Almond Culture and Orchard Management

Overall Project Leader: Emily Symmes
University of California Cooperative Extension, 2279-B Del Oro Avenue, Oroville, CA 95965
(530) 538.7201, ejsymmes@ucanr.edu

CURRENT PROJECT ACTIVITIES SUMMARY:

The Almond Board provides funding for UC Farm Advisors to conduct research projects, including the following eleven almond-related efforts.

Nematicide Trial in a Two-Year-Old Orchard Infested with Plant Parasitic Nematodes

Project Leader: David Doll, UCCE – Merced

This experiment will determine the impacts of four commercially available post-plant nematicides on populations of parasitic nematodes of almond roots. The plot is located on a sandy loam soil with confirmed presence of ring nematode (*Mesocriconema xenoplax*), but no history of replant disease (*Prunus* sp). Five treatments including foliar applied Movento®, two timings of chemigated Melecon®, two timings of chemigated applied Velum 1®, and Diterra® were compared to an untreated control. After the second year of applications, there were no significant differences in trunk diameter growth among the treatments. Nematode counts were variable and populations did not differ between treatments. The same application schedule will be followed for one more year to determine treatment effects.

Mechanical Pruning and Training of Young Almond Trees

Project Leader: Roger Duncan, UCCE – Stanislaus County

Growers in windy areas may contemplate mechanically topping their non-bearing almond trees in an attempt to produce a shorter, more compact tree while reducing labor costs. In this Stanislaus County study, the cost of mechanical topping plus minimal scaffold selection by hand was about $12 per acre higher than conventional, hand-trained trees. Although mechanically topped trees started the second leaf about three feet shorter, they were just as tall as untopped trees by the end of the season. Mechanically topped trees tended to have smaller trunk calipers than unpruned trees but not short-pruned trees. Topping and other methods of tree training did not affect tree anchorage, as measured by a protractor to document tree leaning. There was no difference in 3rd leaf Nonpareil or Monterey yield between mechanically topped trees and trees trained more traditionally by hand.

Root and Shoot Susceptibility of Peach/almond Rootstock to Pistachio Bushy Top Syndrome Isolates of *Rhodococcus* spp.

Project Leader: Elizabeth Fichtner, UCCE – Tulare

Pistachio bushy top syndrome (PBTS) is caused by phytopathogenic bacteria closely related to *Rhodococcus fascians* and *Rhodococcus corynebacteriodes.* PBTS has caused extensive economic loss to pistachio growers in California, Arizona, and New Mexico. Individual pistachio trees with PBTS symptomology were removed from affected orchards; however, pistachio orchards with high PBTS incidence were entirely removed. In the southern San Joaquin Valley, substantial acreage affected by PBTS was replanted to almond; consequently, potential susceptibility of almond rootstock to PBTS isolates of *Rhodococcus* spp. requires investigation. The goal of this work was to determine the susceptibility of roots and foliage of almond rootstock to PBTS isolates of *Rhodococcus* spp. Clonal peach/almond rootstock ('Hansen 536') plantlets were assigned three treatments: 1) uninoculated control, 2) root-inoculated, and 3) foliar-inoculated. Inoculated plants were treated with a cocktail containing each of two PBTS type-isolates (*R. fascians*-like and *R. corynebacteriodes*-like); a plasmid-borne gene was detected in isolates prior to inoculation to verify plasmid presence. Plants were incubated in the greenhouse for 67 days and maintained with standard horticultural practices. Each treatment contained 20 replicate plants and two experimental runs were completed. Root-inoculated plants were shorter and exhibited a higher node density (i.e., shortened internodes) than either uninoculated control plants or foliar inoculated plants. Endophytic populations of the bacteria were detected on inoculated plants, demonstrating the pathogens' ability to colonize and enter peach/almond rootstock. The results of our study demonstrate the susceptibility of clonal peach/almond rootstock to PBTS isolates of *Rhodococcus* spp., with resulting symptomology comparable to that of affected clonal 'UCB-1' pistachio rootstock. Additionally, our work demonstrates the importance of sanitation within micropropagation facilities and wholesale nursery

facilities for the assurance of pathogen-free rootstock materials.

Almond Bloom Disease Control Trials

Project Leader: Brent Holtz, UCCE – San Joaquin County

Sequential treatments of Fontelis (penthiopyrad), Bumper (propiconazole), Tebuconazole, Abound (azoxystrobin), Gem (trifloxystrobin), an experimental fungicide, Merivon (fluxapyroxad + pyraclostrobin), Bravo Weather Stick (chlorothalonil), Quadris Top (difenoconazole + azoxystrobin), Inspire EC (difenoconazole), Quash (metaconazole), Rovral (iprodione) + oil, Luna Sensation (fluropyram + trifloxystrobin), Luna Experience (fluropyram + tebuconazole), Pristine (pyraclostrobin + boscalid), Indar (fenbuconazole), Serenade Optimum (Bacillus subtilis), Microthiol Disperse (micronized wettable sulfur), and Regalia (extract of *Reynoutria sachalinensis*) in tank-mixtures and in various combinations and timings for the control of common almond bloom diseases: brown rot, shot-hole, scab, and rust. All treatments, except the experimental fungicide, significantly reduced the incidence of almond scab when compared to our two untreated controls. Because of the lack of precipitation at bloom we did not have enough brown rot or shot-hole to rate.

Impact of Dormant Topping on Tree Development

Project Leader: Dani Lightle, UCCE – Glenn/ Butte/Tehama counties

An orchard in Glenn county (3 replicates; Nonpareil, Carmel and Butte on Nemaguard) and a second orchard in Tehama county (4 replicates; Nonpareil and Monterey on Hansen) will be mechanically topped November/December 2016 during their second dormant season while control trees will not be topped. Each treatment block is greater than ½ acre in size. Differences in height, caliper measurement, bloom timing, and limb breakage/windthrow as a result of topping will be monitored during the 2017 growing season; yield will be measured beginning in 2018.

Does Fall Nitrogen Application Improve Almond Yield?

Project Leader: Franz Niederholzer, UCCE – Colusa/Sutter/Yuba counties

The current UCCE almond N management recommendation is for application of 20% of the annual N fertilizer requirement between hull-split and leaf drop. However, winter rainfall in the Sacramento Valley regularly exceed the root zone soil water holding capacity, producing conditions where excess soil nitrate can be leached towards groundwater and eliminate any soil nitrate carry over from one season to the next. A field trial was established in a mature Colusa county almond orchard (Nickels Soil Lab) with a good production record on October 26, 2015 to test the effect of two rates of fall N fertilization rates (30 lbs N/acre or 60 lbs N/acre as UN32) on almond yield in 2016. Trees received the same amount of N fertilizer during the 2016 growing season (190 lbs N/acre) and the same farming practices. Plot yield (n = 15;11 trees; 0.09 acres) ranged from 2000-3000 kernel lbs/acre, averaging 2550 kernel lbs/acre in 2016. Fall N, 2015 fertilization did not increase 2016 yield ($p=0.78$) or reduce yield drop from 2015 to 2016 ($p=0.89$). Nonpareil yield in the study block was off 10% from 2015 despite good to excellent summer 2016 leaf N levels. Factors other than N nutrition appeared to influence yield. Late application timing may have influenced our results; however, study trees retained their leaves for 3-4 weeks after N application – enough time for at least some N uptake. Fall 2016 treatments have been applied and include Nonpareil and Aldrich varieties.

Young Orchard Educational Material

Project Leader: Katherine Pope, UCCE – Yolo/Solano/Sacramento counties

New almond orchards are being planted at a rapid pace in Yolo, Solano and Sacramento counties. Much of this acreage is being planted by those with no previous experience in tree crops, some with no experience in agriculture at all. Most of UC Cooperative Extension's tree crop materials are geared towards management of problems in mature orchards. With this in mind, a stand-alone, introductory Young Orchards Handbook was created in 2015 to deal exclusively with the issues confronted in the early years of an orchard's life. Funding in 2016 supported the second Young Orchard Workshop and additional chapters on vertebrate management, cover crops, and pests and diseases that are particularly problematic for young orchards were developed based on these presentations. Videos from the presentations and the updated version of the Young Orchard Handbook are available through the UCCE Capital Corridor (Sac-Solano-Yolo Counties) website:
http://ccfruitandnuts.ucanr.edu/files/238596.pdf

Effect of Winter Flooding on Spider Mite and Navel Orangeworm Population in Almond Orchard

Project Leader: Jhalendra Rijal, UCCE Area IPM Advisor – Northern San Joaquin Valley

The purpose of the study was to evaluate the overwintering mortalities of NOW larvae and web-spinning spider mites in flooded vs. non-flooded almond blocks that have been used for the groundwater recharge project. Based on the protocol of the groundwater recharge project, irrigation water was applied to the flooded portion of the orchard weekly for four consecutive weeks (6 inches of water in each application) in January. The non-flooded portion of the orchard did not receive irrigation water. Ground mummy nuts were collected from flooded and non-flooded blocks twice when the cumulative water reached to 18 and 24 inches. The mummy nuts were cracked, and the number of dead and live NOW larvae were recorded. Proportion of live larvae were numerically lower (33%) in flooded samples compared to non-flooded samples (42%). In addition, seasonal nut samples were collected and evaluated for the presence of NOW larvae/damage at harvest. Based on 900 nuts evaluated, percent nut damage was 0.56% in flooded block while 1.0% in non-flooded block. For spider mites, tree-base soil samples were collected from a representative number of trees from the flooded vs. non-flooded blocks. The soil samples were processed, and the number of overwintered female mites recovered were recorded and the data will be presented at the Almond Conference.

Sodium, Chloride and Boron Accumulation in Almonds – Westside Survey

Project Leader: Blake Sanden, UCCE – Kern County

A 4th leaf quarter section almond block in NW Kern County – 50/50 Nonpareil and Monterey were planted on Hansen rootstock in 2013. A significant increasing gradient in native salt load in this soil is obvious as you move from East to West (EC 1.7 to 6.1 dS/m) despite having leached this ground with two feet of water using sprinklers prior to planting. Four “areas” with dedicated sampling trees have been selected to represent this gradient. The total soil salt load (EC), sodium (Na), chloride (Cl) and boron (B) increase about 3-fold from Area 1 to 4 even after leaching with sprinklers. Area 1 is still pushing the classic salt tolerance thresholds for almonds. Despite this difference in soil salinity all tissue samples for leaves, rootstock and scion wood corings and hull boron content at harvest show no real difference with respect to Na, Cl and B (60 ppm leaves, 360 ppm hulls). However, the trunk circumference of Area 4 is 16% less than Area 1, as would be expected with the higher osmotic/salinity stress. The 2015 3rd leaf yields were disappointing for this block: 312 lb/ac for low salt Area 1 and 137 lb/ac for the high salt Area 4, a 56% decrease. The 2016 4th leaf yields were excellent for Area 1 at 2,350 lb/ac to a low of 838 lb/ac for Area 4, a 64% decrease. After 4 years, plant tissue testing is not revealing numbers consistent with observed reductions in tree growth and yield.

Reliability of Pre-Sanitation Estimates of Overwintering NOW Populations in Mummy Nuts

Project Leader: Emily Symmes, UCCE Area IPM Advisor – Sacramento Valley

The objective of this study is to evaluate whether NOW infestation rates differ if mummy samples are evaluated pre- or post-sanitation activities (shaking and/or poling). Ultimately, the combined estimates of total remaining mummies in the orchard plus overwintering NOW population in those mummies may provide an additional level of decision-support for managing NOW in almonds. Ten orchard sites in the Sacramento Valley have been identified as sample sites for this project. Pre-sanitation samples will be collected after harvest 2016 (November-early December) and post-sanitation samples collected in early 2017 (minimum 30 nuts per cultivar per block on each sample date). Nuts will be cracked and infestation rates compared between sample dates.

Assessment, Survey, and Documentation of the Challenges Facing the Almond Industry in Kern County

Project Leader: Mohammad Yaghmour, UCCE – Kern

The objective of this project is to assess research and educational needs, and document challenges facing the local almond industry in Kern County using a survey. The survey was prepared and is being distributed to growers during meetings and farm visits. Observations during farm visits are being documented. The results of this survey will be used as a reference for the development of my research and extension program to meet the needs of almond growers and almond industry in Kern County.

For More Details, Visit

- Poster locations in Exhibit Hall A + B during the Almond Conference; or on the web (after January 2016) at Almonds.com/ResearchDatabase:
  - 31 – Yaghmour
  - 32 – Lightle
  - 33 – Duncan
  - 38 – Sanden
  - 50 – Pope
  - 62 – Niederholzer
  - 84 – Doll
  - 87 – Fichtner
  - 88 – Holtz
  - 101 – Rijal
  - 102 – Symmes
- 2015 - 2016 Annual Report CD (15-HORT3-Buchner/Symmes); or on the web (after January 2017) at Almonds.com/ResearchDatabase