Topics in Subtropics Newsletter

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News from the Subtropical Tree Crop Farm Advisors in California

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TOPICS IN THIS ISSUE
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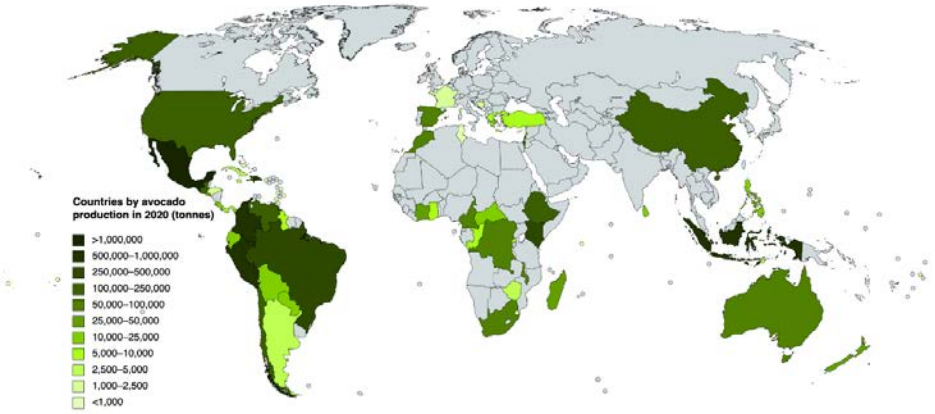
Avocado Production in the World: Observations of production and consumption growth

Eta Takele, Area Agricultural Economist, University of California Cooperative Extension

Production trend: There are over 60 countries listed that grow avocado in the world (Figure 1). The continent of America is the dominant region producing 70% of the avocados in the world. Africa and Asia supply 12% and 14%, respectively (Figure 2) in 2021.



From Wikipedia, the free encyclopedia

Figure 1. Regions of Avocado Production in the World

Among countries, the top 10 countries include Mexico, Columbia, Peru, Indonesia, Dominican Republic, Kenya, Brazil, Haiti, Viet Nam and Chile accounting for 80% of the world's avocado production with Mexico alone accounting for 28% of the world production, producing 2.44 million metric tons in 2021.

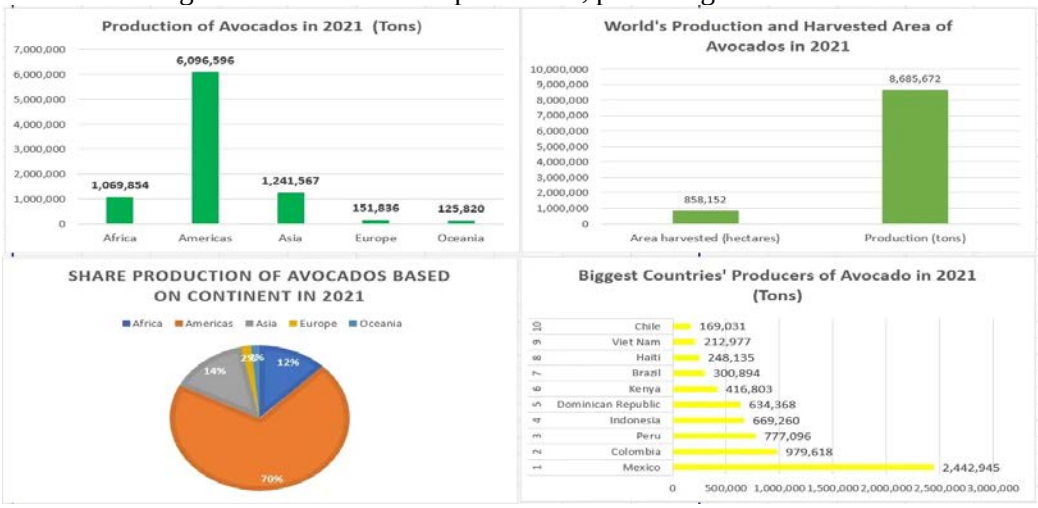
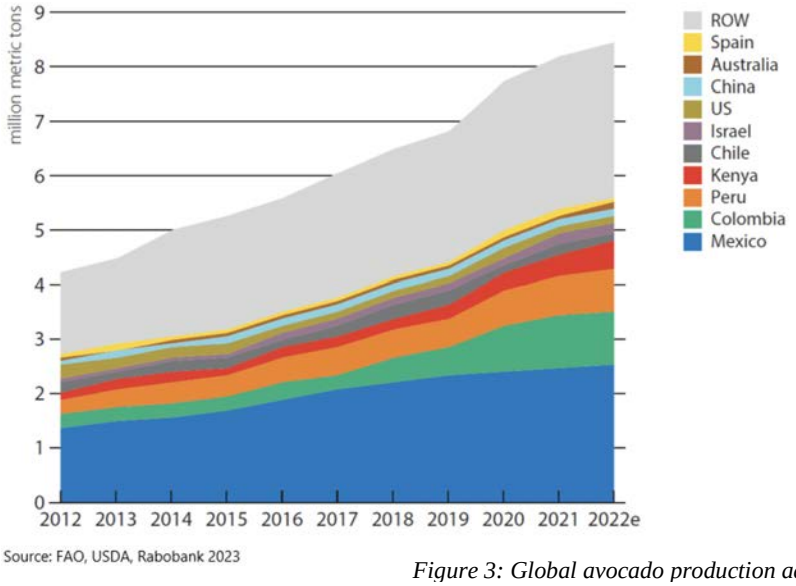


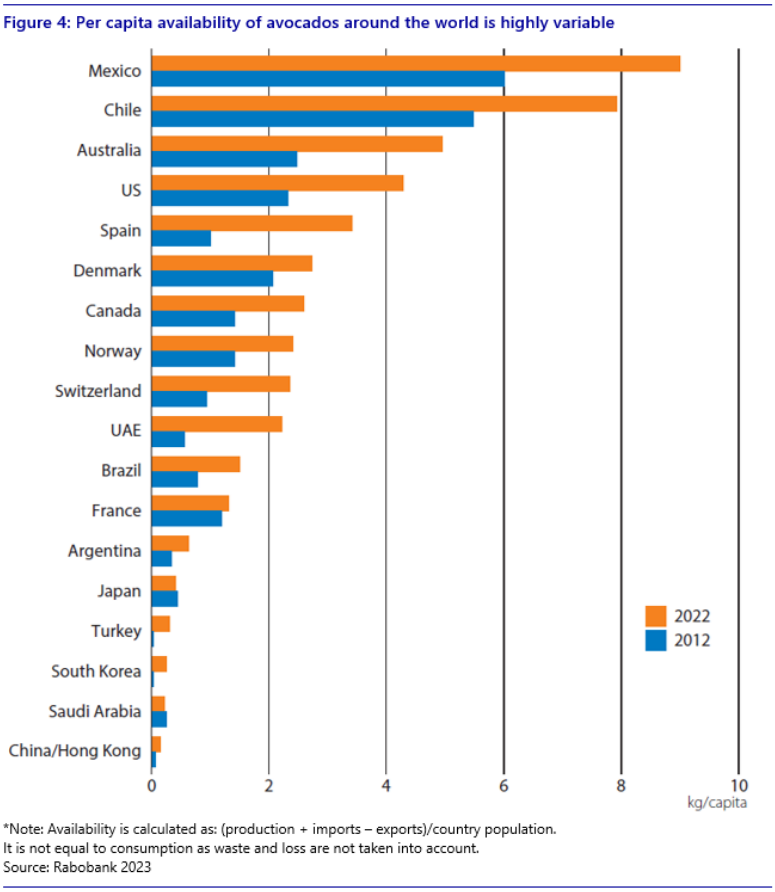
Figure 2. Distribution by Region and Country of Avocado Production in the World. https://scienceagri.com/10-worlds-biggest-avocado-producing-countries/ based on FAO 2022 data.

According to the Food and Agriculture Organization (FAO) data, avocado production in the world has more than doubled in number of hectares from 329,323 in 2000 to 858,152 in 2021 and more than tripled in production from 2.7 million metric tons in 2000 to 8.70 million metric tons in 2021. Also according to Rabobank recently published World Avocado Trade Map, global avocado production expanded by about 7% annually during the past decade. Figure 2 shows the growth in production in some countries of the world since 2012.



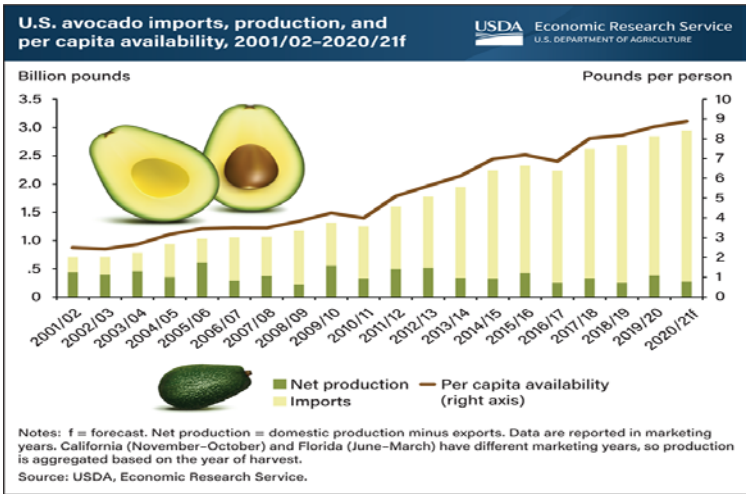
Consumption growth:
The following graph shows the per capita consumption of avocados in some countries of the world in 2012. In 2021. Mexico tops in per capita consumption followed by Chile and Australia.
There has been substantial increase in consumption of avocados in the world over the years. Research and information on benefits of avocados as a source of vitamins, good fiber and substitutes for fat are some of the benefits perceived to have encouraged and increased demand of avocados worldwide. A variety of culinary avocado uses have emerged to promote consumption (Fig. 3).

Figure 3: Global avocado production advanced at a rapid pace



Per capita consumption has increased in several countries. For instance, in the United States per capita consumption increased from ~ 3 pounds (1.36 kg.) per capita in 2001-02 to ~8.5 pounds (3.83 kg) per capita in 2020-21, almost triple in the 20 years period. The following graph (Figure 6) shows the steady increase of per capita consumption in the United States. (Figure below).

According to the Centre for the Promotion of Imports from developing countries (CBI), last updated: 23 January 2023, the global production volume is expected to reach 12 million tonnes by 2030, three times more than a decade ago. In Mexico, the world's largest avocado producer, there was a decrease in volume in 2020. But in the long-term Mexican supplies may increase by 5.2% on an annual basis to fulfil the growing demand in the United States. Countries such as Peru, Colombia and Kenya continued their growth with double digits, with most of their exports being destined for the European market.
Some of the factors that have induced expansion of avocado production in the world include: on the production side, development of improved production techniques such as the technology for reducing salinity from seawater for irrigation in Israel; introduction and improvement of high-density planting/production in many countries such as Chile, South Africa and Israel; and increase of newly growing areas on a rain-fed basis in many African countries such as Kenya, Ghana and Ethiopia.



https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=103810

Figure 6: The steady increase of per capita consumption in the United States

USDA-APHIS Approves New Fuller Rose Beetle Mitigation – a Voluntary Option to Reduce Pesticide Applications

Sandipa Gautam, Area Citrus IPM Advisor UCCE
James R Cranney, President CCQC

At the request of the California Citrus Quality Council (CCQC) USDA's Animal and Plant Health Inspection Service (APHIS) has approved a new sampling protocol that growers can use to reduce pesticide applications for control of Fuller rose beetle (FRB), a quarantine pest in South Korea.

Fuller rose beetles are brown, flightless, snout beetles that have one generation in a year (Figure 1). Three-fourths of their life cycle is spent under the ground where they feed on roots and go through development. Adults emerge from the ground year-round, but the major emergence in the San Joaquin Valley occurs July-September, with 53% of beetles emerging in August. All beetles are females and adult females do not require mating to begin reproduction. Beetles climb to the tree canopy and feed on citrus leaves and lay eggs on cracks and crevices including the under the sepal (Figure 2). Eggs can be present at the time of harvest, thereby making this beetle a quarantine concern for Korea's Animal and Plant Quarantine Agency.

Figure. 1. Fuller rose beetle adult.

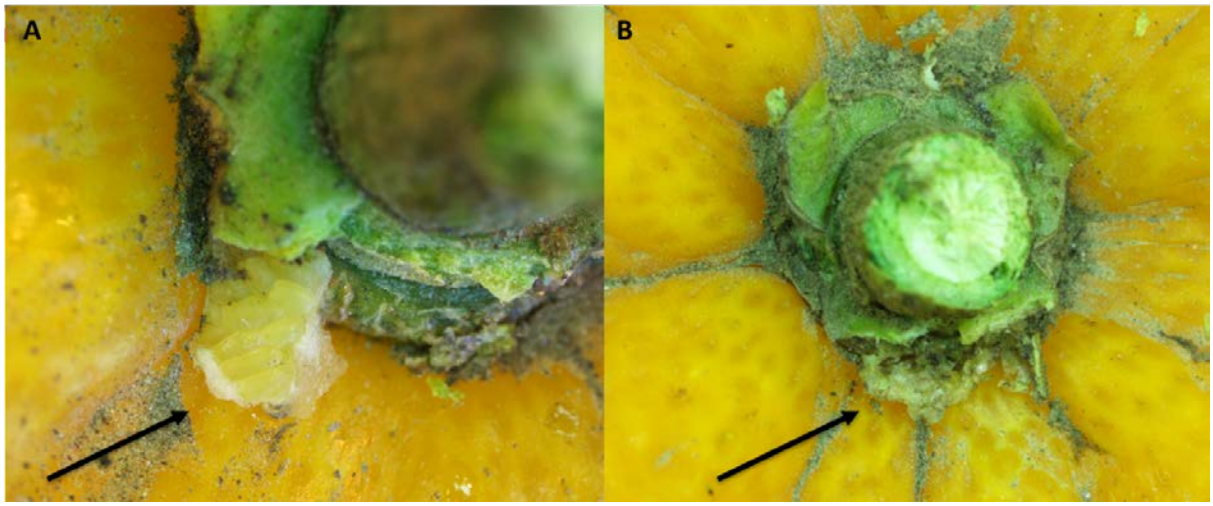


Figure 2. Fuller rose beetle egg masses, live eggs (A) – note yellowish and plump eggs; dead or hatched eggs (B) – dried out egg mass.

Current Practices for FRB Management

Growers have been using a system's approach which combines cultural and chemical methods to target FRB, since 2010. The goal of FRB management is to reduce the beetle population and egg laying. Current regulatory requirements for managing FRB are:

a) Skirt Pruning sufficient to prevent tree skirts from contacting the ground.
b) Weed control sufficient to prevent forming a bridge from ground to tree skirt.
c) **Two insecticide treatments** to control Fuller rose beetle using only University of California recommended pesticides from the UCANR IPM Guidelines web page at http://ipm.ucanr.edu/PMG/r107300311.html

In recent years, most growers and pest control advisors have reported that they no longer detect beetles in most citrus groves. Furthermore, the USDA APHIS interception rate from phytosanitary inspections, where 600 fruits per container are sampled for FRB egg masses, FRB was found in only 0.05 percent of all containers. This indicates that FRB populations are very low in citrus groves.

Since FRB populations in citrus groves are historically low, CCQC has proposed an additional voluntary option for the Korea FRB Protocol to reduce pesticide use:

1. Trees must be skirt pruned to minimize branches touching the ground.
2. Herbicide treatments should be made to eliminate weeds that could be a pathway into the tree.
3. Either option a or option b
    a) Growers must make two pesticide applications to control FRB using pesticides recommended on the University of California Citrus IPM website https://ipm.ucanr.edu/agriculture/citrus/fuller-rose-beetle/
    b) Growers must use the FRB sampling protocol (below), keep records and if no more than two FRB-infested trees per sample are detected they may eliminate the first application and make one application, preferably before October 31 with pesticides recommended on the citrus IPM website.

Fuller Rose Beetle Sampling Protocol:

1. Growers should conduct Fuller rose beetle (FRB) sampling from Aug. 7 – Aug. 31 since that is the peak period of emergence.
2. Conduct a random sample in each citrus block.
    - Divide the block into four quadrants and sample 18 trees that are spread equally apart in each quadrant. A total number of trees sampled is 72 trees.
3. Growers or Pest Control Advisors (PCA) should:
    i. Check suckers inside the tree for signs of FRB leaf chewing and if beetles are detected the tree is considered infested.
    ii. If no beetles are found in the interior, shake two large outside branches over a light cloth and inspect for FRB. If beetles are found, the tree is considered infested.
4. Growers must keep records on the results of the sampling including (i) block identification, (ii) inspection date, (iii) name of inspector, and (iv) number of trees infested with beetles out of 72 trees inspected.
5. If no more than two infested trees are found, growers may eliminate the first FRB pesticide application. If two infested trees are found, growers must make a pesticide application in August or early September.
6. If no more than two infested trees are found, growers are still required to make one pesticide application to control FRB, preferably before October 31.

How will the new protocol help?

- Reduced pesticide use could reduce grower costs to manage FRB.

- Fewer pesticide applications should improve biological control in citrus groves by preserving beneficial insects. Many PCAs and growers attribute severe mealy bug outbreaks to increased pesticide use to control FRB and Asian citrus psyllid.
- Reducing pesticide use to control FRB will help California citrus growers adopt more sustainable production practices and align the industry with the California Department of Pesticide Regulation's Sustainable Pest Management Roadmap.

References:

UCIPM 2017. Citrus Pest Management Guidelines: Fuller Rose Beetle. https://ipm.ucanr.edu/agriculture/citrus/fuller-rose-beetle

DON'Ts – Suggestions for Citrus and Avocado Growers and Others

Ben Faber, Farm Advisor and Mary Lu Arpaia Extension Specialist

Sometimes growers respond to "DO's". Do plant on mounds or berms, Do use avocado clonal rootstocks, etc. But sometimes we respond better to "DON'Ts". Don't plant in wet soil. Don't bury the stem when planting. Don't apply foliar nutrients to avocado. So here, is a list of Don'ts that might make more of an impression than Do's. And some of the Don'ts are Do's, so read them well!

Prior to Planting

Don't do soil analysis to determine suitability. You don't want to know what the pH is or salinity, or where a hard pan might be or areas of waterlogging or high winds. If you know before planting, you can make alternative arrangements, like correcting soil pH or leaching to correct salinity. That's too much work.

Don't choose an appropriate rootstock. Whether you are planning for citrus or avocado, select appropriate rootstocks for the site. Citrus has many more options than avocado, but even with avocado, some rootstocks are more tolerant of certain conditions, such as root rot, salinity and high pH.
Don't consider incorporating pollinizers in an avocado orchard. They might create more fruit.

At Planting

Don't plant on berms or mounds when there is potential for poor water or air drainage. Maintaining good water management, which berms can help, can lead to the long-term health of the orchard.

Don't mulch at planting. This keeps weeds down, reduces evaporative loss and provides some control of avocado root rot.

After Planting

Don't control gophers and ground squirrels and rabbits and mice. They can be especially hard on young trees, but older citrus stems are always a sweet dessert for rodents.

Don't walk the orchard irrigation system, to check for leaks, breaks and non-uniformity.

Don't' have an irrigation system evaluation. It might point out how to better apply water and grow a healthy tree and more successful operation.

Don't prune, thin, or manage tree height and size for optimum production.

Don't use irrigation in anticipation of and during frost or heat events.

Don't whitewash trees to prevent sunburn damage of exposed branches after heat or frost damage.

Don't do fall leaf analysis to assess fertility needs and management.

Don't walk your orchard to assess conditions and observe how harvest and pruning operations are progressing. Walking the orchard only at harvest time means if poor tree conditions have progressed it's harder to correct.

Don't do ground management with cover crops, mulch or various erosion control practices that lead to soil health.

Don't improve conditions for improved avocado pollination and fruit set. Consider promoting biological control through use of hedgerows, cover crops, pesticide use, fertility/pruning/irrigation, and other horticultural practices.

Harvesting

Don't coordinate with your packer on the harvest; this might lead to better fruit quality and higher returns.

Don't pay attention to minimum maturity standards for citrus and avocado; they are just cumbersome regulations.

Don't worry about mixing avocado varieties in the bin, what is the consumer going to know or care?

Don't pay attention to the weather. Extremely hot weather coupled with delays delivering the fruit to the packinghouse may result in a loss of fruit quality and actual weight loss/size from the field to the packinghouse. Likewise, picking wet citrus can lead to peel disorders that only manifest after the fruit is packed.

Don't visit the picking crew while they are picking to inspect the quality of the harvesting job. What harm does a few long stems on citrus for instance do to fruit quality? Or if you are size picking to meet market demand, does it matter that there is a lot of undersized fruit?

These are all sarcastic Don'ts, but there are some real Don'ts that growers forget about:

Don't plant into wet soil. It leads to compaction and poor root growth.

Don't make a hole just as deep as the planting sleeve. Making a deeper hole can lead to the root ball settling and eventually covering the tree stem which can lead to stem cankers.

Don't incorporate an organic planting mix. This leads to decomposition and eventual settling of the material around the football and the stem getting buried.

Don't let the mulch accumulate around the trunk, leading to crown rot.

Don't let mulch fall into planting hole. Same as incorporating in the planting media.

Don't incorporate a fertilizer in the planting hole. The tree is loaded from the nursery and there is a good chance of burning the roots.

Don't spray when wind speeds exceed 10 mph if you are spraying pesticides, no matter how close you are to finishing or how little is still left in the tank. Famous good intentions that backfire.

And for those who prefer a more positive approach, using Do's, here's another way of listing field activities. Remember that every situation is different, and avocados may be more sensitive to some of these Do's than citrus and other deeper-rooted trees crops. So said another way:

Do soil testing prior to planting.

Do choose appropriate rootstocks.

Do mulch at planting, keeping it away from the tree stem and don't incorporate an organic planting mix in the hole.

Do incorporate pollinizers.

On flat ground, shallow ground, do plant on berms or mounds, especially avocados.

Do make a hole no deeper than the root ball and make sure it's not sloppy wet when digging and don't backfill with organic planting mix. Use the native soil. And don't put fertilizer in the planting hole.

Do mulch trees, especially avocados.

Do control rodents, especially in citrus and young trees. But even mature citrus can collapse in a weekend of gopher feeding.

Do an irrigation system evaluation and walk your irrigation lines frequently.

Do maintain tree size, preventing tree shading of neighboring trees and self-shading.

Do use irrigation system for winter warming and cooling during heat spells.

Do whitewash trees after defoliation to prevent sunburn damage.

Do leaf analysis to optimize fertilizer applications.

Do walk the orchard to evaluate conditions before they get worse.

Do make pesticide applications following all guidelines.

Do optimize the orchard for biological control, soil health and tree performance by keeping as much of the ground covered with mulch or cover crop, and including alternative pollen and nectar sources from hedgerows.

Do make sure the trees and orchard are getting the right amount and timing of as good a quality of water as possible.

Do coordinate with your packer on timing of harvest and delivery to the packinghouse to optimize fruit quality. You don't know where your fruit is going to go in the national and international market, and it is important that we all do our part to maintain the excellent reputation of California citrus and avocado.

Do pay attention to fruit seasonality and variances between growing seasons. Paying attention to the market while picking fruit of optimal quality is an important balancing act. Don't play the late market unless you can actually hold your fruit late.

Do pay attention to the weather when you are planning harvests. Keep in mind that the fruit are living and will respire and lose moisture. Keeping fruit in the shade will minimize weight loss before transport to the packing house. Keep the time in the field after harvest to a minimum.

Do inspect the harvested fruit before it leaves your grove. Make sure that stems are short and will not cause puncture wounds (= decay) on adjacent fruit. Make sure you are not mixing avocado varieties in the bin since they will likely be graded out at the packinghouse anyway and will at the least result in an uneven looking packed box.

There are so many Don'ts that it's hard to list them all. The best is this one:
The last Don't is, don't attend grower meetings like those sponsored by CA Citrus Research Board, CA Avocado Society, CA Avocado Commission, CA Assocation of Pest Control Advisers, Pesticide Applicators Professional Association, Groundwater Management group or other grower organizations. Don't stop learning.

If you have some other outstanding Don'ts, **Do** pass them on to me. **Do continue learning and being inquisitive.**

California Efforts to Control Citrus HLB

Ashraf El-kereamy
CE specialist, Department of Botany and Plant Science, UCR
Director of Lindcove Research and Extension Center

Introduction: The devastating citrus disease known as Huanglongbing (HLB), or citrus greening, has been a significant concern for citrus growers worldwide. In California, where the citrus industry plays a vital role in the state's economy, efforts to combat HLB have intensified. The citrus industry and research institutes in California have turned to the establishment and implementation of various strategies to effectively combat this destructive disease. Awareness and education play a vital role in HLB control. UCANR collaborates with other governmental agencies such as CDFA to provide educational resources and training programs for citrus growers and the public. These efforts focus on sharing best practices, disease management strategies, and the importance of early detection and reporting.

Quarantine and Regulatory Measures: To prevent the introduction and spread of HLB, California has implemented strict quarantine regulations. This includes restrictions on the movement of citrus plants and plant material from HLB-infested areas. Quarantine efforts help limit the disease's geographic spread and protect disease-free regions.

Field Survey for the ACP and HLB: Field surveys are an essential component of HLB control efforts in California. Trained personnel regularly conduct surveys to monitor the presence and distribution of both the Asian citrus psyllid (ACP) and HLB. These surveys help identify high-risk areas, track the spread of the disease, and guide targeted control measures in regions where ACP populations or HLB infections are detected. The California Department of Food and Agriculture (CDFA) is leading the field survey and field treatments in California (see links below).

Controlling the ACP: Controlling ACP populations is crucial to minimize the transmission of HLB. Integrated Pest Management (IPM) strategies are employed to manage the ACP effectively. This approach includes the use of biological control agents such as predatory insects, parasitic wasps, and insect pathogens that target ACP. In addition, cultural practices, such as pruning and removal of ACP host plants, are implemented to reduce ACP breeding sites and population densities.

Finding a Cure for the Disease: Scientists and researchers are actively working towards finding a cure for HLB. Extensive research is being conducted to understand the complex interactions between the citrus tree, the HLB bacterium (Candidatus Liberibacter asiaticus), and the insect vector. This research aims to identify targeted treatment options, such as bactericides or antimicrobial agents, that can effectively suppress or eliminate the bacterium within infected trees.

Finding New Resistant/Tolerant Varieties and Rootstocks: Breeding programs and genetic research are focused on developing citrus varieties and rootstocks that exhibit resistance or tolerance to HLB. By studying the genetic makeup of different citrus varieties, researchers aim to identify genes that confer natural resistance to the disease. These efforts can lead to the development of new citrus cultivars and rootstocks that are less susceptible to HLB, providing long-term solutions for disease control. Several HLB tolerant rootstocks have been introduced in California and are being evaluated for growth under

California conditions at Lindcove Research and Extension Center to determine their effects on some of the major citrus varieties growing in the state.

Growing Citrus Under Protective Screen (CUPS): Growing citrus under protective screens, known as the CUPS system, is gaining attention as a preventive measure against HLB. The installation of physical barriers, such as screens or netting, around citrus orchards can prevent the entry of ACP and other insect vectors, reducing the risk of HLB transmission. CUPS also offers additional benefits by providing protection against other pests, wind damage, and adverse weather conditions. One of the first CUPS structures was installed at Lindcove Research and Extension Center and is ready to be used for research purposes.

Improving Overall Tree Health, Especially Roots, through Cultural Practices: Enhancing the overall health of citrus trees, particularly their root systems, is crucial for combating HLB. Cultural practices aimed at improving tree health include proper irrigation management, soil health enhancement, optimized nutrient management, and implementing strategies to reduce stress on the trees. These practices help strengthen the tree's natural defense mechanisms, making them more resilient to HLB and improving their overall productivity. Several federally funded projects have been initiated in collaboration with researchers from Florida and Texas to optimize the cultural practices that will improve overall tree health and reduce the impact of this destructive disease.

Improving Methods of Testing: Efforts are underway to improve the methods of testing for HLB. This includes the development and validation of advanced diagnostic techniques, such as serological assays and next-generation sequencing technologies, to enhance the accuracy and efficiency of HLB detection. Improved testing methods enable early and reliable diagnosis, enabling prompt action to control the disease and prevent its spread.

Conclusion: California's strategies for HLB control encompass a comprehensive approach that includes field surveys, ACP control, research for a cure, breeding and introducing resistant varieties and rootstocks, implementing the CUPS system, cultural practices to enhance tree health, and improving testing methods. The collective efforts of researchers, citrus growers, industry stakeholders, and regulatory agencies are essential for effectively managing and mitigating the impact of HLB on California's citrus industry. Through ongoing research and the adoption of innovative strategies, the goal of controlling HLB and safeguarding the citrus industry's future remains within reach.

Helpful Information & Links

To be sent important ACP/HLB information, news, and updates from the Citrus Insider, click on the link below and sign up:
https://citrusinsider.org/email-signup/

CDFA Spray & Harvest Information:
http://phpps.cdfa.ca.gov/PE/InteriorExclusion/pdf/acpgrowerinformation.pdf

CDFA ACP Compliance Documents, Bulk Citrus mitigations, & Regional Quarantine Information, click on the link: http://www.cdfa.ca.gov/plant/acp/grower-packer-hauler-information.html

ACP-effective materials by the University of California, click on link:
https://www2.ipm.ucanr.edu/agriculture/citrus/Asian-citrus-psyllid/

Interactive Map of ACP/HLB Detections & PMA Boundaries Statewide, click on link:
http://ucanr.edu/sites/ACP/Distribution_of_ACP_in_California/

Information on Monitoring ACP, click on link: https://www2.ipm.ucanr.edu/agriculture/citrus/Asian-citrus-psyllid/

Organic Citrus Guide for ACP/HLB Management in the San Joaquin Valley, click on the link:
San Joaquin Valley Guide for ACP/HLB Management in Organic Citrus (netdna-ssl.com)

Latest Research to Combat HLB - short descriptions, click on the link: http://ucanr.edu/sites/scienceforcitrushealth/

Information on the Data Analysis and Tactical Operations Center (DATOC) Activities & Updates, click on the link: http://www.datoc.us

This June, Dr. Hamutahl Cohen was appointed as an Entomology Advisor with UC Cooperative Extension in Ventura County. Her primary responsibility is to develop environmentally sustainable pest management in agricultural and natural systems. Dr. Cohen is excited to address a myriad of issues related to pest management, including identification and monitoring, pest biology and phenology, crop loss assessment, pesticide resistance prevention, and evaluating integrated pest management methods with an emphasis on biological and cultural controls. She is eager to conduct this work in regional crops such as berries, avocado, citrus, and more.

Prior to joining UC ANR, Dr. Cohen worked as a Commercial Horticulture Agent with the Institute for Food and Agricultural Sciences at the University of Florida. Dr. Cohen obtained her Ph.D. from University of California, Santa Cruz, where she studied how to develop agricultural practices to promote a diversity of beneficial insects and ecosystem services. She then conducted post-doctoral research at UC Riverside, where she studied pollinator health in Yolo County sunflowers. Her research has been presented at national and international conferences, published in >14 peer-reviewed reports, and shared through blogs, factsheets, and field days with her local grower community.

This summer Dr. Cohen will be working with industry and university partners to evaluate the needs of the local grower community and design an applied research and extension program. She is enthusiastic about working in Ventura County, which has a long heritage and tradition of farming dating to 1782 when livestock and crops were grown in Mission San Buenaventura. She believes this is an important place to advance agricultural practices that reduce economic damage from pests while minimizing impacts on the environment, farmworkers, and consumers. She is looking forward to collaborating with growers, pest control advisors, land stewards, researchers, public organizations, and other regional stakeholders. Please contact Dr. Cohen to introduce yourself and talk bugs. She can be reached at hcohen@ucanr.edu.

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Topics in Subtropics

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