AGENDA

California Avocado Commission
Production Research Committee Meeting

Meeting Information

Date: Wednesday, May 18, 2022
Time: 9:00 a.m.
Location: Web/Teleconference

Web Conference URL:

https://californiaavocado.zoom.us/j/5375836823?pwd=aURBZ3BEL29tclBRS1ZRY3QrMkhZQT09

Conference Call Number: 669-900-6833
Meeting ID: 537 583 6823
Passcode: 348652

Meeting materials will be posted online at least 24 hours prior to the meeting at:
https://www.californiaavocadogrowers.com/commission/meeting-agendas-minutes

Committee Member Attendance

As of Wednesday, May 11, 2022, the following individuals have advised the Commission they will participate in this meeting via web/teleconference:

- **Leo McGuire, *PRC Chairman***
- **John Burr**
- **Jason Cole**
- **Jim Davis**
- **Catherine Keeling**
- **Ryan Larkan**
- **Ryan Rochefort**

Time	Item
9:00 a.m.	**1. Call to Order** a. Roll Call/Quorum
9:05 a.m.	**2. Opportunity for Public Comment** Any person may address the Committee at this time on any subject within the jurisdiction of the California Avocado Commission.
9:10 a.m.	**3. Approval of Minutes** a. Consider approval of Production Research Committee Meeting Minutes of December 8, 2021
9:15 a.m.	**4. Research Program Directors Report** a. Update on chloride mitigation study
9:30 a.m.	**5. Discussion Items** a. Potential continuing funding of avocado rootstock trials b. Potential research projects for 2022-23 c. Lease renewal of Pine Tree Ranch
12:00 p.m.	**6. Adjourn Meeting**

Disclosures

The times listed for each agenda item are estimated and subject to change. It is possible that some of the agenda items may not be able to be discussed prior to adjournment. Consequently, those items will be rescheduled to appear on a subsequent agenda. All meetings of the California Avocado Commission are open to the public and subject to the Bagley-Keene Open Meeting Act.

All agenda items are subject to discussion and possible action. For more information, or to make a request regarding a disability-related modification or accommodation for the meeting, please contact April Aymami at 949-341-1955, California Avocado Commission, 12 Mauchly, Suite L, Irvine, CA 92618, or via email at aaymami@avocado.org. Requests for disability-related modification or accommodation for the meeting should be made at least 48 hours prior to the meeting time. For individuals with sensory disabilities, this document is available in Braille, large print, audiocassette or computer disk. This meeting schedule notice and agenda is available on the internet at https://www.californiaavocadogrowers.com/commission/meeting-agendas-minutes and http://it.cdfa.ca.gov/igov/postings/detail.aspx?type=Notices.

If you have questions on the above agenda, please contact Tim Spann at tim@spannag.org or 423-609-3451.

Summary Definition of Conflict of Interest

It is each member's and alternate's responsibility to determine whether they have a conflict of interest and whether they should excuse themselves from a particular discussion or vote during a meeting. To assist you in this evaluation, the following ***Summary Definition of Conflict of Interest*** may be helpful.

A Commission *member or employee* has a conflict of interest in a decision of the Commission if it is reasonably foreseeable that the decision will have a material effect, financial or otherwise, on the member or employee or a member of his or her immediate family that is distinguishable from its effect on all persons subject to the Commission's jurisdiction.

No Commission member or employee shall make, or participate in making, any decision in which he or she knows or should know he or she has a conflict of interest.

No Commission member or employee shall, in any way, use his or her position to influence any decision in which he or she knows or should know he or she has a conflict of interest.

CALIFORNIA AVOCADO COMMISSION
PRODUCTION RESEARCH COMMITTEE
MEETING MINUTES

December 8, 2021

A web/teleconference meeting of the Production Research Committee (PRC) of the California Avocado Commission (CAC) was held on Wednesday December 8, 2021 with the following people participating:

MEMBERS PARTICIPATING VIA TELECONFERENCE:
Bryce Bannatyne
John Burr (9:09)
Jason Cole (9:08)
Dan Grant
Darren Haver
Catherine Keeling
Ed McFadden
Leo McGuire
Tom Roberts (9:03)
Ryan Rochefort

CAC STAFF PARTICIPATING:
Tom Bellamore
Ken Melban
April Aymami

OFFICIALLY PARTICIPATING:
Dr. Tim Spann, Spann Ag Research & Consulting
Dr. Ali Montazar, UC Cooperative Extension

GUESTS PARTICIPATING:
Consuelo Fernandez, Brokaw Nursery
Ben Faber, UC Cooperative Extension

CALL TO ORDER

Leo McGuire, Production Research Committee (PRC) Chairman, called the meeting to order at 9:01 a.m. with a quorum present.

OPPORTUNITY FOR PUBLIC COMMENT

There were no public comments.

APPROVAL OF MINUTES OF AUGUST 4, 2021 PRODUCTION RESEARCH COMMITTEE MEETING

MOTION
To approve the minutes of the August 4, 2021 Production Research Committee meeting.

(McFadden/Rochefort) MSC Unanimous

Motion 21-12-8-1

RESEARCH PROGRAM DIRECTORS REPORT

Dr. Spann informed the Committee that Dr. Monique Rivera, Entomologist at UC Riverside, would be leaving the University at the end of the year to accept a position at Cornell University. Dr. Spann reminded the Committee that Dr. Rivera was hired by UC Riverside to replace Dr. Joe Morse who had retired. CAC considers this an important position since it is responsible for practical pest management research. As such, CAC submitted a letter to the University urging the immediate replacement of this position.

Dr. Spann updated the Committee on the land transfer occurring at the UC South Coast Research and Extension Center in Irvine. Approximately 40 acres of land is being transferred from UC Agriculture and Natural Resources (ANR) to UC Irvine (UCI) for the construction of faculty housing, with the potential for an additional 30 more acres to be transferred later. Although the transfer within the University is essentially finalized, the University will still need to go through permitting with the city of Irvine for development which will likely take several years. Negotiations are beginning in 2022 between UCI, ANR and the researchers whose projects will be affected.

Dr. Spann told the Committee that the grower economic survey they helped to develop was recently completed and presented to the Board of Directors at their November meeting. Ken Melban, CAC Vice President Industry Affairs, shared a summary of the survey results with the Committee. Of 1743 surveys sent out 174 were returned. The returned surveys represented 10% of both the number of growers and the acreage of the industry. Not surprisingly, water was a large part of production costs, especially in district 1 and 2. The survey also showed, despite year to year variation, the industry is overall remaining profitable.

DISCUSSION ITEMS

A. Presentation from Dr. Ali Montazar, Irrigation and Water Management Farm Advisor, University of California Cooperative Extension, USDA Grant Funding for "Improving Avocado Resource-Use Efficiency through Updated Crop Water Use Information and Irrigation Management Strategies"

Dr. Spann introduced Dr. Ali Montazar and explained that Dr. Montazar had received USDA funding to re-evaluate the crop water needs for avocados. Dr. Montazar made a brief presentation to the Committee about the project and explained that the overall goal is to develop an improved crop coefficient value for avocados to be used in calculating crop water needs. The current crop coefficient was developed man years ago from a study that was not initially designed to develop to provide a crop coefficient and it does not account for any seasonal variability in the trees' water needs.

The Committee was very supportive of Dr. Montazar's work and offered to assist in any way they could as the project develops. Dr. Spann explained that CAC's grower outreach tools would be made available to Dr. Montazar to communicate his results to the industry as the project progresses.

ACTION ITEMS

A. Consider approval of the research proposal "Understanding the Effects of Soil Microbial Community Enhancement on Avocado Stress Tolerance"

Dr. Spann reminded the Committee that this proposal was originally presented to the Committee at their June 29 meeting, but discussion was tabled until their August meeting so it could be reviewed in the context of the other proposals being considered. Following the discussion at the August 4 meeting, the Committee asked for the proposal author to revise the proposal to reduce the project scope and budget. Thus, the revised proposal is before the Committee for their consideration. Discussion ensued and there was general agreement among the Committee members that the topic of the proposal is a worthwhile one, but there was a feeling that if the Committee were to consider funding work on the microbiome a more basic, non-product specific, proposal would be more appropriate. Discussion continued and the issue of funding research for a private company's product was a major concern. There was no support from the Committee to recommend the proposal for funding.

B. Consider approval of the research proposal "Development of Chloride Mitigation Strategies for Californian Avocado Growers: Technology Review and Treatment Prediction"

Dr. Spann reminded the Committee that they had reviewed an earlier draft of this proposal at their August 4 meeting. Following that discussion, the Committee asked for the proposal to be revised and the budget to be reduced. The revised proposal is what is before the Committee for their consideration. There was concern during the discussion in August of why Dr. Liu's salary was being included in the proposal rather than being covered by the University. Dr. Spann informed the Committee that Dr. Liu, a member of the chemical engineering department at UC Riverside, holds a 9-month faculty appointment and is only paid for 9-months of the year. The positions are common outside of agriculture where faculty members' primary task is teaching. Faculty with 9-month appointments commonly ask for salary funding in grants for their additional 3 months of annual salary.

Discussion ensued and there was agreement that chlorides are a major issue industry-wide and this proposal would be a good starting point to try to address this issue. There was some concern among the Committee members that at the end of this project there would be nothing tangible to provide to the growers, rather this project would shed light on potential avenues of research that could develop mitigation strategies that growers could use.

Motion
To recommend funding the proposal "Development of Chloride Mitigation Strategies for California Avocado Growers: Technology Review and Treatment Prediction."

(Cole/Burr) MSC 9 yea, 1 nay

Motion 21-12-8-2

C. Consider approval of the research proposal on mitigation of cadmium in avocado groves

Dr. Spann began the discussion by reminding the Committee that there were a couple of instances in early 2021 of loads of California avocados being rejected in Taiwan due to elevated levels of cadmium. These incidents followed early detections in South Korea in 2019. Dr. Spann informed the Committee that since the earliest detections in 2019, CAC has been working quietly to understand the cadmium issue. There exist natural cadmium deposits throughout California that can be taken up by some crops, in particular leafy greens in the Salinas Valley. CAC along with members of the handler community has conducted sampling throughout the California avocado growing region, as well as a more detailed sampling at CAC's Pine Tree Ranch demonstration grove. Dr. Spann shared these results with the Committee and explained that the levels of cadmium in soil appear quite random, change drastically over very short distances, and do not necessarily correlate with levels found in fruit.

Discussion ensued and a major concern from the Committee is that this proposal would only result in more data about the issue but not develop any recommendations for mitigation. Also, since this is not a domestic issue, if a rootstock was found that did not take up cadmium, would the grower community have any incentive to remove trees and replant? The Committee suggested that this may be an item better suited for discussion by the CAC Board of Directors to provide the Committee with some guidance as to what they would like to see done before taking any steps to fund research on cadmium. There was no support from the Committee to recommend the proposal for funding.

ADJOURN MEETING

Leo McGuire, Production Research Committee (PRC) Chairman, adjourned the meeting at 12:12 p.m.

Respectfully submitted,

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Timothy Spann

EXHIBITS ATTACHED TO THE PERMANENT COPY OF THESE MINUTES

EXHIBIT A December 8, 2021 Production Research Committee AB 2720 Roll Call Vote Tally Summary

CALIFORNIA AVOCADO COMMISSION

Production Research Committee

AB 2720 Roll Call Vote Tally Summary

To be attached to the Meeting Minutes

Meeting Name:	**Meeting Location:**	**Meeting Date:**
California Avocado Commission Production Research Committee Meeting	*Teleconference*	*December 8, 2021*

Attendees Who Voted	***MOTION 21-12-8-1***	***MOTION 21-12-8-2***
Leo McGuire, Chair	Yea	Yea
Bryce Bannatyne	Yea	Yea
John Burr	Absent	Yea
Jason Cole	Absent	Yea
Dan Grant	Yea	Nay
Darren Haver	Yea	Yea
Catherine Keeling	Yea	Yea
Ed McFadden	Yea	Yea
Tom Roberts	Yea	Yea
Ryan Rochefort	Yea	Yea
Outcome	**Unanimous**	**9 yea, 1 nay**

Item 5. a. Potential Continuing Funding of Avocado Rootstock Trials

Background: In 2019, the Production Research Committee recommended and the Board approved three years of funding to establish a series of rootstock trials using the five most promising advanced selections from the UC Riverside rootstock breeding program, with the goal of collecting data to make a decision about whether to commercially release any of these selections. That funding began on November 1, 2019 and will expire on October 31, 2022.

Due to issues related to budwood availability and difficulty propagating some of these rootstocks, all the trials were not established in 2019/2020 as originally intended. Below is a table showing the trials that have been established, which rootstocks are planted and the year they were planted.

	Year Planted		
Grower/Grove Manager	2019	2020	2021
Leo McGuire, Temecula	PP35, PP40		PP42, PP80
John Lamb, Camarillo	PP35, PP40		PP42, PP45, PP80
Rick Shade, Carpinteria		PP35, PP40, PP42, PP45, PP80	
Andy Gabryszak (West Pak), Temecula		PP35, PP40, PP45	
Pete Miller, Goleta		PP35, PP40, PP42, PP45, PP80	
Chris Sayer, Ventura		PP35, PP40, PP45	
CalPoly, SLO		PP35, PP40, PP45	
Note: Dusa is also planted as a commercial standard control at all trial locations.			

The earliest of these plantings have begun to produce and were harvested in 2021 and 2022. The 2020 plantings should have some yield in 2022 and the final plantings from 2021 will likely not have their first harvest until 2023.

The question before the Committee is whether to continue funding to support future data collection on these plantings. The funding that has been provided in the current contract is: 2019-20 $100,000; 2020-21 $115,000; 2021-22 $135,000 ($350,000 total).

Attached are the most recent annual report from Dr. Manosalva as well as the most recent milestone report.

Large-scale field testing and potential release of five elite advanced rootstocks.

Annual report November 1st 2020 – October 31st 2021
Principal Investigator: Dr. Patricia Manosalva
Department of Plant Pathology and Microbiology, UC Riverside

Co-Investigators: Dr. Mary Lu Arpaia (Professor of Extension, Subtropical Horticulture; Field and Extension activities), Dr. Peggy Mauk (Professor of Extension, Subtropical Horticulture; Avocado response to salinity, Extension activities), Department of Botany and Plant Sciences, UC Riverside, and Dr. Lauren C. Garner, Cal Poly University.

Cooperators: UCCE Farm Advisors, Grower Cooperators at Field Sites, and South Coast Research Extension Center (SCREC) at Irvine.

Section 1: Establishment and data collection on five large-scale field trials in June 2020. Five field sites were established in June 2020 **(Table 1).** All trees are grafted to 'Hass'. **Table 1** reports the rootstocks planted at each site and the number of trees of each rootstock. Water and soil analyses were collected prior to planting and special conditions such as root rot, salinity and soil pH for each site is reported. Each rootstock was planted in a single block to facilitate subsequent harvest data collection. ***A subset of 30 trees per accession were assessed and evaluated for height (ft), canopy size, above-graft trunk diameter (mm), and below-graft trunk diameter (mm), in addition to rating overall health, salinity damage, heat damage, vegetative flush, bloom, and fruit set on April 2021, July 2021, and October 2021***. In addition, tree mortality was also assessed in each plot.

Table1. Description of the rootstock trials established in 2020. Number of trees per rootstock is indicated in parenthesis.

Grower/Manager	City	Year	Rootstocks (#s)	Conditions
Aline Ranch/Rick and CJ Shade	Ventura	June 25 & 26, 2020	Dusa (61), PP35 (116), PP40 (100), PP45 (100), PP42 (28), PP80 (39)	High Phytophthora Root Rot (PRR) incidence.
Andrew Gabryszak and Nick Lahr	Temecula	June 18, 2020	Dusa (100), PP35 (116), PP40 (100), PP45 (70)	High PRR incidence, high chloride levels, high pH.
Pete Miller	Goleta/ Santa Barbara	June 26, 2020	Dusa (100), PP35 (116), PP40 (100), PP45 (100), PP42 (28), PP80 (39)	High PRR incidence, high chloride and salinity levels, clay soils (problems with soil saturation).
Chris Sayer	Ventura	June 16, 2020	Dusa (100), PP35 (116) , PP40 (100), PP45 (100)	High salinity in the water.
Dr. Lauren Garner Cal Poly SLO	San Luis Obispo	June 23 & 24, 2020	Dusa (96), PP35 (96), PP40 (97), PP45 (95)	Water with high pH, alkalinity due to $CaCO_3$.

Temecula plot (Newhouse Green Gold_ A. Gabryszak & N. Lahr): Trees were planted at a 15' x 20' tree spacing and all trees exhibited similar size at the time of planting. A subset of 30 trees per rootstock were selected, labelled, and used to collect data. These trees will be utilized as reference data trees for the duration of the project. The trees evaluated were tagged as need it and the wooden sticks were spray painted for easy identification of the blocks and trees. At this location ~80% of the Dusa trees died. PP45 rootstock was planted next to Dusa section and only 1/70 trees planted died. We believe that the combination of high temperatures, the soil structure (clay), and Phytophthora root rot (high incidence) was probably the cause of high mortality of Dusa plants. PP45 exhibited better performance that Dusa under these conditions (high heat, heavy soil, and PRR). This also has been observed in some plots in Ventura when these combinations are not favorable for Dusa. At this location, 3/100 PP40 and 11/116 PP35 trees died. PP45 exhibited the best scores for heat damage (majority ranged from 0 – 0.5) followed by PP35 (majority ranged from 0.5 - 1). PP40 and Dusa were more heat sensitive. All PP35 exhibited heavy blooming followed by PP45 and PP40. Dusa exhibited heavy flush but less blooming. All rootstocks exhibited similar salt damage.

Ventura plot 1 (Petty Ranch LP_Chris Sayer): Trees were planted at a 15' x 20' tree spacing at this location and trees exhibited similar size at the time of planting. A subset of 30 trees per rootstock were selected, labelled, and used to collect data. These trees will be utilized as reference data trees for the duration of the project. Highest mortality was found in PP45, followed by PP40 (2) and Dusa (1). The trees evaluated were tagged as need it and the wooden sticks were spray painted for easy identification of the blocks and trees. Dusa, PP35, and PP40 trees exhibited heavy flush. PP45 is the rootstock with less new vegetative tissue. Blooming is consistently better in PP35. No fruit set has been observed yet in this location.
Dusa, PP40, and PP35 are the best performers at this location (PP40 exhibited better flush than Dusa and PP35 better blooming than Dusa). PP45 is the worse rootstock at this location.

Ventura plot 2 (Aline Ranch_ Rick & CJ Shade): A subset of 30 trees per rootstock were selected, labelled, and used to collect data. These trees will be utilized as reference data trees for the duration of the project. We did not paint the wooden sticks and mark the blocks because the manager could not meet with us and we could not get his approval to paint the sticks and color code the rootstocks. Approximately, 15% of Dusa trees died but none of the trees corresponding to the UCR rootstocks died at this location. All rootstocks at this location were blooming and flushing in April. In April 2021, PP80 and PP45 have heavy flushing (majority ranged from 4.5 - 5), followed by PP42, PP40, and PP35. Dusa was the only rootstock with less flushing scores (majority ranged from 0-3). In October 2021, PP45, PP40 and PP42 has the heaviest flushing. All rootstock consistently received similar ratings for salt damage (no much salt damage) in all the evaluations. Dusa was the least performer at this location for overall health, heat damage, and fruit set. PP35, PP40, PP45, and PP42 UCR rootstocks are the best performers in this location in terms of heat resistance and overall health followed by PP80 and Dusa. All rootstocks at this location start setting some fruits (mostly less than 10 fruits). The majority of PP45 evaluated actually are setting fruits and exhibited higher scores (<30) while others less than 10 fruits per tree. Dusa trees exhibited less fruit set at this location with only two trees bearing less than 10 fruits.

Santa Barbara plot (Pete Miller): Trees were planted at a 15' x 15' tree spacing and trees exhibited similar size at the time of planting. Trees were planted in 5 sections in this ranch having

different soil characteristics. All sections with the exception of section 3 have from 40-90% Phytophthora root rot (PRR) incidence. Sections 1 and 2 in addition to high PRR incidence exhibited high soil salinity, high chloride levels and high saturation (heavy soils). A subset of 10 trees per rootstock in each section were selected and labeled to collect data. These trees will be utilized as reference data trees for the duration of the project. Tree height and canopy size were recorded. In addition, we scored for: tree health, salt and heat damage, flush, blooming, and fruit set. The trees evaluated were tagged as need it and the wooden sticks were spray painted for easy identification of the blocks and trees.

A. **Section C (S1): 60% of PRR incidence.** Chloride is not a problem yet but it is on the high side (eventually will became a problem), high soil salinity (2.71 dS/m), has 99% of saturation, high CEC. Dusa, PP35, PP40, PP80, and PP45 were planted in this section. All rootstocks at this location were flushing in April and October 2021. PP35 and PP80 exhibited the best flushing at this section followed by PP40, PP45, and Dusa. In October 2021, only PP80 trees has <10 fruits/tree in this section. Dusa and PP35 are the rootstocks with the best overall health and salt damage scores followed by PP80 and PP40. As expected, PP45 trees have the worse scores for salt damage.

B. **Section A (S2): 40% of PRR incidence.** Soil analyses indicate high chloride levels, high soil salinity (3.65 dS/m), and high % of saturation (66.5%), clay soil. Dusa, PP35, PP40, PP80, and PP45 were planted in this section. All rootstocks at this location were flushing in April and October 2021. PP35 exhibited the best flushing scores at all the evaluations conducted compared with other rootstocks. In April 2021, all Dusa, PP35, and PP40 trees were blooming, however, PP45 and PP80 have trees with no blooming. All rootstocks have similar overall health and heat damage ratings. Dusa and PP35 are the rootstocks with the best salinity damage scores and PP45 as expected exhibited the worse salinity damage scores in this section. In April 2021, trees corresponding to Dusa, PP35, PP40, PP80, and PP45 rootstocks after one year of planting have flowered and we anticipated harvesting the first crop from these trees in 2022. In October 2021, some the trees for all rootstocks has <10 fruits/tree. PP35 has more trees bearing fruits than the other rootstocks.

C. **Section B (S3): 0% of PRR incidence.** No problems with salinity or chloride. Low nitrogen, optimum soil saturation. Dusa, PP35, PP40, PP42, and PP45 were planted in this section. All rootstocks at this location were blooming and flushing in April 2021. PP35 was the rootstocks having the best flushing and were blooming heavily. PP45 was the rootstock accession that exhibited less flushing and blooming when compared with the other rootstocks. In October 2021, all rootstocks were flushing but not blooming. PP45 and PP40 exhibited the best flushing scores, followed by Dusa, PP35, and PP42. All rootstocks have similar overall health, heat and salt damage scores in April 2021, however in October 2021, PP45 exhibited the best overall health scores followed by PP35, PP40, PP42, and Dusa. Dusa has the worse heat damage when compared with the other UCR rootstocks. PP42 and PP45 are the rootstocks with less heat damage. In April 2021, after one year of planting, fruit set was observed in 10 – 30% of trees for all rootstocks at this section, however in October 2021, only fruit was observed in PP35 and PP40 (bear <10 fruits/tree).

D. **Section 4: 90% of PRR incidence.** No problems with salinity or chloride. Optimum soil saturation and pH. Dusa, PP35, PP40, PP42, and PP45 were planted in this section. Majority of trees rated for each rootstock at this location were blooming and flushing in April 2021. Dusa and PP45 exhibited lower flushing scores compared with the other rootstocks at this

section. In October 2021, all rootstocks have similar flushing scores and were not blooming. In April 2021, PP40 and PP42 exhibited the best scores for overall tree health. PP40 seems to be the best performer at this section of the field. All rootstocks had similar ratings for heat and salt damage. In October 2021, PP40 was the best rootstock in this section for overall health, salinity, and heat, followed by PP35, Dusa, and PP45. After one year of planting, in April 2021, fruit set was observed for the majority of trees rated for all rootstocks at this section, however in October 2021, only few trees were bearing <10 fruits.

E. **Section 5: 50% of PRR incidence.** No problems with salinity or chloride. Optimum soil saturation and pH. Dusa, PP35, PP40, PP42, and PP45 were planted in this section. Majority of trees rated for each rootstock at this location were blooming (April 2021) and flushing (April and October 2021). PP35 and PP45 exhibited the best scores for flushing followed by PP42, Dusa, and PP40. PP45 is the overall best performer at this location, followed by PP35, Dusa, PP40, and PP42. After one year of planting, in April 2021, fruit set was observed for the majority of trees rated for all rootstocks at this section, however in October 2021 only a few trees of the UCR rootstocks evaluated hold <10 fruits/tree. No trees from Dusa trees have fruits.

San Luis Obispo Plot (Dr. Lauren Garner): In March 2021, soil samples and *Phytophthora cinnamomi* samples were collected as per the UC Riverside protocols and sent to the UCR pathology laboratory. *Phytophthora cinnamomi* was not detected, but new analyses will be conducted. All trees were assessed and evaluated for height (ft), above-graft trunk diameter (mm), and below-graft trunk diameter (mm), in addition to rating salinity damage, heat damage, vegetative flush and bloom on a scale of 0-5 on March 2021, July 2021 and October 2021. Data analyses have been conducted on the August 2020 and March 2021 data sets. Post-hoc comparison using the Tukey HSD test, indicated that trees on 'PP40' rootstock were significantly taller (M=3.94 ft; SD=0.35) than trees on 'PP35' (M=3.71ft; SD=0.35) or 'Dusa' (M=3.51; SD=0.39). Additionally, trees grafted on 'PP45' rootstock appear to have the highest rate of growth **(Figure 1.).** Trees on 'PP45' rootstock had significantly greater trunk diameters than those on other treatments, for both above and below the graft union diameters, with mean diameters of 29.11 mm (SD=4.05) and 39.10 mm (SD=4.35), respectively.

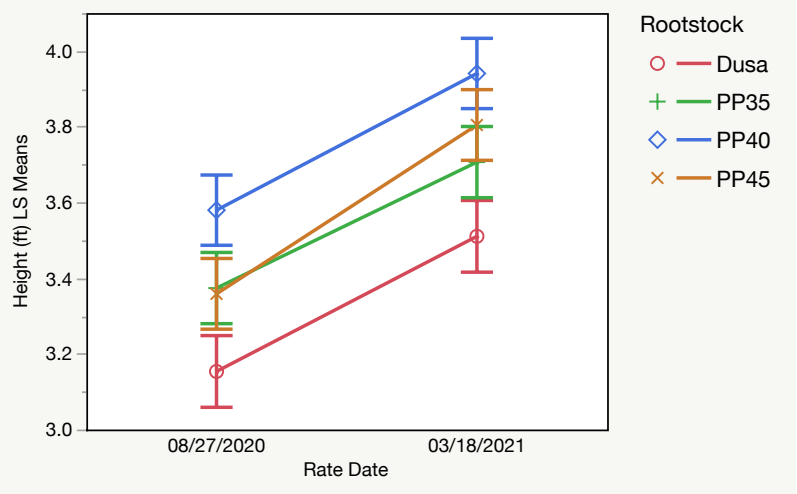


Figure 1. Least squares mean of height (ft) of four avocado rootstocks ('Dusa', 'PP35', 'PP40', 'PP45') collected 2 (8/27/2020) and 7 (3/18/2021) months after transplant at the research plot in San Luis Obispo, CA. Bars represent confidence limits; n=10.

Section 2: Collection of tree health and harvest data for PP35, PP40, PP42, PP45, and PP80 UCR advanced rootstocks at Pine Tree and Bonsall rootstock trials (established June 2017). Two trials were established in June 2017 that consist of 30 rootstocks all grafted to Hass. The rootstocks are a mix of commercially available material (Dusa®, Toro Canyon, Steddom, Uzi and Zentmyer), UCR rootstocks (PP and GD series), selections from South Africa (Westfalia program), and other international material. There are 10 replications of each rootstock at each site and the trees are planted in a randomized block design. The 2 sites for the trials vary in their general characteristics. The southern site is located near Bonsall, CA in San Diego County. The soil at this site is a deep loam with mostly good drainage. The site has both saline irrigation water and moderate to high levels of *P. cinnamomi*. The grower is organic and applied coarse compost to the site at the time of planting. The trees are planted at a 10 ft. x 10 ft. spacing. The northern site is located near Santa Paula, CA in Ventura County. The site is characterized as a rocky, alluvial riverbed. Originally, it was planned that the site would be irrigated with a blend of district and well water (poor quality) but since planting, the trees have only been irrigated with district water. Although *P. cinnamomi* was isolated from the site, it was found to be at generally low levels. The trees are planted in a 15 ft x 15ft. spacing and were mulched in Fall 2018 about 14 months after planting. At the Ventura site, the trees were planted on low berms (about 18 inches in height).

Summary of Bonsall and Santa Paula Rootstock Trials (August 9, 2021)

Bonsall Site. The Bonsall site had harvestable yield in 2019 and an increase in yield in both 2020 and 2021. In 2019, 18 out of the 30 rootstocks had fruit on a portion of the trees. Average yield for those trees ranged from 1.4 kg per tree for AB20 to 0.07 kg/tree for GD4. From a statistical perspective AB20 had the highest amount of fruit, followed by several rootstocks (Toro Canyon, Uzi, ZERALA™, PP51, GD10, R106, RO.15, RO.18 and AB22) which were statistically intermediate. The remaining rootstocks had significantly lower yield from AB20 and yield ranged within this group from a high of 0.13 kg/tree (GD11) to 0.00 kg/tree (LEOLA™, Zentmyer, PP40, PP42, PP45, PP80, GD5, GD6, GD19, GD20 and RO.17). Yield based on fruit count was similar in results. In 2020 yield increased both from a fruit weight and fruit count perspective. Seventeen of the 30 rootstocks had fruit on at least 1 of the surviving trees. Yield ranged from a high of 16.9 kg/tree (AB22) to a low of 0.0 kg/tree (LEOLA™, Uzi, Zentmyer, PP40, PP45, PP50, PP51, PP80, GD3, GD4, GD5, GD6, GD10). AB22's yield was significantly higher than all other rootstocks. AB20 followed and was also statistically higher than the others. R106 and RO.15 were intermediate between the 2 highest yielding rootstocks and the lowest yielding trees. Fruit count results were similar.

In 2021, most of the rootstocks had fruit on the surviving trees. Steddom, PP45, PP52, GD6 and RO.17 were the exceptions having no fruit on any of the trees. Yield ranged from 11.6 kg/tree (R106) to 0.0 kg/tree. R106's yield was significantly higher than all other rootstocks. Following R106, and statistically higher than the lowest yielding trees was AB22 (8.3 kg/tree). This rootstock was not significantly different from Dusa, Topara, Toro Canyon, Uzi, ZERALA™, PP35, PP40, PP50, PP51, GD3, GD4, GD10, GD11, GD20, R).15, RO.18 and AB20. These latter rootstocks were not statistically different from the lowest performing rootstocks. In terms of cumulative yield based on either fruit weight or count, AB22 has thus far had significantly more fruit harvested compared to all rootstocks with a total of 26.1 kg/tree. R106 is the second most productive (16.3 kg/tree) and differs significantly from the remaining rootstocks. The remaining rootstocks range in cumulative yield from 8.6 kg/tree (AB20) to a low of 0.0 kg/tree (PP45, GD6). The cumulative yield data based on fruit count per tree is similar.

Average fruit size has decreased since 2019 when fruit size averaged 316 g/fruit to 242 g/fruit in 2021. There are no statistical differences in average fruit size due to rootstock with the exception of the Uzi rootstock which has had very few large fruits and an average fruit size of 745 g.

Santa Paula Site. No fruit could be found to harvest at the Santa Paula site in 2019 and yield was low in 2020 but higher than the Bonsall site in 2021, probably due to better overall tree health. In 2020, 18 of the 30 rootstocks bore fruit on the surviving trees. Yield ranged from a high of 2.8 kg/tree (GD19) to a low of 0.0 kg/tree (Dusa, LEOLA™, Toro Canyon, Zentmyer, ZERALA™, PP42, PP52, GD5, GD6, GD20, RO.17, RO.18). The following rootstocks had the highest yield and were not statistically different from each other; they are listed in descending order in terms of yield, GD19, AB20 and PP80. Yield data based on fruit count followed a similar pattern. In 2021, all rootstocks had at least a third of the trees bearing fruit. Statistically significant differences exist between the rootstocks in terms of both kg/tree and fruit count/tree although the trends are similar. AB20 had the highest yield (13.8 kg/tree) and differed statistically from LEOLA™, ZERALA™, PP40, PP42, PP51, PP80, and GD3. Toro Canyon had the second highest yield and differed significantly from LEOLA™ and PP80. All other rootstocks did not differ significantly from each other. For a 2-year cumulative yield perspective, AB20 is the highest yielding rootstock (9.9 kg/tree) and it is significantly higher in total yield to all rootstocks with the exception of Topara, Toro Canyon, GD11, RO.15 and AB22. Toro Canyon's cumulative yield is higher than LEOLA™ but not from any of the other rootstocks. Average fruit size for the two years ranges from a high of 342 g/fruit for GD5 to a low of 257 g/fruit for PP50. Fruit for Steddom, PP80, GD5, GD6, GD10 differ in average fruit size from PP50 with all others intermediate in size.

Section 3: Data collection on the two large-scale field trials of PP35 and PP40 UCR advanced rootstocks established in Summer 2019. In Summer 2019, two semi-commercial field trials of PP35 and PP40 UCR advanced rootstocks were established in Temecula (Riverside county) and Camarillo (Ventura county). Water and soil samples were collected and used for field characterization.

Rootstock trial at Temecula: A total of 102 PP35 and 75 PP40 trees grafted to 'Hass' were planted on June 14, 2019 with the collaboration of Leo McGuire. Trees are planted into the top of mounds at a 15 ft x 20 ft spacing. Water analyses showed an EC value of 0.86 dS/m and 102 mg/L of chloride, indicating a possible problem with chloride toxicity. In addition, water analyses showed moderate problems with high pH (7.9) and alkalinity (as $CaCO_3$). Soils samples were positive for *Phytophthora cinnamomi*. In 2021, an extension of this field was done by planted a total of 100 Dusa, PP80, and PP42 trees grafted to 'Hass'.

Tree performance at Temecula: Thirteen PP40 (17% tree mortality) and 10 PP35 (9.8% trees mortality) trees died and were replaced with extra trees in July 2020 (trees have been labeled). Trees at this location was rated on April, July, and October 2021. Tree height and canopy size was recorded. In addition, we scored for: tree health, salt and heat damage, flush, blooming, and fruit set. In April 2021, all PP35 and PP40 trees exhibited heavy and nice flush (all trees scored as 5, the best). Bloom was heavy in all PP35 and PP40 trees that did not have fruits. Leo McGuire did the first harvest of this plot on April 21th. There were 6/25 trees that had 4-6 pieces and two of them had 12 large fruits. A total 95 fruits were collected for a total weight of 53.7 pounds (lbs) for PP35 (0.56 lb/PP35 fruit). There were 4/21 PP40 trees that had from 1 to 4 pieces per tree. A total of 13 fruits were collected from PP40 producing a total weight of 7.1 lbs (0.54 lbs/PP40 fruit). Overall trees looked healthy with most of the PP35 and PP40 trees having tree health

scores ranging from 0 - 0.5 (0 = best and 5 = dead). At this location, PP40 exhibited more heat damage than PP35. PP35 and PP40 at this location exhibited similar performance regarding salt damage. In October 2021, PP35 and PP40 exhibited both similar height and overall health (0.5), salinity (1) and heat damage scores (<0.5). This time 100% of PP40 trees were loaded with fruits (>30 fruits/tree) when compared with PP35 most of the trees evaluated have <30 fruits/tree. Leo will be conducting the harvest on PP35 and PP40 on February 2022. A subset of 30 trees of the newly planted Dusa, PP42, and PP80 has been scored as baseline for this field extension at this orchard.

Rootstock trial at Camarillo: A total of 100 PP35 and 51 PP40 trees grafted to 'Hass' were planted in Camarillo on August 7th, 2019. Trees are planted at a 18 ft x 20 ft spacing. Water analyses from this field showed an EC value of 1.16 dS/m, high level of chloride 148 mg/L, high pH (8.7) and alkalinity (as $CaCO_3$). None of the soil samples collected from this field were positive for the presence of *Phytophthora cinnamomi*, the causal agent of phytophthora root rot (PRR), using different diagnostic methods including traditional isolation, TaqMan qPCR, and Recombinase Polymerase Amplification (RPA) using a Phytophthora specific probe. In 2021, an extension of this field was done by planted a total of 100 Dusa, PP80, and PP42 trees grafted to 'Hass'.

Tree performance at Camarillo: At this plot, 26 PP40 and 31 PP35 trees have died due to deer damage. These trees have been replaced in June 2020 and the plot map updated. PP35 trees at this location are taller than PP40 trees. In May 2021, tree height and canopy size were recorded. In addition, we scored for: tree health, salt and heat damage, flush, blooming, and fruit set. Data is being analyzed. Overall health ratings of the majority of the PP35 and PP40 trees at this location ranged between 1 to 2. Trees exhibited similar heat damage. However, at this location, PP40 exhibited less salt damage, but we need to run statistical analysis with all the data collected. All PP35 and PP40 trees exhibited heavy and nice flush (majority of trees scored as 5, the best). Blooming was observed in the majority of PP35 and PP40 trees. The majority of the PP35 and PP40 trees just started to set fruits for next year which will be the first 2022 harvest. On contrary of the two years-old PP35 and PP40 rootstocks planted in Temecula, the same age trees for the same rootstocks did not produce 2021 harvest at this field in Camarillo.The new ratings are scheduled for November 10 (2021).

Section 4. Collection of tree health and harvest data for PP35, PP40, PP42, PP45, and PP80 UCR advanced rootstocks at four previously established field trials. Two rootstocks trials were previously established in Temecula (Riverside county) and two in Santa Paula (Ventura county). Table 3 presents the field conditions at each plot. Trees at these field sites were rated using a scoring system from 0 to 5, 0 being the best for tree health, salinity, and heat. Tree mortality were also recorded. Jim Brown 2 and the 2 plots at Limoneria will be rated this month (November 2020). ***Note: at all these sites harvest was previously scheduled for April-May, 2020. The occurrence of COVID-19 required rescheduling the harvest for both sites, however fruit drop occurred at both sites so we could not get yield data this year.***

Table 2. Previously established rootstock trials and field conditions.

Grower/Ranch	City	Year	Rootstocks (#s)	Conditions
Jim Brown #1	Temecula	2012	CTP, NTP, Dusa, Thomas, PP35, PP40, PP42, PP45, PP80, VC804	High PRR incidence, high pH and alkalinity due to high levels of $CaCO_3$
Jim Brown #2	Temecula	2013	Dusa, Thomas, PP40, PP70, PP71, PP80, PP83, PP84, PP86, PP88	High PRR incidence, high pH and alkalinity due to high levels of $CaCO_3$
Gunderson	Santa Paula	2006	Dusa, Thomas, SA-1, PP18, PP21, PP22, PP40, PP42, PP45, PP56, PP58, PP63	High PRR incidence, high pH and alkalinity due to high levels of $CaCO_3$, and possible problems with salinity (EC, 1.44 dS/m)
Limoneria 2	Santa Paula	2011	Dusa, PP25, PP26, PP35, PP45, PP48	High salinity and alkalinity levels.

Tree health and mortality

Jim Brown 1: There is a high tree mortality in this plot (>50% for 50% of the rootstocks). PP80 is the best rootstocks regarding tree health, salinity, heat, and less tree mortality. Dusa, PP42, PP35, and PP45 perform similar and have less 50% mortality in this field. The worst rootstocks in terms of tree health and mortality are the Chilean rootstocks NTP and CTP (100 % mortality) followed by Thomas and PP40 (~70% mortality). We visited this plot in April 21 (2021) and after assessing this plot we decided to drop this plot due to the high tree mortality.

Limoneira Plots. The previous manager Andy Coker is no longer working at Limoneira. We have been communicating and working with the new managers: Mr. Edgar Gutierrez (Vice President of Farming Operations) and Mr. Vince Giacolone (Director of Southern Management Operations).

Limoneira 2: Ratings at this site were conducted December 3rd 2020, April and October 2021. No tree mortality was recorded at this site during the evaluation dates. On December 2020, trees for all rootstocks were not flushing and blooming. Overall tree health, salt and heat damage scores were mostly 0. All trees for each rootstock flowered and exhibited from low (< 20 fruits), medium (> 50), and heavy (> 50) fruit set for the 2021 harvest. On April 2021, most of the trees were flushing and all trees were blooming and retained most of the fruits that were harvested on May 2021. PP48 and PP35 has the lowest scores for salt damage compared with other rootstocks. PP45 has the best flushing and heat damage scores at this site. PP45 and PP26 trees showed the best overall health scores. We harvested this plot on May 2021. Over 1000 lbs. were obtained from Dusa and PP45, which were the best producers compared with the other rootstocks. The second-best rootstock was PP25. PP35 was among the less producers in this plot. All rootstock exhibited similar values regarding average weight per fruit. Dusa, PP25, PP45 and PP48 shown similar average number of fruits per tree (100-136). In October 2021, all rootstocks were flushing but no blooming. PP35 exhibited the best flushing. Dusa, PP35, and PP45 are the best performers in this plot. Fruit set for harvest in 2022 suggest that PP45, PP35, Dusa, and PP26 will be the best producers in 2022 since the majority of trees were loaded with >30 fruits/tree.

Gunderson: Ratings at this site were conducted on April 30th 2021. New tree mortality was observed for Thomas (1), PP22 (1), PP63 (1), and SA-1 (1). All rootstocks were flushing and blooming. SA-1 and Thomas were the rootstocks with less flushing. In April 2021, ratings at this

site indicates PP18, PP21, PP40, PP42, and PP45 showed the best tree health and heat scores and less tree mortality when compared to Dusa® (37%) and other rootstocks. Thomas, SA-1, KB1, and Zutano seedlings were the poorest performing rootstocks at this site. Fruit set was assessed and PP18, PP21, PP40, PP42, and PP45 have good fruit set with fruits >30 fruits per tree. Thomas, PP58, SA-1, KB-1, and Zutano seedlings did not have good fruit set scores. We harvested this plot on May 2021. Note that fruits in this plot have been dropped because of the wind before harvest. As expected, and in agreement with our fruit setting scores, PP18, PP21, PP40, PP42, and PP45 were the best producers in this plot. PP42 was the best performer regarding total fruits and pounds harvest as well as more fruits per tree. On the other hand, Thomas, PP58, SA-1, KB-1, and Zutano seedlings were the rootstocks with less yield and fruit numbers. In October 2021, all rootstocks were flushing but no blooming. PP45 and PP42 have the best flushing scores. PP21, PP40, PP42, and PP45 showed the best tree health and heat scores and less tree mortality when compared to Dusa® (37%) and other rootstocks. Fruit set for harvest in 2022 suggest that Dusa, PP18, PP21, PP40, PP42, and PP45 will continue to be the best producers since the majority of trees were loaded with >30 fruits/tree.

Title: Commercial-scale field testing and potential release of elite advanced rootstocks

PI: Patricia Manosalva
Co-PIs: Mary Lu Arpaia, Lauren C. Garner, and Peggy Mauk

Data collection in this report was collected by:

- *Manosalva lab personnel*: Amber Newsome (Jr. Specialist), Matthew Elvena (Jr. Specialist), Aidan Shands (Ph.D. student), Ben Hoyt (Ph.D. student), Patricia Manosalva, and grower cooperators. Amber Newsome conducted the data analysis for this report.
- *Garner lab*: Dr. Garner and Rashaan Souikane (data collection and data analysis).

Overall Goal: The overall goal for this proposal is to collect field data of the small regional active rootstock trials and the commercial-scale rootstock trials established in 2019 and 2020 in California.

Period Nov 1st 2021 to January 31th 2022:
Prepared by Dr. Patricia Manosalva, Dr. Mary Lu Arpaia, Dr. Lauren C. Garner, and Rashaan Souikane

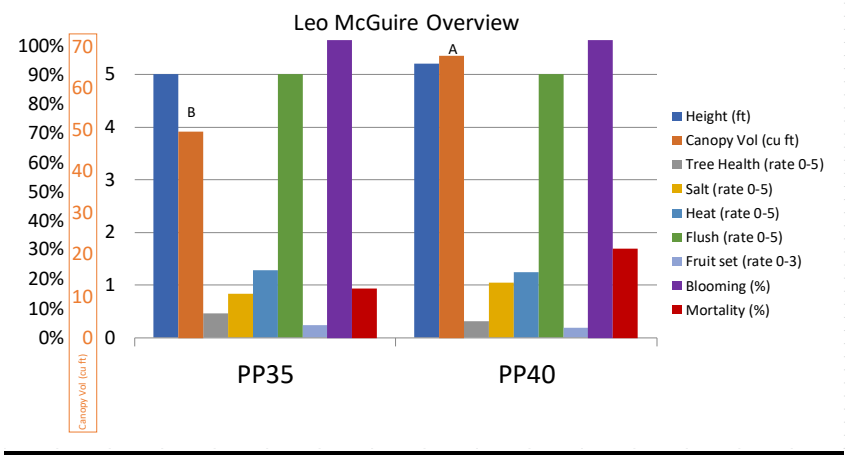
Milestones proposed:

- Collect tree health data at Camarillo and Temecula sites established in 2019.
- Collect tree health data at five sites established in 2020.
- Collect tree health data at Pine Tree Ranch and Bonsall rootstock trials.

A. Collect tree health data at Temecula and Camarillo sites established in 2019.

Leo McGuire plot (Temecula). Non-significant differences were found between PP35 and PP40 at this location regarding tree height, tree health, salt and heat damage (**Fig. 1**). However, PP35 exhibited significant less canopy size when compared to PP40. All PP35 and PP40 trees exhibited heavy flush (no significant differences found). Bloom was heavy in all PP35 and PP40 (no significant differences). At this location, PP40 exhibited more mortality (30%) than PP35 (17%).

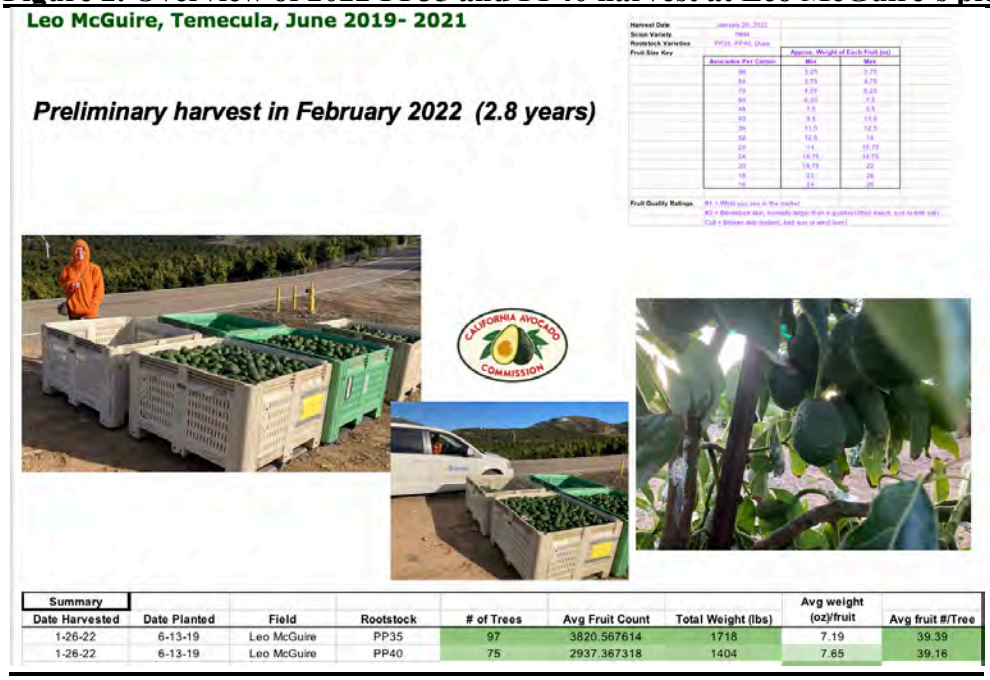
Figure 1. Overview of ratings in Leo McGuire plot



- Harvest was conducted in this plot on January 26 (2022) and crop was sent it to packing house by Leo who provide the data presented in this report. Amber Newsome from the Manosalva lab supervised the harvest at this plot. Trees in this plot were planted in June 2019. From 95 trees of PP35 trees grafted with

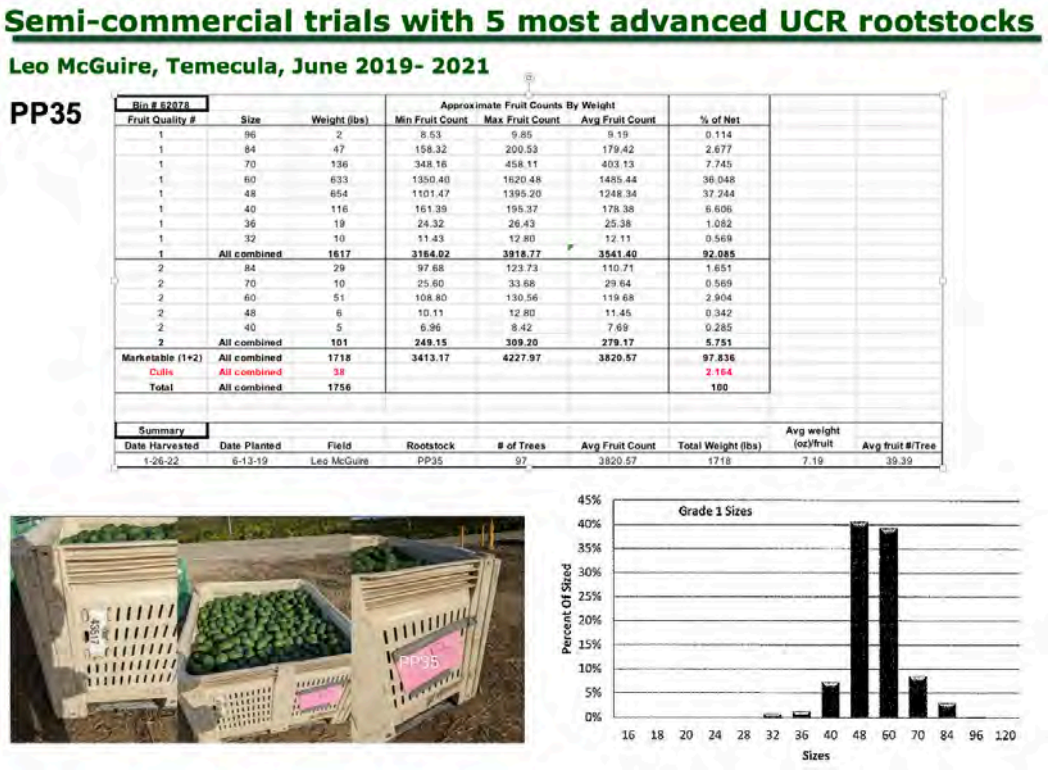
'Hass' we obtained 3820.57 average fruit count and a total of 1,718 lbs (marketable fruit) from a total 1756 lbs. including culls. The average fruit number per tree was 39.39 and the average weight (oz)/fruits was 7.19 oz. Majority of the crop for PP35 was marketable sizes: 37.24% (48) and 36.05% (60) **(Fig.2 and 3).**

Figure 2. Overview of 2022 PP35 and PP40 harvest at Leo McGuire's plot



Summary								
Date Harvested	Date Planted	Field	Rootstock	# of Trees	Avg Fruit Count	Total Weight (lbs)	Avg weight (oz)/fruit	Avg fruit #/Tree
1-26-22	6-13-19	Leo McGuire	PP35	97	3820.567614	1718	7.19	39.39
1-26-22	6-13-19	Leo McGuire	PP40	75	2937.367318	1404	7.65	39.16

Figure 3. Overview of 2022 PP35 harvest at Leo McGuire's plot



- From 75 trees of PP40 trees grafted with 'Hass' we obtained 2937.37 average fruit count and a total of 1,404 lbs (marketable fruit) from a total 1449 lbs. including culls. The average fruit number per tree was 39.16 and the average weight (oz)/fruits was 7.65 oz. Majority of the crop for PP40 was marketable sizes: 50.7% (48) and 23.9% (60).

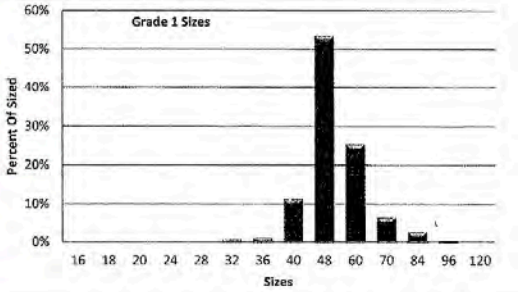
Figure 4. Overview of 2022 PP40 harvest at Leo McGuire's plot

Leo McGuire, Temecula, June 2019- 2021

PP40

Bin # 62078			Approximate Fruit Counts By Weight			
Fruit Quality #	Size	Weight (lbs)	Min Fruit Count	Max Fruit Count	Avg Fruit Count	% of Net
1	96	2	8.53	9.85	9.19	0.138
1	84	34	114.53	145.07	129.80	2.346
1	70	87	222.72	293.05	257.89	6.004
1	60	347	740.27	888.32	814.29	23.948
1	48	734	1236.21	1565.87	1401.04	50.656
1	40	154	214.26	259.37	236.81	10.628
1	36	13	16.64	18.09	17.36	0.897
1	32	7	8.00	8.96	8.48	0.483
1	**All combined**	**1378**	**2561.16**	**3188.57**	**2874.86**	**95.1**
2	84	5	16.84	21.33	19.09	0.345
2	60	11	23.47	28.16	25.81	0.759
2	48	6	10.11	12.80	11.45	0.414
2	40	4	5.57	6.74	6.15	0.276
2	**All combined**		**55.98**	**69.03**	**62.50**	**1.794**
Marketable (1+2)	**All combined**	**1404**	**2617.14**	**3257.60**	**2937.37**	**96.894**
Culls	All combined	45				3.106
Total	All combined	1449				100

Summary							Avg weight	
Date Harvested	Date Planted	Field	Rootstock	# of Trees	Avg Fruit Count	Total Weight (lbs)	(oz)/fruit	Avg fruit #/Tree
1-26-22	6-13-19	Leo McGuire	PP40	75	2937.37	1404	7.65	39.16



John Lamb plot (Camarillo). No significant differences were found between PP35 and PP40 at this location for most of the phenotypic traits recorded with the exception of tree health. At this location, PP35 trees exhibited better tree health than PP40. All trees were heavily flushing and blooming with 95% (PP35) – 100% (PP40) trees bearing fruits at this location. We will schedule harvest at this plot for April/May 2022

B. Data collections of the five commercial-scale fields established in 2020

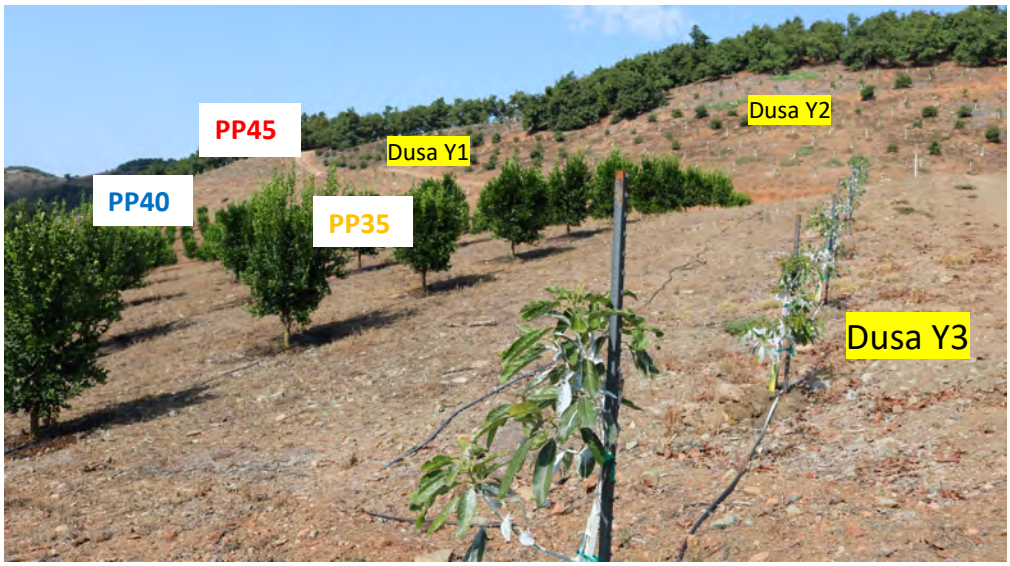
Table 1. Plots established in 2020:

Grower/Manager	City	Year	Rootstocks (#s)	Conditions
Aline Ranch/Rick and CJ Shade	Ventura	June 25 & 26, 2020	Dusa (61), PP35 (116), PP40 (100), PP45 (100), PP42 (28), PP80 (39)	High PRR (replanting)
Andrew Gabryszak and Nick Lahr	Temecula	June 18 2020	Dusa (100), PP35 (116), PP40 (100), PP45 (70)	High PRR, high chloride levels, high pH
Pete Miller	Goleta/ Santa Barbara	June 26, 2020	Dusa (100), PP35 (116), PP40 (100), PP45 (100), PP42 (28), PP80 (39)	Optimal (1/5 section), High PRR, high chloride, high EC, clay soils (problems with soil saturation)
Chris Sayer	Ventura	June 16, 2020	Dusa (100), PP35 (116) , PP40 (100), PP45 (100)	High salinity in the water (EC). Possible problem with limestone. PRR was not detected using direct isolation methods.
Dr. Lauren Garner Cal Poly SLO	San Luis Obispo	June 23 & 24, 2020	Dusa (96), PP35 (96), PP40 (97), PP45 (95)	No major problems in soil analyses. Water with high pH, alkalinity due to $CaCO_3$. PRR analyses is pending in soil

1. Newhouse Green Gold Galen Newhouse
38655 Sky Canyon Dr. Murrieta, CA (Temecula).
Managers: Andrew Gabryszak and Nick Lahr (West Pak Avocado)

- At this location we did not found significant differences among the rootstocks regarding tree health, heat damage, flush, and blooming scores. At this plot, Dusa exhibited the highest mortality (>80%). Majority of trees in the areas Dusa Y1 and Dusa Y2 indicated in Figure 5 died.

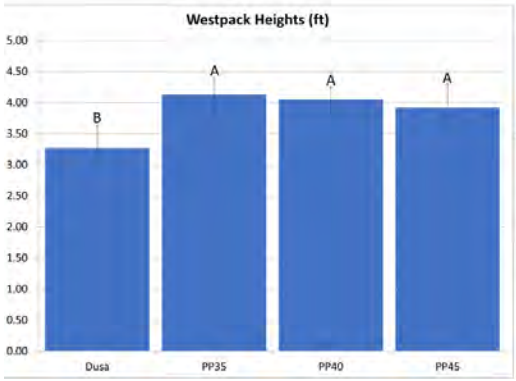
Figure 5. Layout of this plot at Temecula



- We believe that the combination of high temperatures in July 2020, the soil structure (clay), and Phytophthora root rot (high incidence) was probably the cause of high Dusa tree mortality. Dusa exhibited less tree height compared with other rootstocks scored (n=22, only alive trees, **Fig. 6**). At this plots, Dusa

and PP40 rootstocks exhibited less salt damage and the best flush scores compared with PP45 and PP40 (**Fig. 7 and 8**). PP35 and PP45 exhibited heavy blooming compared with other rootstocks.

Figure 6. Tree height (ft)

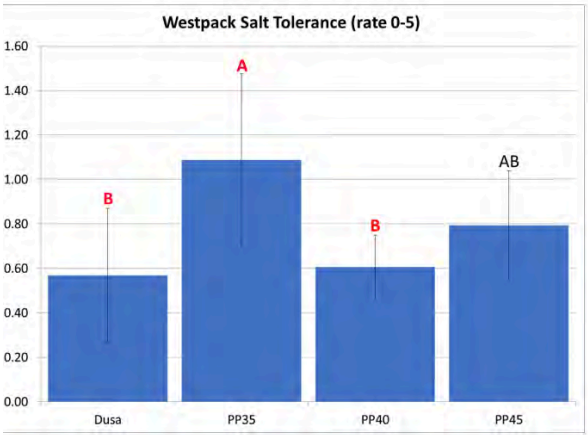


Rootstock	Height (ft)
Dusa	3.27
PP35	4.13
PP40	4.05
PP45	3.92

Connecting Letters Report

Level		Mean
PP35	A	4.1304348
PP40	A	4.0479310
PP45	A	3.9206897
Dusa	B	3.2677273

Figure 7. Salt damage score (0 – 5 dead)

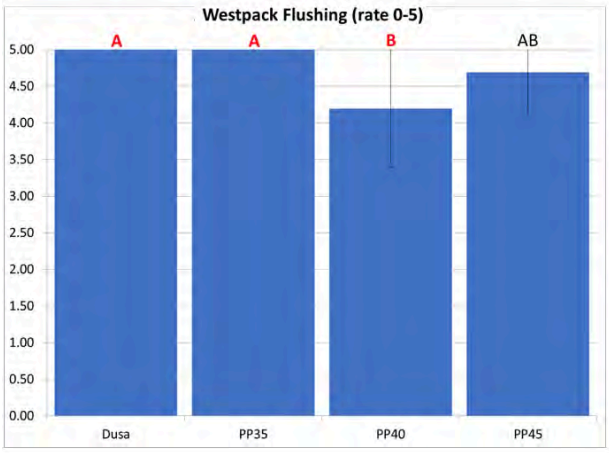


Rootstock	Salt
Dusa	0.57
PP35	1.09
PP40	0.61
PP45	0.79

Connecting Letters Report

Level		Mean
PP35	A	1.0869565
PP45	A B	0.7931034
PP40	B	0.6071429
Dusa	B	0.5681818

Figure 8. Flush score (0 – 5 best)



Rootstock	flush
Dusa	5.00
PP35	5.00
PP40	4.20
PP45	4.69

Connecting Letters Report

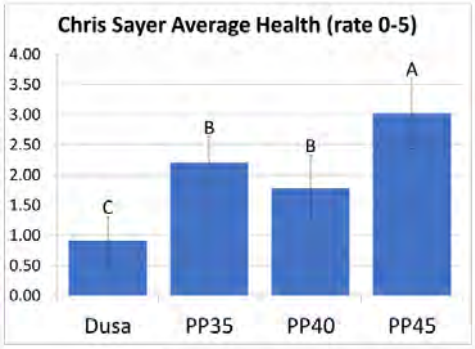
Level		Mean
Dusa	A	5.0000000
PP35	A	5.0000000
PP45	A B	4.6896552
PP40	B	4.1964286

2. Chris Sayer (Ventura)

We did not detect significant differences regarding tree height among all rootstocks tested at this location (**Fig. 9**). However, we found significant differences among rootstocks for tree health, flush, salinity, and heat damage scores. Dusa exhibited the best tree health scores followed by PP35 and PP40 (**Fig. 10**). The salinity damage was low at this plot (<0.9), however Dusa, PP35, PP45 exhibited similar salinity scores. PP40 was the rootstocks with the highest damage for salinity (0.9, **Fig. 11**). More heat damage was observed at this location and similar with tree health scores, Dusa was the best performer followed by PP35 and PP40. PP45 rootstock has more heat damage (**Fig. 12**). Except for PP45 that exhibited less flush scoring, all the other rootstocks exhibited heavy flush at this location (**Fig. 13**). At this location Dusa and PP45 exhibited heavy blooming compared with PP35 and PP40.

Figure 9. Layout of this plot at Temecula

Figure 10. Tree health score (0 – 5 dead)

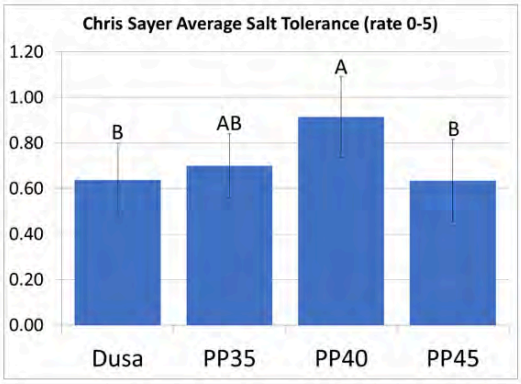


Rootstock	Health
Dusa	0.91
PP35	2.20
PP40	1.78
PP45	3.02

Connecting Letters Report

Level		Mean
PP45	A	3.0192308
PP35	B	2.2000000
PP40	B	1.7758621
Dusa	C	0.9137931

Figure 11. Salt damage score (0 – 5 dead)

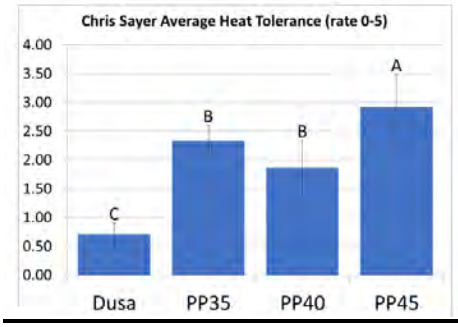


Rootstock	Salt
Dusa	0.64
PP35	0.70
PP40	0.91
PP45	0.63

Connecting Letters Report

Level		Mean
PP40	A	0.91379310
PP35	A B	0.70000000
Dusa	B	0.63793103
PP45	B	0.63461538

Figure 12. Heat damage score (0 – 5 dead)

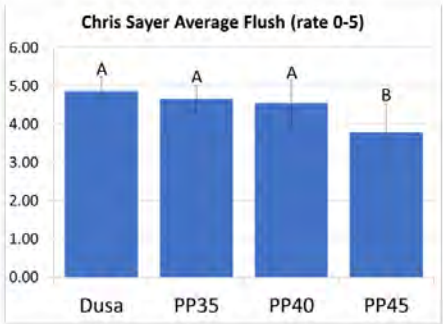


Rootstock	Heat
Dusa	0.71
PP35	2.33
PP40	1.86
PP45	2.92

Connecting Letters Report

Level		Mean
PP45	A	2.9230769
PP35	B	2.3333333
PP40	B	1.8620690
Dusa	C	0.7068966

Figure 13. Flush score (0 – 5 best)



Rootstock	Flush
Dusa	4.86
PP35	4.67
PP40	4.55
PP45	3.78

Connecting Letters Report

Level		Mean
Dusa	A	4.8620690
PP35	A	4.6666667
PP40	A	4.5517241
PP45	B	3.7800000

3. Aline Ranch, Rick Shade (Ventura)

Approximately, 10% of Dusa trees died but none of the trees corresponding to the UCR rootstocks died at this location (**Fig. 14**). There were significant differences among rootstocks for all the data collected at this plot. Dusa exhibited the less tree height followed by PP35, PP80, and PP42. PP40 and PP45 were the tallest trees at this plot (**Fig.15**). This plot has 100% of PRR incidence and the grower has problems for replanting with trees like Dusa. As expected, the best performers at this location are PP42 and PP45 followed by PP80. PP45 and PP45 are highly resistant to *P. cinnamomi,* the causal agent of PRR, when compared with Dusa in our greenhouse screening using several isolates of the pathogens. Dusa, PP35, and PP40 exhibited the same tree health scorings (**Fig. 16**). The salinity damage was low at this plot (< 1) and all rootstocks except for PP45 have similar salt damage (no differences). This is consistent since PP45 is less salinity tolerant than other rootstocks (**Fig. 17**). More heat tolerant rootstocks at this plot are PP42, PP45, and PP80 when compared with Dusa, PP35, and PP40 (**Fig. 18**). All rootstocks at this location were heavily blooming and flushing. PP80 exhibited the best flushing scores followed by PP42, PP45, PP40 and PP35. Dusa exhibited the less flushing at this location (**Fig. 19**).

Figure 14. Layout of this plot at Temecula

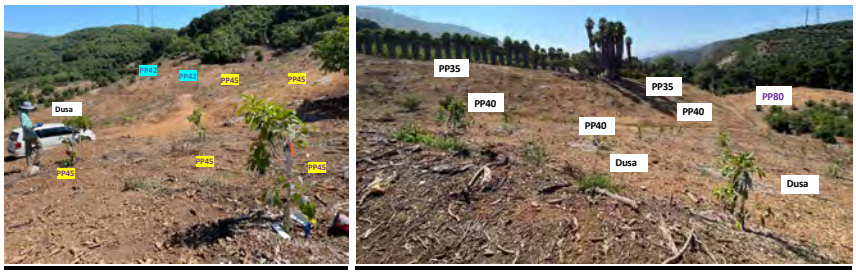
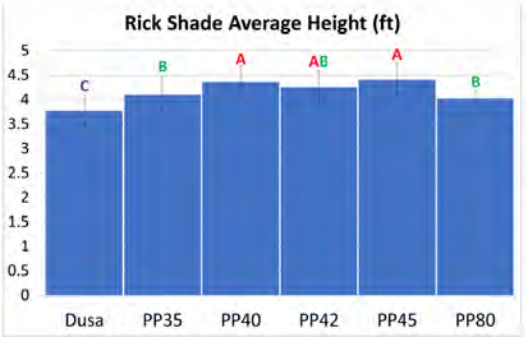


Figure 15. Tree height (ft)

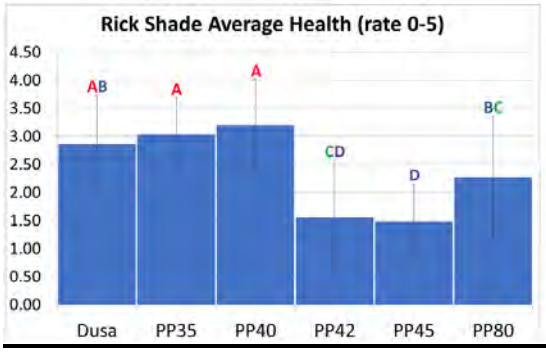


Rootstock	Height (ft)
Dusa	3.77
PP35	4.10
PP40	4.35
PP42	4.25
PP45	4.40
PP80	4.02

Connecting Letters Report

Level		Mean
PP45	A	4.4000000
PP40	A	4.3500000
PP42	A B	4.2500000
PP35	B	4.1000000
PP80	B	4.0166667
Dusa	C	3.7666667

Figure 16. Tree health score (0 – 5 dead)

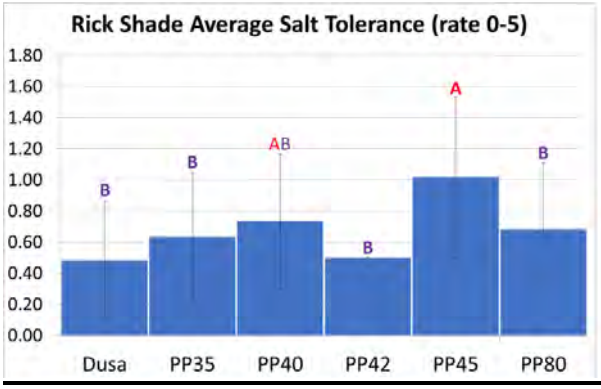


Rootstock	Health
Dusa	2.87
PP35	3.03
PP40	3.20
PP42	1.55
PP45	1.48
PP80	2.27

Connecting Letters Report

Level		Mean
PP40	A	3.2000000
PP35	A	3.0333333
Dusa	A B	2.8666667
PP80	B C	2.2666667
PP42	C D	1.5500000
PP45	D	1.4833333

Figure 17. Salt damage score (0 – 5 dead)

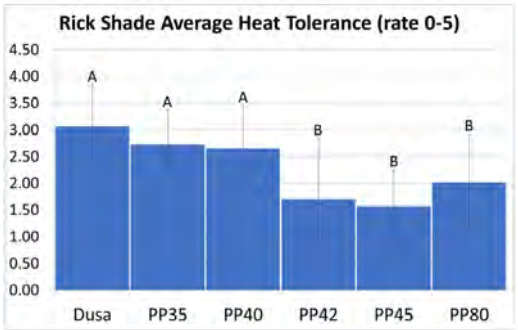


Rootstock	Salt
Dusa	0.48
PP35	0.63
PP40	0.73
PP42	0.50
PP45	1.02
PP80	0.68

Connecting Letters Report

Level		Mean
PP45	A	1.0166667
PP40	A B	0.7333333
PP80	B	0.6833333
PP35	B	0.6333333
PP42	B	0.5000000
Dusa	B	0.4833333

Figure 18. Heat damage score (0 – 5 dead)

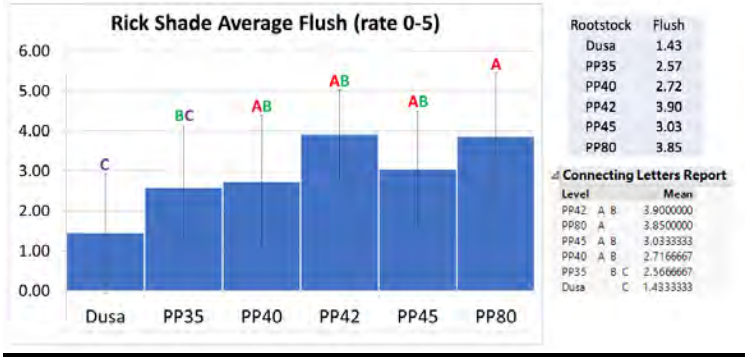


Rootstock	Heat
Dusa	3.07
PP35	2.72
PP40	2.65
PP42	1.70
PP45	1.57
PP80	2.02

Connecting Letters Report

Level		Mean
Dusa	A	3.0666667
PP35	A	2.7166667
PP40	A	2.6500000
PP80	B	2.0166667
PP42	B	1.7000000
PP45	B	1.5666667

Figure 19. Flush score (0 – 5 best)



Rootstock	Flush
Dusa	1.43
PP35	2.57
PP40	2.72
PP42	3.90
PP45	3.03
PP80	3.85

Connecting Letters Report

Level			Mean
PP42	A	B	3.9000000
PP80	A		3.8500000
PP45	A	B	3.0333333
PP40	A	B	2.7166667
PP35		B C	2.5666667
Dusa		C	1.4333333

4. Pete Miller Ranch (Goleta, Santa Barbara)

A. Section C (S1): 60% of PRR incidence. Chloride is not a problem yet but it is on the high side (eventually will became a problem), **high soil salinity (2.71 dS/m)**, has **99% of saturation**, high CEC. Dusa, PP35, PP40, PP80, and PP45 were planted in this section.

B. Section A (S2): **40% of PRR** incidence. Soil analyses indicate **high chloride levels**, high soil **salinity (3.65 dS/m),** and high % of saturation (66.5%), clay soil. Dusa, PP35, PP40, PP80, and PP45 were planted in this section.

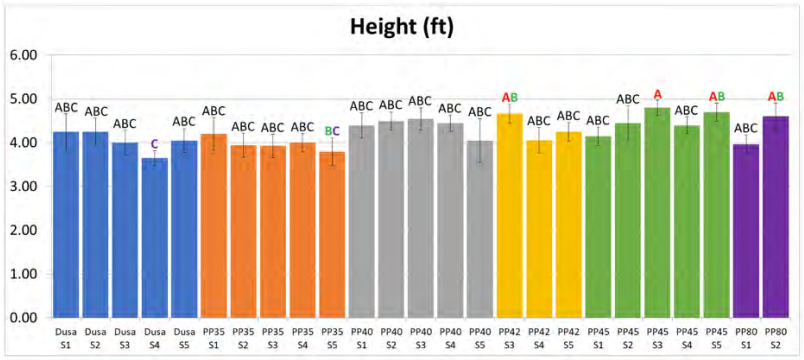
C. Section B (S3): 0% of PRR incidence. No problems with salinity or chloride. Low nitrogen, optimum soil saturation. Dusa, PP35, PP40, PP42, and PP45 were planted in this section.

D. Section 4: 90% of PRR incidence. No problems with salinity or chloride. Optimum soil saturation and pH. Dusa, PP35, PP40, PP42, and PP45 were planted in this section.

E. Section 5: 50% of PRR incidence. No problems with salinity or chloride. Optimum soil saturation and pH. Dusa, PP35, PP40, PP42, and PP45 were planted in this section.

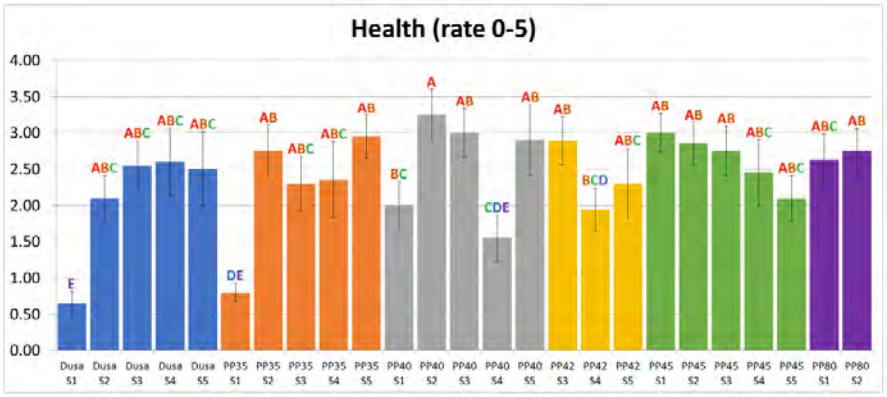
- There were significant differences among rootstocks for all the data collected at this plot among all sections. At this plot, Dusa trees from S4 were significantly different than PP45 and PP42 trees in S3, PP45 trees at S5, and PP80 trees at S2 regarding tree height. PP45 trees from S3 exhibited the highest tree height. With the exception of PP35 trees from S5 and Dusa S4, all rootstocks planted in each section were not significantly different on tree height (**Fig. 20**). Trees from Dusa in S1, PP35 in S1, and PP40 in S4 exhibited the best health scores. All other rootstocks performed similar at each section (**Fig. 21**). In the section 1 (S1), PP45 and Dusa were significant different from each other in terms of salinity damage. As expected, PP45 is more salinity sensitive than Dusa at this section. All the rootstocks perform similar for salt damage in all the sections. In S2 that has similar conditions than S1 but less PRR incidence and soil saturation no significant differences were observed among rootstocks (**Fig. 22**). PP35 trees at S1 was significantly different from PP40 trees at S5 regarding heat damage being PP35 at S1 the best performer. No significant differences were detected for heat tolerance among all the other rootstock accessions planted at all sections in this location (**Fig. 23**). PP35 and Dusa trees in S1 were the best performers. Majority of rootstocks in all the sections exhibited new vegetative growth being PP40 trees in S2 and S3 the trees exhibiting less flush (**Fig. 24**). All trees in all sections were blooming and bearing fruits. All trees in section 1 for all rootstocks evaluated did not have any fruits. We expect the first real harvest of this plot in 2023.

Figure 20. Tree height (ft)



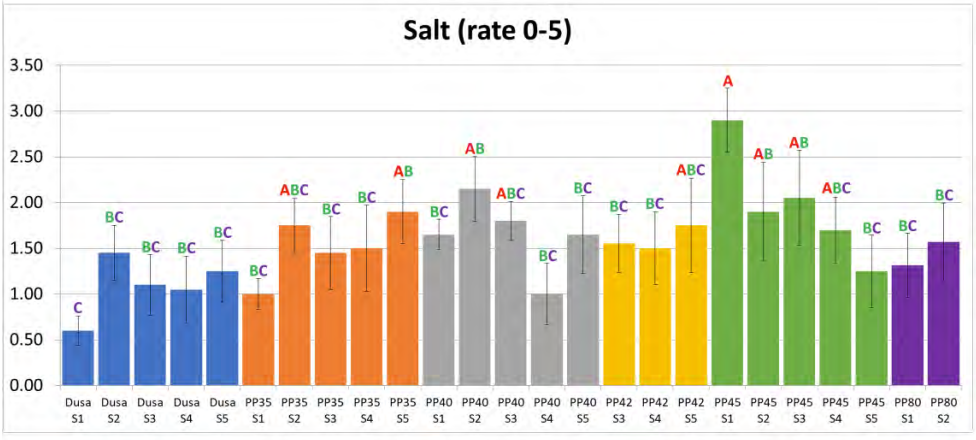
Connecting Letters Report		
Level		Mean
PP45-3	A	4.8000000
PP45-5	A B	4.7000000
PP42-3	A B	4.6666667
PP80-2	A B	4.6071429
PP40-3	A B C	4.5500000
PP40-2	A B C	4.5000000
PP40-4	A B C	4.4500000
PP45-2	A B C	4.4500000
PP40-1	A B C	4.4000000
PP45-4	A B C	4.4000000
Dusa-1	A B C	4.2500000
Dusa-2	A B C	4.2500000
PP42-5	A B C	4.2500000
PP35-1	A B C	4.2000000
PP45-1	A B C	4.1500000
PP42-4	A B C	4.0555556
Dusa-5	A B C	4.0500000
PP40-5	A B C	4.0500000
Dusa-3	A B C	4.0000000
PP35-4	A B C	4.0000000
PP80-1	A B C	3.9687500
PP35-2	A B C	3.9500000
PP35-3	A B C	3.9330000
PP35-5	B C	3.8000000
Dusa-4	C	3.6500000

Figure 21. Tree health score (0 – 5 dead)



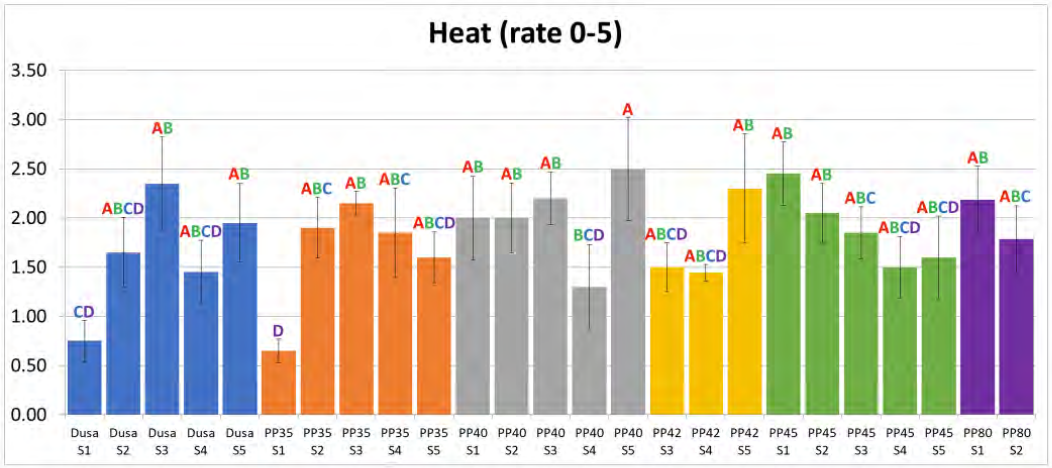
Connecting Letters Report		
Level		Mean
PP40-2	A	3.2500000
PP40-3	A B	3.0000000
PP45-1	A B	3.0000000
PP35-5	A B	2.9500000
PP40-5	A B	2.9000000
PP42-3	A B	2.8888889
PP45-2	A B	2.8500000
PP35-2	A B	2.7500000
PP45-3	A B	2.7500000
PP80-2	A B	2.7500000
PP80-1	A B C	2.6250000
Dusa-4	A B C	2.6000000
Dusa-3	A B C	2.5500000
Dusa-5	A B C	2.5000000
PP45-4	A B C	2.4500000
PP35-4	A B C	2.3500000
PP35-3	A B C	2.3000000
PP42-5	A B C	2.3000000
Dusa-2	A B C	2.1000000
PP45-5	A B C	2.1000000
PP40-1	B C	2.0000000
PP42-4	B C D	1.9444444
PP40-4	C D E	1.5500000
PP35-1	D E	0.8000000
Dusa-1	E	0.6500000

Figure 22. Salt damage score (0 – 5 dead)



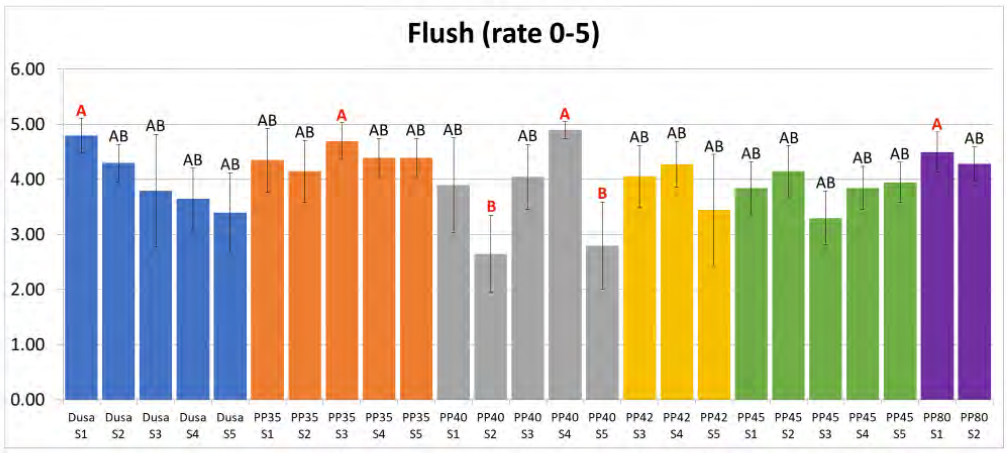
Connecting Letters Report		
Level		Mean
PP45-1	A	2.9000000
PP40-2	A B	2.1500000
PP45-3	A B	2.0500000
PP35-5	A B	1.9000000
PP45-2	A B	1.9000000
PP40-3	A B C	1.8000000
PP35-2	A B C	1.7500000
PP42-5	A B C	1.7500000
PP45-4	A B C	1.7000000
PP40-1	B C	1.6500000
PP40-5	B C	1.6500000
PP80-2	B C	1.5714286
PP42-3	B C	1.5555556
PP35-4	B C	1.5000000
PP42-4	B C	1.5000000
Dusa-2	B C	1.4500000
PP35-3	B C	1.4500000
PP80-1	B C	1.3125000
Dusa-5	B C	1.2500000
PP45-5	B C	1.2500000
Dusa-3	B C	1.1000000
Dusa-4	B C	1.0500000
PP35-1	B C	1.0000000
PP40-4	B C	1.0000000
Dusa-1	C	0.6000000

Figure 23. Heat damage score (0 – 5 dead)



PP40-5	A				2.5000000
PP45-1	A	B			2.4500000
Dusa-3	A	B			2.3500000
PP42-5	A	B			2.3000000
PP40-3	A	B			2.2000000
PP80-1	A	B			2.1875000
PP35-3	A	B			2.1500000
PP45-2	A	B			2.0500000
PP40-1	A	B			2.0000000
PP40-2	A	B			2.0000000
Dusa-5	A	B			1.9500000
PP35-2	A	B	C		1.9000000
PP35-4	A	B	C		1.8500000
PP45-3	A	B	C		1.8500000
PP80-2	A	B	C		1.7857143
Dusa-2	A	B	C	D	1.6500000
PP35-5	A	B	C	D	1.6000000
PP45-5	A	B	C	D	1.6000000
PP42-3	A	B	C	D	1.5000000
PP45-4	A	B	C	D	1.5000000
Dusa-4	A	B	C	D	1.4500000
PP42-4	A	B	C	D	1.4444444
PP40-4		B	C	D	1.3000000
Dusa-1			C	D	0.7500000
PP35-1				D	0.6500000

Figure 24. Flush score (0 – 5 best)



Connecting Letters Report					
Level					Mean
PP40-4	A				4.9000000
Dusa-1	A				4.8000000
PP35-3	A				4.7000000
PP80-1	A				4.5000000
PP35-4	A	B			4.4000000
PP35-5	A	B			4.4000000
PP35-1	A	B			4.3500000
Dusa-2	A	B			4.3000000
PP80-2	A	B			4.2857143
PP42-4	A	B			4.2777778
PP35-2	A	B			4.1500000
PP45-2	A	B			4.1500000
PP42-3	A	B			4.0555556
PP40-3	A	B			4.0500000
PP45-5	A	B			3.9500000
PP40-1	A	B			3.9000000
PP45-1	A	B			3.8500000
PP45-4	A	B			3.8500000
Dusa-3	A	B			3.8000000
Dusa-4	A	B			3.6500000
PP42-5	A	B			3.4500000
Dusa-5	A	B			3.4000000
PP45-3	A	B			3.3000000
PP40-5		B			2.8000000
PP40-2		B			2.6500000

5. San Luis Obispo Plot (Dr. Lauren Garner and Rashaan Souikane). *This report was prepared by Dr. Garner and Rashaan Souikane.* ***January 2022***

San Luis Obispo Plot (Dr. Garner): Avocado trees were transplanted at the Cal Poly site on 24 June 2020 using a randomized complete block design with 10 replications of 8-10 trees per treatment in 3 blocks for a total of 384 trees. Data collection was conducted in August 2020, March 2021, July 2021 and October 2021. All trees were assessed by Dr. Garner's team, who evaluated tree height (ft), above-graft trunk diameter (mm), and below-graft trunk diameter (mm), in addition to rating salinity damage, heat damage, vegetative flush and bloom on a scale of 0-5. Statistical differences detected in the data collected in Aug. 2020 and Mar. 2021 were provided in the July report.

Statistical analyses of data collected in July 2021 and Oct. 2021 are currently underway, but our analysis of changes over time in tree height and trunk diameter are reported herein. PP45 appears to have the fastest rate of growth on average compared to the other three rootstocks (**Fig. 25**). Additionally, all rootstocks have an average above-graft to below-graft diameter ratio below or near 1 (**Fig. 26**). During the reporting period, three senior projects were being conducted by Cal Poly undergraduate students. The subjects for most of these projects overlap with already planned data collection at all sites. However, one includes the evaluation of presence or absence of

trunk suckers prior to suckering that occurred as part of standard management practices. Additional management practices that occurred during the reporting period include that all trees were skirted to approximately 18", weeds on the berm were controlled by hand weeding, and a cover crop was planted and maintained between berms to limit weeds, erosion, and runoff.

Figure 25. Box plot of the height (m) of four avocado rootstocks ('Dusa', 'PP35', 'PP40', 'PP45') collected 2 months after transplanting and subsequently during the spring (3/18/2021), summer (7/17/2021), and fall vegetative flush (10/22/2021) at the research plot in San Luis Obispo, CA; n=10.

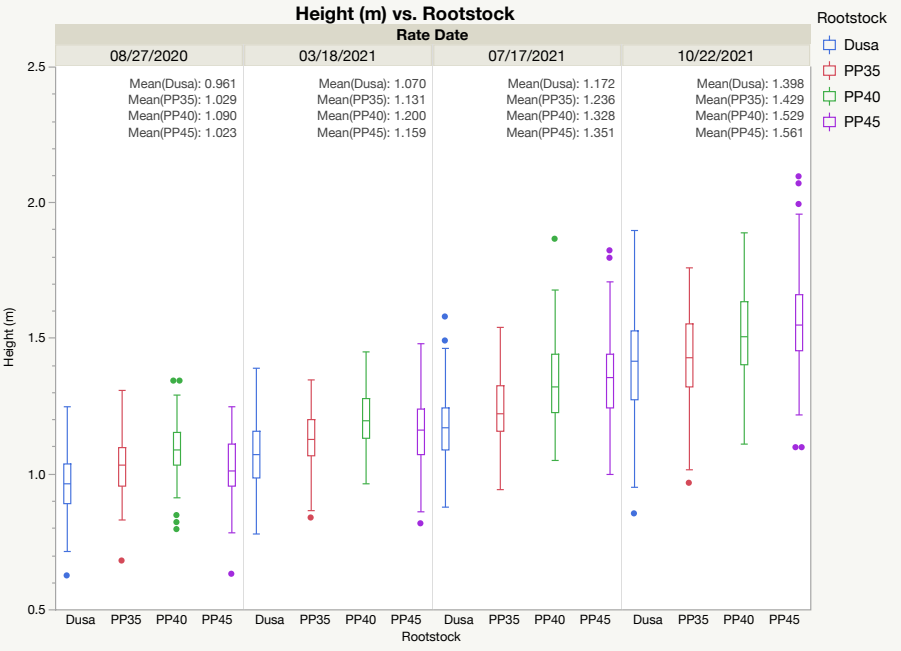
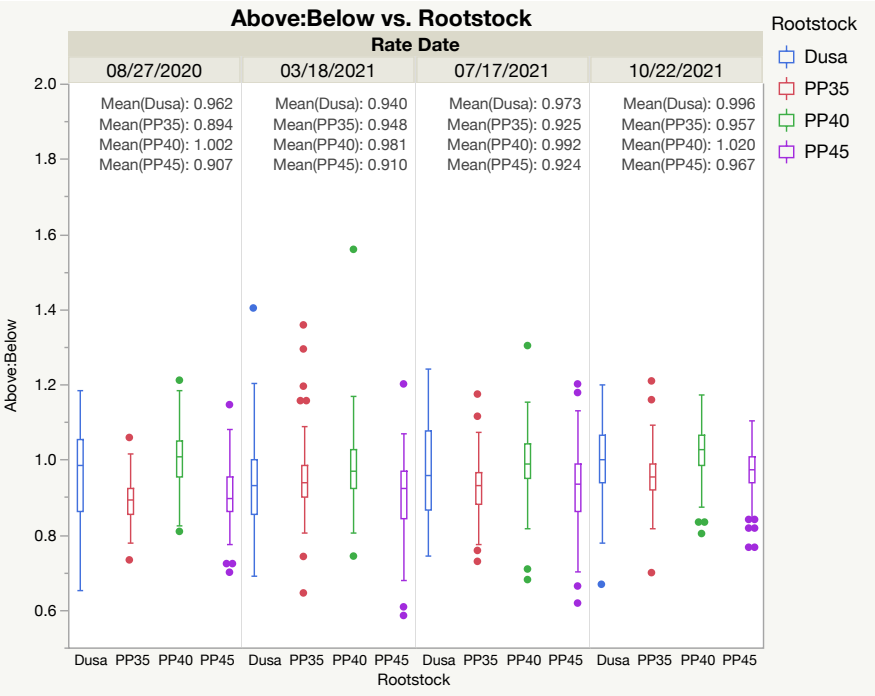


Figure 26. Box plot of the above and below graft union trunk diameter ratio (above:below) of four avocado rootstocks ('Dusa', 'PP35', 'PP40', 'PP45') collected 2 months after transplant and subsequently during the spring (3/18/2021), summer (7/17/2021), and fall vegetative flush (10/22/2021) at the research plot in San Luis Obispo, CA; n=10.



D. **Collection of tree health for PP35, PP40, PP42, PP45, and PP80 UCR advanced rootstocks at four previously established field trials.** Two rootstocks trials were previously established in Temecula (Riverside county) and two in Santa Paula (Ventura county). Table 2 presents the field conditions at each plot. Trees at these field sites were rated using a scoring system from 0 to 5, 0 being the best for tree health, salinity, and heat.

Table 2. Previously established rootstock trials and field conditions.

Grower/Ranch	City	Year	Rootstocks (#s)	Conditions
Jim Brown #1	Temecula	2012	CTP, NTP, Dusa, Thomas, PP35, PP40, PP42, PP45, PP80, VC804	High PRR incidence, high pH and alkalinity due to high levels of $CaCO_3$
Jim Brown #2	Temecula	2013	Dusa, Thomas, PP40, PP70, PP71, PP80, PP83, PP84, PP86, PP88	High PRR incidence, high pH and alkalinity due to high levels of $CaCO_3$
Gunderson	Santa Paula	2006	Dusa, Thomas, SA-1, PP18, PP21, PP22, PP40, PP42, PP45, PP56, PP58, PP63	High PRR incidence, high pH and alkalinity due to high levels of $CaCO_3$, and possible problems with salinity (EC, 1.44 dS/m)
Limoneria 2	Santa Paula	2011	Dusa, PP25, PP26, PP35, PP45, PP48	High salinity and alkalinity levels.

Jim Brown 1 and 2: These two plots have been dropped from the program since majority of trees are dead and are not worth to keep evaluation and data collection.

Limoneira Plots. The previous manager Andy Coker is no longer working at Limoneira. We have been communicating and working with the new managers: Mr. Edgar Gutierrez (Vice President of Farming Operations) and Mr. Vince Giacolone (Director of Southern Management Operations).

Limoneira 2: At this site PP35 is the smallest trees with the less canopy size and PP35 was significant different from Dusa and PP45 which were among the tallest and with more canopy size trees (**Fig. 27**). No significant differences were found among rootstocks regarding tree health and heat damage scores. All trees also were heavily blooming at this location. Significant differences were detected among rootstocks regarding salt damage, flush, and fruit set. PP35 and PP48 were the rootstocks with less salinity damage and were significantly different from Dusa and PP26 that showed the highest salinity damage scores (**Fig. 28**). PP48 trees exhibited less flushing when compared with PP45, PP26, and Dusa. PP45 in this location was the most vigorous and with the most vegetative growth at this location (**Fig. 29**). Except for PP35, all the rootstocks showed similar scores of fruits set being PP45 trees the ones with more fruits followed by Dusa, PP25, and PP26 (**Fig. 30**). In this plot, PP25 (n= 6/20) and PP26 (7/20) have the higher tree mortality. This plot was harvested by 48 plus size picking (7.5 – 9.5 oz) on January 31 (2022). **Table 3** showed the amount of fruit collected for that size. The rest of fruits will be harvest on April 2022. PP45 was the rootstock that produced more total pounds and fruits followed by PP26 and Dusa. Interesting, PP26 produce more fruits and more pounds with half of size of trees than Dusa and PP45. (**Table 3 and Fig. 31**). The less producer in this harvest was PP25 followed by PP48 and PP35. Notice that PP35 at this plot are trees significantly smaller and with less canopy area. Once we collected all fruits at this plot, we will calculate yield tree efficiency by canopy size.

Table 3. Summary of Limoneria 2 size picking January 2022.

Date Harvested	Field	Rootstock	# of Trees	Total Fruit #	Total Weight (lbs)	Avg weight (oz)/fruit	Avg fruit #/Tree
1-31-22	Limoneira 2	Dusa	14	1472	788.28	8.57	105.14
1-31-22	Limoneira 2	PP25	7	597	318.56	8.54	85.29
1-31-22	Limoneira 2	PP26	15	1902	1055.38	8.88	126.80
1-31-22	Limoneira 2	PP35	15	998	542.91	8.70	66.53
1-31-22	Limoneira 2	PP45	15	2199	1214.72	8.84	146.60
1-31-22	Limoneira 2	PP48	6	732	381.84	8.35	122.00

Figure 27. Tree height and canopy size

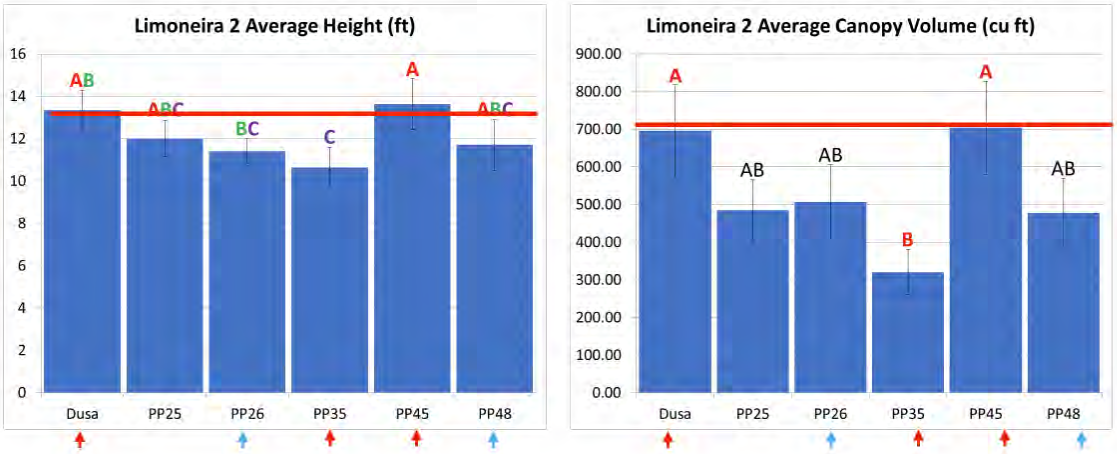
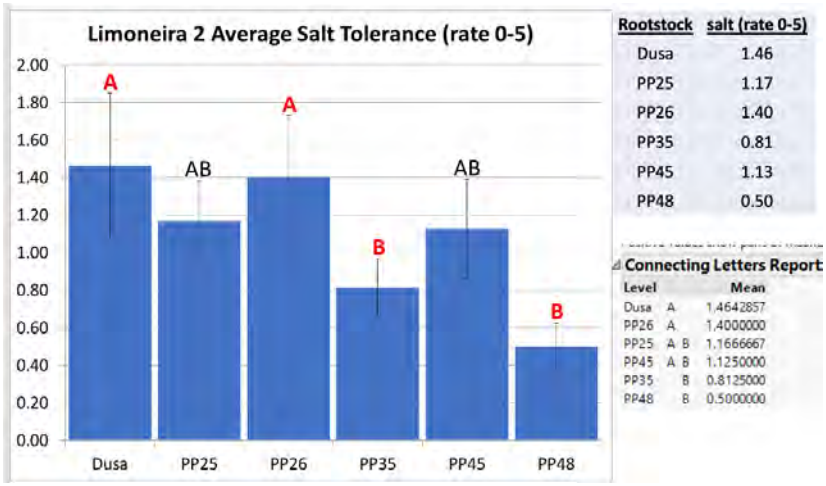


Figure 28. Salt damage score (0 – 5 dead)

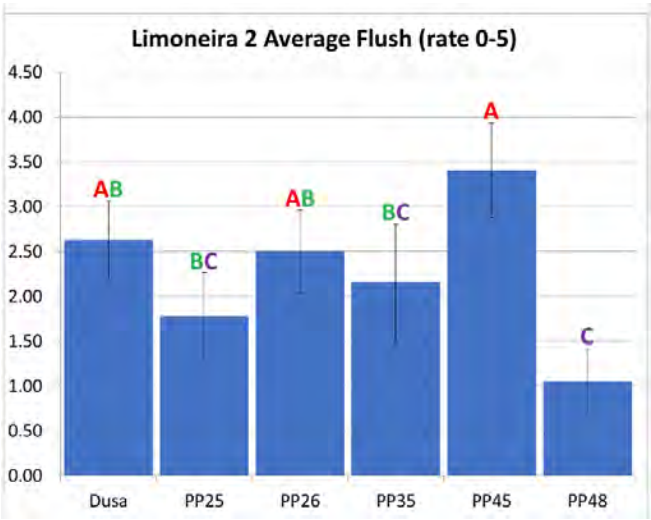


Rootstock	salt (rate 0-5)
Dusa	1.46
PP25	1.17
PP26	1.40
PP35	0.81
PP45	1.13
PP48	0.50

Connecting Letters Report

Level		Mean
Dusa	A	1.4642857
PP26	A	1.4000000
PP25	A B	1.1666667
PP45	A B	1.1250000
PP35	B	0.8125000
PP48	B	0.5000000

Figure 29. Flushing score (0 – 5 best)



Rootstock	flush (rate 0-5)
Dusa	2.63
PP25	1.78
PP26	2.50
PP35	2.16
PP45	3.41
PP48	1.06

Connecting Letters Report

Level		Mean
PP45	A	3.4062500
Dusa	A B	2.6250000
PP26	A B	2.5000000
PP35	B C	2.1562500
PP25	B C	1.7777778
PP48	C	1.0555556

Figure 30. Fruit set scores (0 – 3 best). 0= no fruits, 1 = < 10, 2 = 10-30, 3 = >30 fruits/tree.

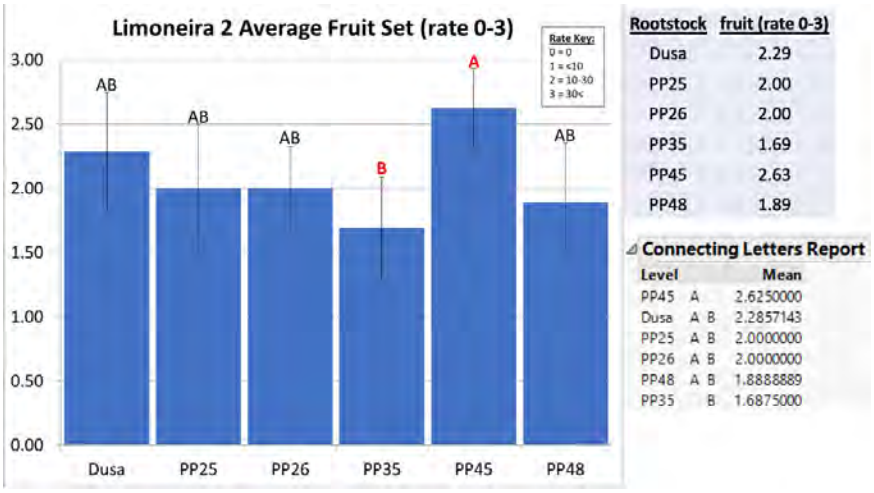
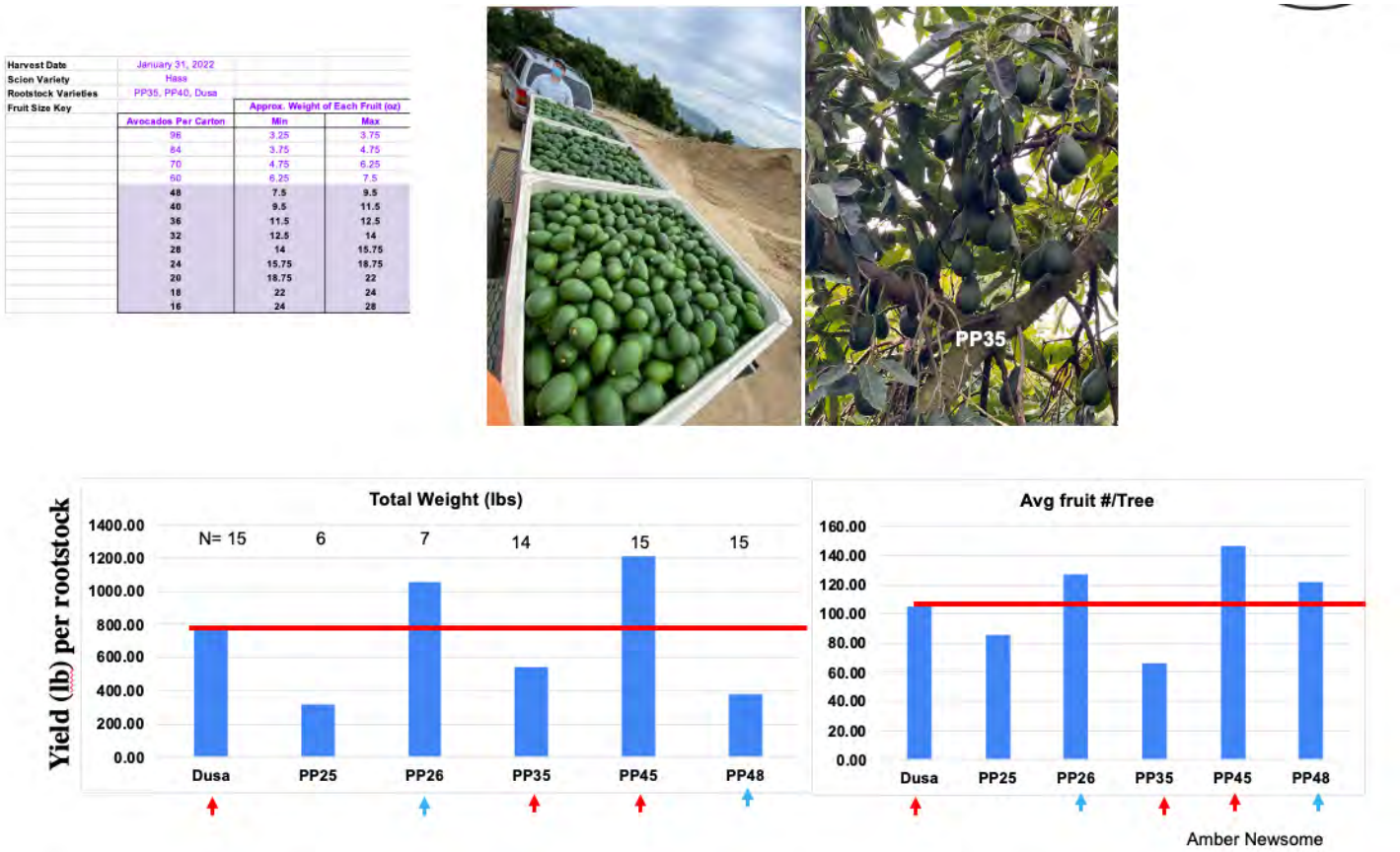


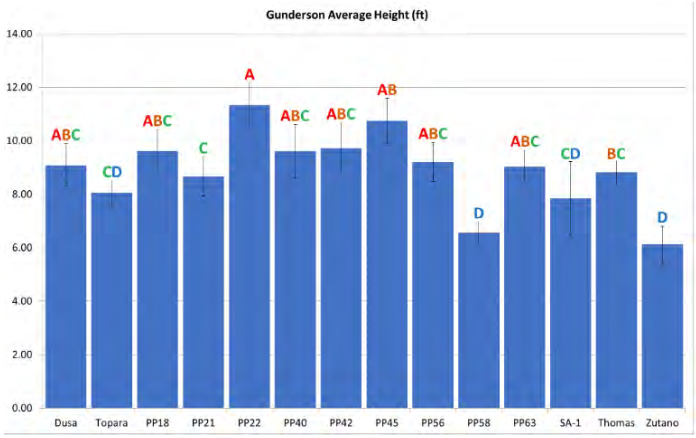
Figure 31. Harvest summary (48+ size picking)



Gunderson: All rootstocks at this location exhibited significant differences regarding all the phenotypic traits collected. PP22 and PP45 are the tallest trees in this plot and Zutano seedlings and PP58 are the smallest (**Fig. 32**). Similar, PP45, PP22, and Dusa are the most vigorous trees with biggest canopy size when compared with Zutano seedlings, PP58, and SA-1 (**Fig. 33**). Zutano seedlings, KB1, SA-1 are the trees with poor tree health scores when compared with PP45, PP42, and PP18 (**Fig. 34**). At this plot the salinity damage scores were general

low, however SA-1 and PP45 have low values of salinity damage and PP22 has the highest salinity damage (**Fig. 35**). Interestingly, SA-1 exhibited more heat damage than the other rootstocks. PP45 is the best rootstock at this location and exhibited also heat tolerance (**Fig. 36**). All rootstocks with the exception of Zutano seedlings exhibited similar heavy flush and blooming. No significant differences were observed in terms of fruit set. Harvest at this plot is schedule for April/May 2022.

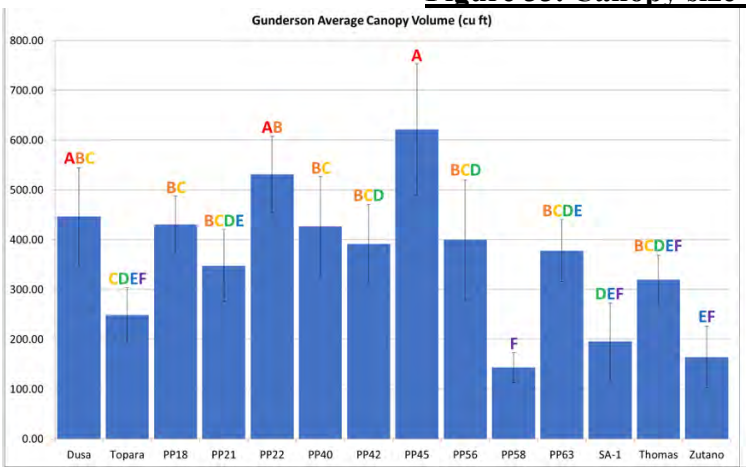
Figure 32. Tree height (ft)



Connecting Letters Report

Level		Mean
PP22	A	11.335302
PP45	A B	10.740434
PP42	A B C	9.733159
PP18	A B C	9.618329
PP40	A B C	9.606710
PP56	A B C	9.209787
Dusa	A B C	9.090661
PP63	A B C	9.035980
Thomas	B C	8.820412
PP21	C	8.671778
KB1	C D	8.042159
SA-1	C D	7.841208
PP58	D	6.572616
zutano sdlng	D	6.129206

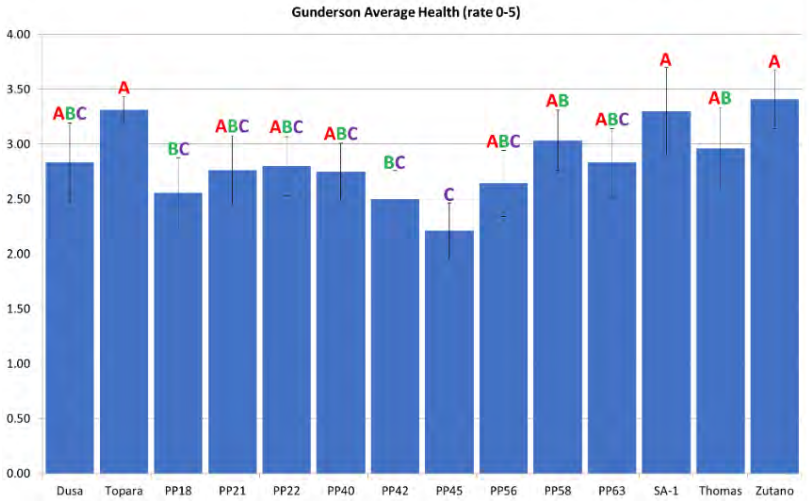
Figure 33. Canopy size (cu ft)



Connecting Letters Report

Level		Mean
PP45	A	620.79800
PP22	A B	530.66424
Dusa	A B C	446.40284
PP18	B C	430.03991
PP40	B C	426.77833
PP56	B C D	399.25353
PP42	B C D	391.62526
PP63	B C D E	377.75908
PP21	B C D E	347.44357
Thomas	B C D E F	319.59392
KB1	C D E F	248.26800
SA-1	D E F	195.78842
zutano sdlng	E F	164.15407
PP58	F	143.05128

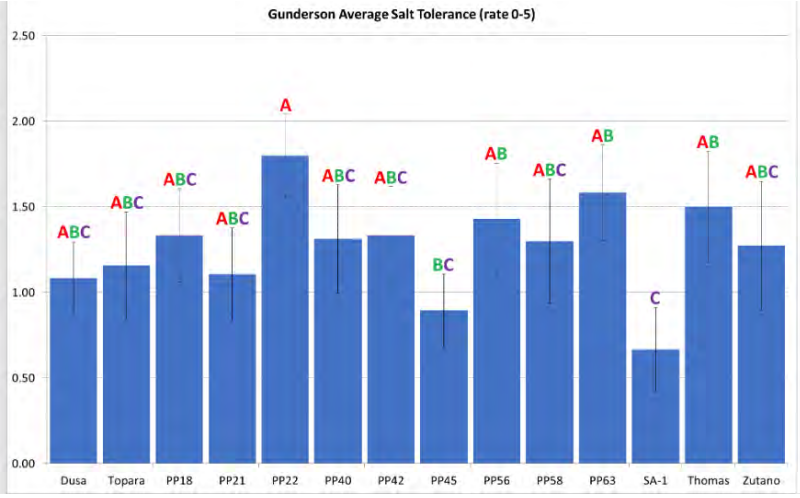
Figure 34. Tree health score (0 – 5 dead)



Connecting Letters Report

Level		Mean
zutano sdlng	A	3.4090909
KB1	A	3.3125000
SA-1	A	3.3000000
PP58	A B	3.0333333
Thomas	A B	2.9615385
Dusa	A B C	2.8333333
PP63	A B C	2.8333333
PP22	A B C	2.8000000
PP21	A B C	2.7631579
PP40	A B C	2.7500000
PP56	A B C	2.6428571
PP18	B C	2.5555556
PP42	B C	2.5000000
PP45	C	2.2105263

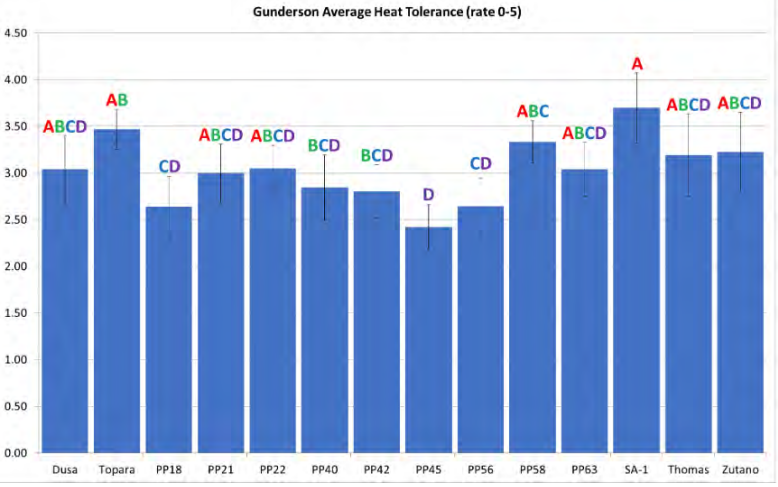
Figure 35. Salt damage score (0 – 5 dead)



Connecting Letters Report

Level		Mean
PP22	A	1.8000000
PP63	A B	1.5833333
Thomas	A B	1.5000000
PP56	A B	1.4285714
PP18	A B C	1.3333333
PP42	A B C	1.3333333
PP40	A B C	1.3125000
PP58	A B C	1.3000000
zutano sdlng	A B C	1.2727273
KB1	A B C	1.1562500
PP21	A B C	1.1052632
Dusa	A B C	1.0833333
PP45	B C	0.8947368
SA-1	C	0.6666667

Figure 36. Heat damage score (0 – 5 dead)



Connecting Letters Report

Level		Mean
SA-1	A	3.7000000
KB1	A B	3.4687500
PP58	A B C	3.3333333
zutano sdlng	A B C D	3.2272727
Thomas	A B C D	3.1923077
PP22	A B C D	3.0500000
Dusa	A B C D	3.0416667
PP63	A B C D	3.0416667
PP21	A B C D	3.0000000
PP40	B C D	2.8437500
PP42	B C D	2.8055556
PP56	C D	2.6428571
PP18	C D	2.6388889
PP45	D	2.4210526


PP35
B


Calavo
62763


Cal62763(W)
62763


43517


43517
B


PP35
B


45251


45251


PP40


PP40


Dusa
A


Cal62078(W)
62078

All trees that were harvested today (1/26/22) were originally planted on 6/13/19

Sample A. 16 Dusa trees harvested today (less than 1 bin of fruit)

Sample B. 97 PP35 trees harvested today (2 bins of fruit)

Sample C. 75 PP40 trees harvested today (2 bins of fruit)

In each sample, ALL fruit from the trees was included (damaged fruits, small fruits, large fruits, etc.) so the data will accurately report the production of each line

B - Red. PP3

Calavo

WEIGHMASTER CERTIFICATE

THIS IS TO CERTIFY that the following described commodity was weighed, measured, or counted by a weighmaster, whose signature is on this certificate, who is a recognized authority of accuracy, as prescribed by Chapter 7 (commencing with Section 12700) of Division 5 of the California business and Professions Code, administered by the Division of Measurement Standards of the California Department of Food and Agriculture.

Grower: MFT 2012
LEO MCGUIRE
5035 TIERRA DEL ORO
CARLSBAD, CA 92008

Weigh location: Calavo Growers, Inc.
Temecula PH
28410 Vincent Moraga Dr.
Temecula, CA 92590

Hauler: MFT 2012

Vendor	Receipt #	Grade Date	Run #	Bins	PO #	Receive Date	License #
005-28668B	841203	01/28/22	315	2	00204476	01/26/22	

Variety	Size	Weight	Percent of Net
# 1 HASS			
	96	2	.114
	84	47	2.677
	70	136	7.745
	60	633	36.048
	48	654	37.244
	40	116	6.606
	36	19	1.082
	32	10	.569
# 1 SUBTOTAL		**1617**	**92.085**
# 2 HASS			
	40	5	.285
	48	6	.342
	60	51	2.904
	70	10	.569
	84	29	1.651
# 2 SUBTOTAL		**101**	**5.751**
MARKETABLE		**1718**	**97.836**
CULLS			
		38	2.164
TOTAL		**1756**	

BIN NUMBERS RECEIVED		
62763	43517	

Healed Scars	STD	CULL
Ground Damage		2
Rodent Damage		1

Gross Weight(lbs):	1928
Common Tare Weight: 86 lbs/bin	172
Net Weight(lbs):	1756

Joseph Malagon

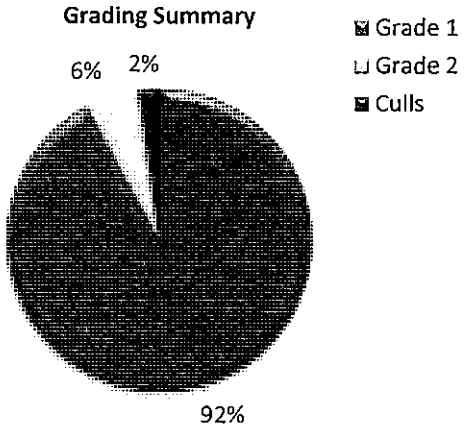
Weighmaster Deputy

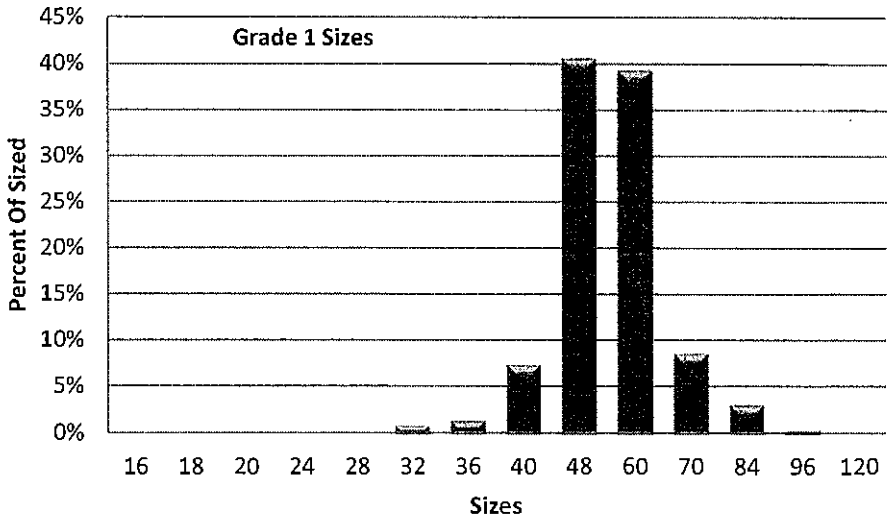
CALAVO GROWERS, INC.

005-28668B
MFT 2012
LEO MCGUIRE
5035 TIERRA DEL ORO
CARLSBAD CA

Tally Description		
Crop Year	:	2022
Pool	:	MULTIPLE
Pool Week	:	MULTIPLE
Packinghouse	:	MULTIPLE
Date Graded	:	1/28/2022
Run Number	:	MULTIPLE
Variety	:	MULTIPLE
Grade	:	1
Receipt Number	:	MULTIPLE
District	:	5
Bins Delivered	:	###########################
Average/Bin	:	919
Bin Equivalents	:	2
Date Received	:	MULTIPLE
Where Received	:	MULTIPLE
Gross Weight	:	1,928
Tare	:	172
Net Weight	:	1,756

Weight Data			
Fruit Size	Grade 1 Pounds	Grade 2 Pounds	Size Distribution
16			
18			
20			
24			
28			
32	10		0.57%
36	19		1.08%
40	116	5	6.61%
48	654	6	37.24%
60	633	51	36.05%
70	136	10	7.74%
84	47	29	2.68%
96	2		0.11%
120			
Grade 1	1,617		92.08%
Grade 2	101		5.75%
Culls	38		2.16%
Undersized			
Net Weight	1,756		100.00%





PP40

Calavo

WEIGHMASTER CERTIFICATE

THIS IS TO CERTIFY that the following described commodity was weighed, measured, or counted by a weighmaster, whose signature is on this certificate, who is a recognized authority of accuracy, as prescribed by Chapter 7 (commencing with Section 12700) of Division 5 of the California business and Professions Code, administered by the Division of Measurement Standards of the California Department of Food and Agriculture.

Grower: MFT 2012
LEO MCGUIRE
5035 TIERRA DEL ORO
CARLSBAD, CA 92008

Weigh location: Calavo Growers, Inc.
Temecula PH
28410 Vincent Moraga Dr.
Temecula, CA 92590

Hauler: MFT 2012

Vendor	Receipt #	Grade Date	Run #	Bins	PO #	Receive Date	License #
005-28668C	841204	01/28/22	313	2	00204475	01/26/22	

Variety	Size	Weight	Percent of Net
# 1 HASS			
	96	2	.138
	84	34	2.346
	70	87	6.004
	60	347	23.948
	48	734	50.656
	40	154	10.628
	36	13	.897
	32	7	.483
# 1 SUBTOTAL		**1378**	**95.1**
# 2 HASS			
	40	4	.276
	48	6	.414
	60	11	.759
	84	5	.345
# 2 SUBTOTAL		**26**	**1.794**
MARKETABLE		**1404**	**96.894**
CULLS			
		45	3.106
TOTAL		**1449**	

BIN NUMBERS RECEIVED		
45251	0000	

Healed Scars	STD	CULL
Ground Damage		2

Gross Weight(lbs):	1621
Common Tare Weight: 86 lbs/bin	172
Net Weight(lbs):	1449

Joseph Malagon.

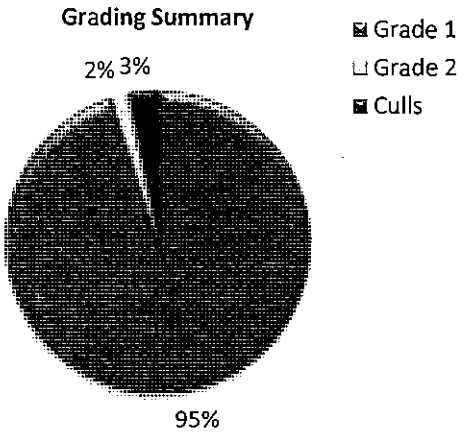
Weighmaster Deputy

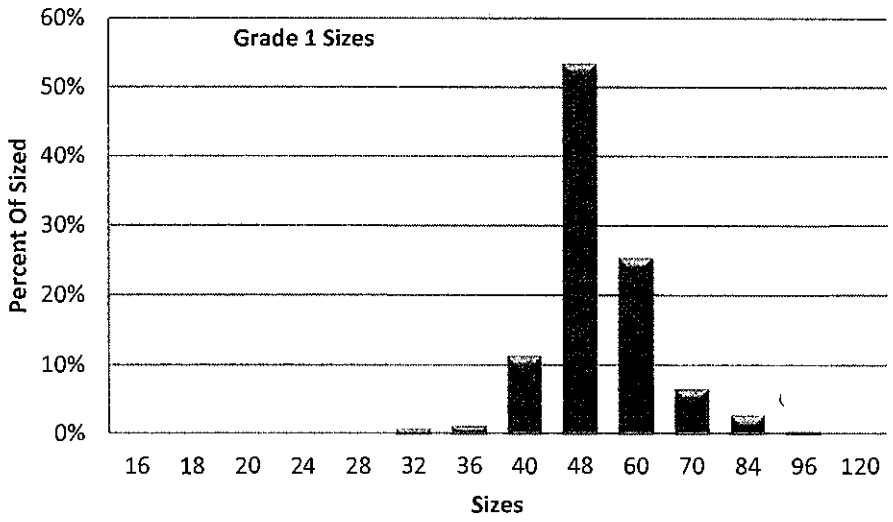
CALAVO GROWERS, INC.

005-28668C
MFT 2012
LEO MCGUIRE
5035 TIERRA DEL ORO
CARLSBAD CA

Tally Description		
Crop Year	:	2022
Pool	:	MULTIPLE
Pool Week	:	MULTIPLE
Packinghouse	:	MULTIPLE
Date Graded	:	1/28/2022
Run Number	:	MULTIPLE
Variety	:	MULTIPLE
Grade	:	1
Receipt Number	:	MULTIPLE
District	:	5
Bins Delivered	:	############################
Average/Bin	:	758
Bin Equivalents	:	2
Date Received	:	MULTIPLE
Where Received	:	MULTIPLE
Gross Weight	:	1,621
Tare	:	172
Net Weight	:	1,449

Weight Data			
Fruit Size	Grade 1 Pounds	Grade 2 Pounds	Size Distribution
16			
18			
20			
24			
28			
32	7		0.48%
36	13		0.90%
40	154	4	10.63%
48	734	6	50.66%
60	347	11	23.95%
70	87		6.00%
84	34	5	2.35%
96	2		0.14%
120			
Grade 1	1,378		95.10%
Grade 2	26		1.79%
Culls	45		3.11%
Undersized			
Net Weight	1,449		100.00%





Item 5. c. Lease Renewal of Pine Tree Ranch

Background: In 2013, CAC entered a 10-year lease with the Cal Poly Pomona Foundation to lease 11-acres of the Pine Tree Ranch in Santa Paula to use as a demonstration grove. At the time, there were approximately 2-acres of mature Hass avocado trees and 9-acres of old lemon trees on the 11-acres that were leased. CAC undertook a redevelopment plan to remove the lemon trees and replant to avocados. Following is a summary of what was planted and what has been done with the property since 2013, along with some of the challenges that have arisen and what needs to be addressed if the lease is renewed.

9-acre Redevelopment

In late 2013 the old lemon trees were removed and chipped and the land was prepared for replanting to avocados. All the irrigation was redone to accommodate the new plantings and row spacings and to allow for each block to be watered separately if needed. Planting of avocados began in 2014.

Lamb Hass: In 2014, a double offset row of Lamb Hass trees was planted at a 10 x 10 spacing along the fence at the front of the property primarily for the purpose of screening the remaining acreage from the road. These trees continue to grow as originally intended and are harvested annually.

Flat and Berm Planting: In 2014, 10 rows of Hass trees were planted starting at the west edge of the property and moving east. These rows were planted at a "traditional" 20 x 20 spacing. The first five rows (from the west) were planted on flat ground, and the next five rows were planted on berms. No plans were made initially to manage these trees differently other than comparing the flat vs berm planting style.

In 2018, with the approval of gibberellic acid (GA) for use on avocados, a trial was initiated in the flat and berm rows to compare untreated trees to trees treated with GA, GA + urea, and GA + boron. For varying reasons — late timing in 2018 due to registration timing, heatwaves causing fruit drop, harvesting errors — the trial has generated mediocre data at best. However, the trees continue to be treated and harvested with the hope of gleaning something from the data.

In 2018, funding was provided to Dr. Themis Michilaides to study avocado branch canker (ABC). Upon isolating the fungi associated with ABC, Dr. Michailides and his team were given permission to use some of the untreated trees in the flat and berm rows to conduct field inoculations to confirm the pathogenicity of the various fungi they had isolated. This work continued through spring 2021.

High Density Planting: Moving east from the flat and berm plantings 15-rows of Hass trees were planted in 2014 at varying row and tree spacings resulting in a total of nine different spacings. From west to east, there are five rows planted at 20, 15 and 10-feet between rows, and from north to south tree spacing is 15, 10 and 7.5-feet. In 2020, the highest density spacings were thinned to every other tree and all other spacings were maintenance pruned. Additional pruning 10 x 15 spacing is being done in 2022. This planting has been popular with attendees at field days and has been very helpful in demonstrating the difficulty of planting Hass trees at close spacings.

Original Rootstock and Scion Block: Most of the remainder of the 9-acres was planted in 2014 with a rootstock and scion variety block. This block was heavily damaged by deer and approximately half of the trees did not survive more than a year. Additionally, there was some miscommunication at planting which resulted in uncertainty about where each variety/rootstock was planted. Thus, in 2016 this original rootstock/variety block was removed and replaced as described below.

Rootstock Block: In 2017, in cooperation with UC Riverside, a new rootstock block of 300 trees was planted that consists of 10 trees each of 30 different rootstocks (several commercially available rootstocks, as well as several UCR advanced selections and several South African selections). This block has developed nicely and yield data are collected annually.

Soil Moisture Sensor Block/Cover Crop Block: Also in 2017, a 1/2-acre planting of Hass trees was made with funding from a CDFA grant as part of drought mitigation funding. The block was planted with the intention of comparing calendar-based irrigation with sensor-based irrigation. The grant covered the initial planting and first two years of maintenance of the block. During this short period, there was no difference in plant water use based on calendar or sensor irrigation. Unfortunately, the project did not continue due to technical issues with trying to irrigate such a small area on demand (see "Challenges" later in this document).

In the winter of 2018/19, in cooperation with UC Cooperative Extension, a cover crop demonstration was planted in the row middles of this block. Four different cover crop mixes were planted — pollinator attractants, low profile mix, biomass mix, and mustards mix — each in two adjacent row middles. This served as a good demonstration for a field day and was written up in *From the Grove*.

GEM Spacing Trial: In the final open 3/4-acre plot, a GEM spacing trial was planted in spring 2021. Again, this was in cooperation with UC Cooperative Extension with Ben Faber and Sonja Rios securing a UC grant to establish the trial. The planting consists of three different spacings replicated three times across the block.

Existing 2-acres of Mature Trees

The 2-acre block of existing mature Hass trees was divided into four sections and the irrigation was split so that each quadrant could be managed independently. The block was initially used to study the efficacy and movement of various pesticides for use against the polyphagous shot hole borer (PSHB) to avoid crop destruct costs working in commercial groves. The various injections and branch removals to trace chemical movement in the trees resulted in the trees being in quite poor condition when that work ended. Thus, in 2017 a plan was developed to look at different grove rejuvenation strategies in the four quadrants — complete replant, traditional stumping, stumping with a nurse limb, one major scaffold limb removed each year over several years. The complete replant quadrant failed due again to deer pressure, which killed about 3/4 of the newly planted trees. The remaining quadrants came back well and have been on a maintenance pruning program since regrowing.

Challenges

Undertaking a demonstration grove has not been without its challenges and these will need to be addressed going forward if a lease renew is considered.

Irrigation: There are two wells on the property that can be used for irrigation. Despite these wells being of similar depth and separated by only about 1,000 feet, they have vastly different quality water. The well on the CAC portion of the grove is extremely salty and when it was used caused the trees to begin to decline within a few months of being irrigated that water. The other well has very good water quality but is too large to irrigate just the CAC portion of the ranch, much less a single block of less than acre. If the CAC portion of the ranch is irrigated without irrigating some of the Cal Poly portion as well, water must be dumped which has caused concerns with the neighbors when ditches become clogged and water flows onto their property.

If the lease were to be renewed, an agreement for the payment and installation of a variable frequency drive on the large well should be negotiated with the new lease so that there is more flexibility to manage irrigation more precisely on CAC's portion of the ranch.

Grove Management: It is impossible to manage an endeavor such as this without enlisting the help of a grove management company. Over the duration of the current lease two different grove managers have been contracted to manage the grove over three different periods. Given the large number of projects at the ranch, any change in grove management is very disruptive and potentially leads to issues if things are forgotten to be communicated during a management transition. Additionally, the mere selection of a grove manager by CAC is difficult to do without some appearance of favoritism.

If the lease is renewed, the Board should consider instituting some policy for grove management selection and retention. Staff's recommendation would be that the grove manager is not changed more often than every 5-years, unless serious issues arise, to minimize disruptions to the management of projects.

A Demonstration Grove vs. A Commercial Grove: It has appeared at times that Pine Tree Ranch was viewed as a potential profit center or should at least be self-supporting financially. If the lease for Pine Tree Ranch is renewed there must be a very clear understanding of its purpose and what the expectations should be. If the ranch is to be used as a truly demonstration site then projects cannot be undertaken with the expectation of trees becoming profit centers. For instance, if a block is planted to demonstrate the effects of various soil amendments added to the planting hole on tree establishment, then the goal may be achieved with 3-years. There should be no expectation that those trees will necessarily have a 20-year life span. In other words, there should be no concerns about removing and replanting trees so long as there is a clear and defined goal for doing so.

Defined Goals: Perhaps the greatest error at the outset of the Pine Tree Ranch lease was not having a well-defined list of projects and goals for the ranch. Trees were planted with no real goal for what the various plantings should achieve over the course of the lease. If the lease is renewed, a list of very specific goals should be made for what CAC wants to achieve at the ranch over the next lease period and projects should be developed to meet those goals.