examined each stage of the micropropagation of avocado, including rootstocks, cultivars and wild relatives. Avocados are very sensitive to tissue culture conditions. During the course of their research, they determined the development of optimized tissue culture protocols for different avocado varieties and rootstocks can shorten the propagation cycle, which could positively impact the California avocado industry.

The avocado micropropagation

Figure 2. In vitro avocado shoots at the initiation and establishment phases. Photos courtesy of Dr. Raquel Folgado, HBG.

Figure 3. In vitro avocado shoots at the propagation stage. Photo courtesy of Dr. Raquel Folgado, HBG.

system established by the researchers consists of sterilization, initiation, establishment, shoot proliferation, elongation and rooting. Researchers started by developing protocols to optimize the sterilization process and reduce the risk of contamination — successfully producing a surface decontamination method for juvenile and adult avocados. The researchers also discovered a new stage, which they called "establishment," was critical to propagation. Experiments led the researchers to identifying the critical components in the medium, thus successfully creating media where avocado shoots (explants) could initiate and establish in tissue culture. At this time, more than 50 cultivars and rootstocks have been successfully established.

As concerns the multiplication stage — when small clusters of shoots develop, elongate and increase — researchers noted juvenile materials were easier to establish in culture and that the cultivar and state of the explant also played a role. Based on this knowledge, the group has successfully started the first avocado in vitro repository in the United States with more than 15 genotypes. The research group will continue to secure additional avocado genetic resources.

Going forward, the team will continue to conduct research to better understand the in vitro rooting process of avocados and continue the micrografting trials, which produced positive preliminary results. The Huntington, in partnership with the University of Queensland, also developed the first cryopreservation protocol for avocado clonal materials and will continue studies in an effort to establish the first cryobank for this crop.

Figure 4. Examples of avocado micrografting. Shoot tips are dissected and grafted in tissue-cultured rootstocks. Photo courtesy of Dr. Raquel Folgado, HBG.