Almond Culture and Orchard Management (Farm Advisor Projects)

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CURRENT PROJECT ACTIVITIES SUMMARY:

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

Tree Growth Response to Wood Mulch Incorporation in a Newly Established Orchard

Project Leader: Mae Culumber, UCCE – Fresno County

This experiment will determine if a 50-60 ton/ac wood chip amendment rate has a detrimental impact on establishment of young almond trees. Visual replant disease growth ratings conducted in August found a 3x reduction in overall vigor in wood chipped trees compared to an untreated control in the first growing season. Trunk circumference data will be collected at the end of October. Leaf tissue samples were collected in July and have been sent for analysis. Trends indicate soil inorganic N concentrations (0-45 cm) one month after fertigation were lower in wood chips compared to plots that received other organic amendments, fumigation and control treatments. Significantly higher soil total N and organic C in wood chip treatments over all other plots was observed during summer and fall months. This suggests wood chip trees stunting corresponds to nutrient immobilization processes. Continued tree growth and soil nutrient monitoring will take place from establishment to the nut bearing growth period of the orchard.

Survey to Determine the Frequency of Prunus Necrotic Ringspot Virus Occurrence in Newly Established Almond Orchards

Project Leader: David Doll, UCCE – Merced County

Recently there has been an increase occurrence of mosaic leaf symptoms and bud failure in young to middle aged almond plantings due to Prunus Necrotic Ringspot Virus (PNRSV). Although the initial source of infections is unknown, there is a high possibility that these orchard infections originated with infected nursery material. This survey sampled newly established orchards to determine the frequency of PNRSV occurrence. Three leaves from 10-12 trees of the same variety were selected and pooled from one to two-year-old trees that have not flowered and sent to a commercial testing lab to test for PNRSV. Four samples of the 41 tested positive for PNRSV with infected trees sourced from three different nurseries (7 different nurseries tested). This level of infection is concerning as infected trees serve as a source of inoculum for healthy almond trees within the area, eventually reducing crop yields.

Post-Plant Solarization or Pre-Plant Soil Fumigation for Control of Verticillium Wilt in Young West Side Orchards

Project Leader: Roger Duncan, UCCE – Stanislaus County

Almond orchard planting has expanded rapidly into the Westside of the North San Joaquin Valley which is a historical growing area for processing tomatoes, watermelons, cantaloupes, honeydews and many other melon species. Tomatoes and melons are excellent hosts for the soil borne fungal pathogen, *Verticillium dahlia*, which can survive in the soil for many years. Young almond trees are also susceptible to infection by *V. dahlia* and many new orchards planted in this area are afflicted with symptoms of Verticillium wilt disease. In this 11-acre field trial, we are comparing preplant fumigation with Telone II, chloropicrin and Dominus (allyl isothiocyanate), which is a new, potentially organically acceptable alternative soil fumigant. Fumigants were applied during September 2016, with and without tarps. Potted trees of 'Shasta' on Cornerstone rootstock were planted in late October 2016. Preplant fumigation is being compared against post-plant solarization with black, embossed, polyethylene film for post-treatment soil levels of *Verticillium dahlia* and pathogenic nematodes, incidence and severity of Verticillium wilt disease, tree growth and yield. Data collection is ongoing.

Almond Bloom Disease Control Trials
Project Leader: Brent Holtz, UCCE – San Joaquin County

Sequential treatments' of Aproach (Picoxystrobin + Cyproconazole), Fontelis (penthiopyrad), Quadris Top (difenoconazole + azoxystrobin), Bravo Weather Stick (chlorothalonil), Inspire EC (difenoconazole), experimental products from DuPont Crop Protection, Syngenta Crop Protection, and Nichino America, along with organic products Timorex Gold (tea tree oil), Microthiol Disperse (micronized wettable sulfur), and Regalia (extract of Reynoutria sachalinensis) in tank-mixtures and in various combinations and timings for the control of almond brown rot and scab. Most treatments significantly reduced the incidence and severity of brown rot and scab when compared to our two untreated controls.

Impact of Dormant Topping and In-Season Topping on Tree Development and Early Yield
Project Leader: Dani Lightle, UCCE – Glenn/ Butte/Tehama counties

This study is following two orchards that were planted winter 2014/15; one planted on Nemaguard and the other on Hansen. The trees were flat-topped at a height of approximately 9 feet in November 2016. The estimated cost for the mechanical topping treatment (including topping and brush removal) was approximately $90 per acre. At a price of $2.50/lb, yields in 4th leaf on topped trees would need to be equivalent to any yield loss in 3rd leaf, plus an additional 36lbs/ac. Yield data was collected in September 2017.

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, established in 2015, was continued in a mature Colusa county almond orchard (Nickels Soil Lab) with a good production record. On October 20, 2016, two rates of fall N fertilization rates (30 lbs N/acre or 60 lbs N/acre were applied as UN32 and ammonium sulfate) to test the influence of fall N on almond yield of well-managed trees the following year (2017). Trees received the same amount of N fertilizer during the 2017 growing season (185 lbs N/acre, total, in 5 applications between March and June) and the same farming practices. Plot yield (n = 15; 11 trees; 0.09 acres) ranged from 1500 -4200 kernel lbs/acre, averaging 3000 kernel lbs/acre in 2017. Fall N, 2016 fertilization did not increase 2017 yield (p=0.82) or influence yield difference from 2016 to 2017 (p=0.89). Average Nonpareil yield in the study block was up 17% from 2016 to 2017, but fall N did not appear to influence this increase. Late application 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 2017 treatments have been applied and include a mid-September and mid-October treatments at rates of 30 lbs N/acre.

Sodium, Chloride and Boron Accumulation in Almonds – Westside Survey (Year 3)
Project Leader: Blake Sanden, UCCE – Kern County

In 2013 a 50/50 Nonpareil-Monterey orchard on Hanson rootstock was planted 6 miles NW of Lost Hills. A significant increasing gradient in native salt load (1.7 to 6.1 dS/m) and boron runs from East to West despite having leached this ground with two feet of water with sprinklers prior to planting. Dedicated trees in four "areas" following this gradient have been sampled annually for soil salinity (EC), Na, Cl and B, leaf and rootstock/scion tissue salt/nutrient concentrations, Nonpareil kernel yield, tree circumference, height and canopy diameter. As expected, tree size and yield decline by about 40-50% from the low to high salt area. Hull B concentration was significantly greater for the 3rd and 4th leaf harvest, but was actually higher for the low salt Area 1 (180 ppm) compared to the high salt Area 4 (157 ppm) for the 2017 5th leaf harvest. There is almost zero tip/leaf burn even in the high salt area and only scattered gummosis on a few trees. As of July 2017, there is about a 20% increase in B concentration in both rootstock and scion phloem tissues for Area 4 compared to Area 1. No differences in B, Na or Cl are found in the xylem or leaf tissue.

Sacramento Valley Pest Monitoring and IPM Updates

Project Leader: Emily Symmes, UCCE Area IPM Advisor – Butte, Colusa, Glenn, Sutter-Yuba, Tehama Counties

Pest monitoring was conducted throughout the 2017 growing season in multiple almond orchard locations representing the Sacramento Valley (Colusa County, Butte County, Glenn County, and Tehama County). In particular, materials and lures for trapping navel orangeworm, peach twig borer, and oriental fruit moth were procured and deployed. Trap catch data was disseminated in the different counties via various extension methods, including weekly email lists website updates (25); monthly IPM breakfast meetings throughout the Sacramento Valley (10); and personal contacts with growers, Farm Advisors, PCAs, and CCAs (numerous). A new format for presenting the information online at www.sacvalleyorchards.com is being developed for use beginning in 2018. The data collected provides continuity in the historical record of pest activity in almonds in the Sacramento Valley.

Investigation of Hull Rot Causal Agents, and Environmental Conditions Conducive to Disease Development in Kern County

Project Leader: Mohammad Yaghmour, UCCE – Kern County

Hull rot is primarily caused by *Rhizopus stolonifer* and *Monilinia fructicola* causing the leaves, spurs, and parts of the shoot near the infected fruits to die. A toxin produced during infection moves from the infected fruit into the surrounding tissue killing the vascular tissue. While this disease does not affect the kernels during infection, it affects future yields by killing fruiting spurs and wood. The objective of this project is to investigate the causal agents of hull rot and associated fungi in Kern County, and understand orchard factors and environmental conditions playing a role in disease development. Is *Aspergillus niger* an important factor in disease development in Kern County? The project was initiated in a 5th leaf commercial orchard planted with cultivars Nonpareil (NP), Sonora, and Monterey. Two main plots were set up in the orchard representing soil variations. In each plot, five replicates in the NP variety was established. This season, data was collected to better understand the problem. Soil moisture and stem water potential was monitored for all plots. Hull rot incidence was recorded for NP and Sonora varieties. Koch's postulates were also performed on NP trees using *A. niger*. Hull rot symptoms were reproduced and *A. niger* was successfully re-isolated from inoculated hulls confirming that this fungus can cause hull rot. Disease was also observed during farm calls, and *R. stolonifera* and *A. niger* was isolated from cankers which suggests that these two fungi are invading the tissue. It is very important to understand the biology of *A. niger* in hull rot development to develop effective management strategies.

For More Details, Visit

- Poster locations in Exhibit Hall A + B during the Almond Conference; or on the web (after January 2017) at Almonds.com/ResearchDatabase:
  - 48 – Niederholzer
  - 55/56 - Culumber
  - 68 – Holtz
  - 75 – Doll
  - 76 – Yaghmour
  - 81 – Duncan
  - 83 – Lightle