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About the Cover:
Blueberries, just about to ripen in early May
See story page 4.
Photo by Matthew Malcolm

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The Survival of a Small Farmer

Growing Berry Crops in Santa Barbara with Ed Seaman

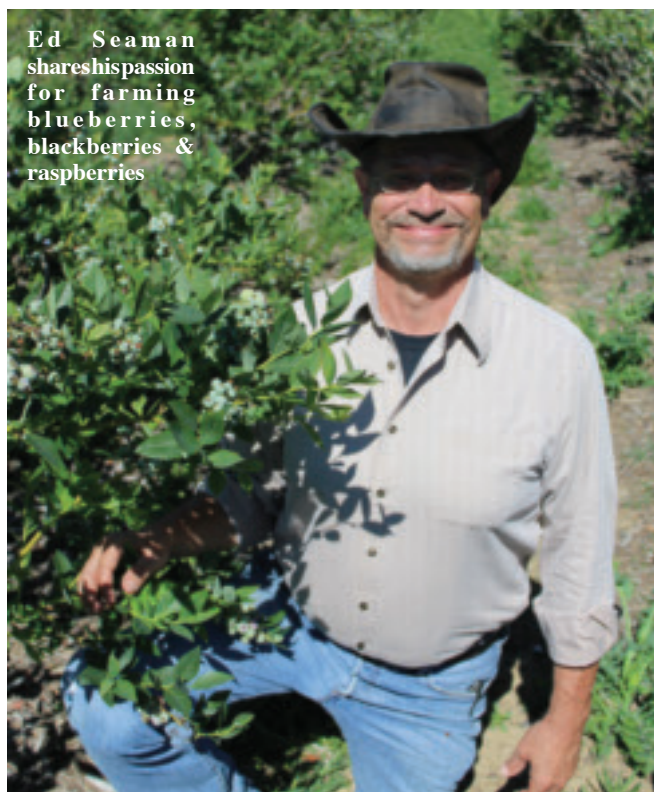
By Matthew Malcolm, Managing Editor

If you've taken the Highway 101 to Santa Barbara in the Summer time, you've probably seen a blueberry hut on the side of the road; and if you've stopped by, you'll notice rows of blueberries, blackberries and raspberries behind the hut. This small farm, known as Santa Barbara Blueberries at Restoration Oaks Ranch, is run by Ed Seaman and his family. "Grandpa Rolland Jacks bought 955 acres of Santa Barbara wilderness back in 2002," he said. "He developed a small portion of the acreage into blueberries in 2004, wanting to get into the business."

Unfortunately for him and his family, a lot of others were also getting into blueberry production at the time; and they were not able to compete with the market prices at their costs and smaller level of production. Seaman's foreman, Tom Lemkuil shared, "Eventually we were only making about 50 cents a flat, and that just wasn't sustainable."

The family wasn't sure what to do, but they were still fixed on growing blueberries, so Jacks' wife suggested they set up a fruit stand and take advantage of the location of their farm being right alongside Highway 101. It's a high traffic area, and many folks coming in and out of Santa Barbara were willing to stop by to purchase some local berries. Things took off from there, and they eventually set up a more official stand, and began diversifying the farm with blackberries and raspberries.

Ed Seaman
shares his passion
for farming
blueberries,
blackberries &
raspberries





Raspberries in season

They began U-Pick farming as that became popular as well.

Seaman came on board with the family farm in 2009, after many years of working in IT. He didn't have a background in agriculture, but moved forward to help develop the business. "I made phone calls to every local market around, to see if they would work with us and sell our berries," he said. "Whole Foods was the first who agreed to work with us; but everyone else would not, even though they claim to be sourcing local produce."

Later, the drought came along, and like other farmers, they had to downsize their acreage a bit. This year, though, Seaman was grateful to see a lot more rain come and fill up the reservoirs and begin recharging a dwindling groundwater supply. "We had a good rainy season this year with 23 inches in this area," he shared. "Unfortunately though, almost a third of that came down in one weekend; and a lot of it ran off, so we really only got about 16 inches of useful rain."

Seaman explained that they have two small watersheds on the property, and just 12 inches of rain is a lot of water for them to handle and soak down into the soil. "Our berry farm is located around some very hilly terrain," he expressed. "Without the proper water flow, earthworks, and vegetation, we will never retain the water that we otherwise could."

Seaman has thought hard and looked into what they can do with their farmland to help recharge the aquifers and prevent run-off and erosion in the future, but he keeps running into unreasonably high costs for permits and too many government restrictions to be able to change much. "We have lots of

(continued on page 6)



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Ed Seaman

(continued from page 5)

wildlife and wild oak woodlands surrounding us,” he noted. “And we would love to implement some habitat restoration, planting some more oaks and grasses on the slopes to improve our erosion situation and really recharge the aquifers. We are currently working with the Cachuma Water District to make some of this happen.”

There really aren’t any other blueberry growers in the area. There is a cattle ranch next door, and some other livestock down the street, so they are pretty unique to the area in what they do. Blueberries thrive in acidic soils, and the natural pH of the area is around 7, so they have had some changing to do from the get-go. Seaman explained that they used to use citric acid to lower the pH, but that got very expensive and did not prove very effective at keeping the pH down. “We currently use a soil amendment (basically sulfuric acid) to lower the pH that we calibrate through the driplines,” Seaman explained. “Although this is a natural occurring element, most of this acid comes from open strip mines and we cannot get it organic certified; otherwise we would be an organic farm. We do not apply any pesticides, and we would like to add that certification to our label, but we couldn’t produce our blueberries without the sulfur.”

They have considered using a sulfur burner to lower the pH instead, which apparently qualifies for organic certification, but Seaman doesn’t believe that this carbon dioxide-producing tool will remain on the organic certification approved list for long though, so they are not going to pursue that.

As seaman explained, they haven’t had the need for pesticides on their farm, and that may be in part, due to the fact that blueberries are not native to the area. So although they don’t experience the same level of pest pressure as blueberry growers in other areas, they are still far from being pest-free.

Because of all the native oaks in the area, birds were the first culprits for stealing their crop away. “Birds love blueberries, and as a result, we lost about 70% of our first crop to them,” Seaman said. “From then on, we invested in bird netting that we suspend over the blueberries with steel cables and comes down on the sides. The netting has proven effective at keeping the birds out. After harvest, we take it back down and roll it up to store for the next year.”

The netting lasts about five years, before it should probably be replaced. This is where deer and other wild animals can be a problem though. “We’ve had deer, wild pigs and even a black bear come across the field,” he said. “The deer don’t actually eat the fruit, but they can really tear up the



Thornless
Blackberries,
great for
U-Pick

bird netting, just to get into the field to nibble on some leaves.”

Now that they have netting to manage the birds, their biggest pests in the field are the ones that burrow under the ground – gophers and ground squirrels. “When I first started, I recall seeing a blueberry bush that was dying on me, and didn’t understand why,” he said. “I tugged on it slightly and it came right out; and I found that every root had been chewed up by gophers. So we do everything we can to trap them, and then rely on the owls to take care of the rest.”

Other than the larger pests, spider mites are usually always around to one degree or another on the caneberries. To manage them, Seaman explained that they have used predatory mites, light oil that they apply in the beginning of the season, and even a good spray of water will knock them down. “We just got two inches of rain the other week, which was nice because it helped wash the mites off as well,” he said. “The only downside is that the rain will bring more weeds.”



Blueberries, just
about to ripen in
early May

Start rolling out the netting to protect the crop from the birds



Seaman had a good berry harvest this year, and the raspberries & blackberries are still going. “Blueberries are our main attraction, and we grow 17 different varieties, mainly southern high-bush varieties,” he shared. “But we are planning to add more raspberries and blackberries next year, because they are very popular. Our blackberries are Prime-Arc 45, which are spineless, so nobody gets poked when harvesting. That’s especially good for our U-Pick program. We are also planning on trying out some new blueberry varieties next year, being developed at a nursery in Florida.

At the fruit stand, they are also expanding the products they offer, with unprocessed honey from some beehives they have, blueberry Vanilla Shrub; and

(continued on page 22)



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Invasion of Brown Marmorated Stink Bug

Orchard Pest Update – Peach Growers Beware

By Jhalendra Rijal, Ph.D., UCCE Area IPM Advisor – San Joaquin, Stanislaus, Merced Counties

Brown marmorated stink bug (BMSB), is an invasive stink bug species, causing significant economic damage to several crops including tree fruits, vegetable and field crops in much of the US in the past 7-8 years. Although BMSB was detected in Allentown, Pennsylvania in the late 1990s, a major attention was given to this pest in 2010 when significant crop loss (~\$37 million by the apple industry alone) was reported in the Mid-Atlantic states. Currently, BMSB has been spread to more than 43 States from east to west including California. BMSB is a type of stink bug with size ~5/8 inch long, and marmorated (i.e., marble) brown color. Males are slightly smaller than the females, and lack of ‘claspers’ at



the end of the abdomen. Although there are few characteristics to look at, the presence of two white bands in the antennae of BMSB adults is the most typical to distinguish from other similar looking stink bugs such as rough stink bug and conperse stink bug.

The trend of establishing BMSB has been that they invade first in urban areas where they find a diversity of food sources such as fruit trees of different kinds, landscape and ornamental trees such as trees of heaven, Chinese pistache, catalpa, several species of the ash tree, Eastern redbud, English holy, etc. BMSB can be a significant nuisance pest during the winter due to their mass movement into houses. During the late Fall and early Winter, BMSB adults seek overwintering sites, predominately houses, barns, old trees and other enclosed structures, and that's the time when the residents notice the BMSB activity. In Spring, adults disperse from the overwintering shelters

to find early-season hosts commonly. BMSB prefers to feed on reproductive structures that include fruits and seeds. BMSB females deposit light-green eggs on the underside of leaves (**Fig. 1**). BMSB has five nymphal stages. All life stages, except the first instar, actively feed on fruits by inserting their straw-like mouth part, injecting the salivary enzyme into the fruit and sucking the softened content from the fruits. Unlike other stink bugs, BMSB is active in orchards throughout the growing season and has one or two generations per year in cooler climates and more generations in warmer climates. Direct feeding damage on fruits is characterized by the presence of a depressed area, discolored surface and necrotic spots typically beneath the fruit surface. Peaches and nectarines are considered ‘high risk’ crops to BMSB attack from fruit set through harvest. Feeding can cause significant damage on young and mature peaches by developing necrotic areas inside the fruit, which results in unmarketable fruits for both fresh and canning purposes. See some feeding damage in **Fig 2 (page 10)**.

In California, although BMSB was first detected in Los Angeles County in 2002, a large population of BMSB has been discovered in Midtown Sacramento in Fall 2013, and since then BMSB has been showing up in many community gardens and parks, other business and residential areas of the Sacramento metropolitan area. To date, there are 9 Counties (Butte, Sutter, Yolo, Sacramento, San Joaquin, Santa Clara, Los Angeles, Siskiyou, and Stanislaus) with an established BMSB population. The reproducing population of BMSB was detected for the first time in Stanislaus County in the summer of 2015 near freeway-99 in Modesto. Since then, residents from

(continued on page 10)



Figure 1. BMSB first instar nymphs surrounding the egg mass after hatching (on a nectarine leaf)



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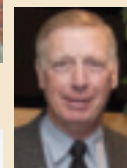
Kevin Day, UCCE Tulare County Director & Pomology Advisor



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Gary Schulz, California Citrus Research Board, President



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Brown Marmorated Stink Bug

(continued from page 8)

Modesto metropolitan area reported sightings of BMSB in their houses, backyard fruit and ornamental trees, and parks. However, BMSB has not been reported in the agricultural area in California until recently.

Given the indication of spreading BMSB in Modesto and nearby areas, and having commercial agriculture as close as a few miles from the infested residential area, BMSB potentially poses a serious threat to several crops including peach, one of the favorite hosts of BMSB.

In 2016, we conducted detection monitoring in several peach orchards in Stanislaus and Merced Counties using standard BMSB pyramid traps and captured more than 30 BMSB adults from one of the peach orchards located about 8 miles east of Highway-99. This was the first report of BMSB infestation in an agricultural area of California.

Fig 2 External feeding damage on peaches

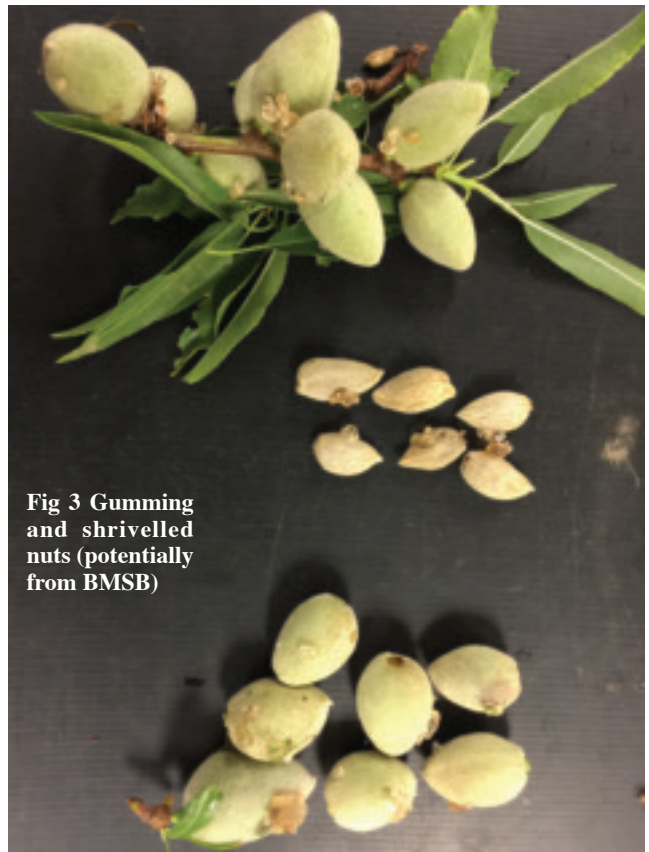


Fig 3 Gumming and shrivelled nuts (potentially from BMSB)

The highest capture was recorded around mid-October. In 2017, we deployed traps in different host crops (peaches, almonds, walnuts) and began capturing BMSB adults in mid-March, likely an overwintering generation. Some of these orchards, especially in walnuts, traps were placed based on the growers' report of BMSB invading their houses next to the orchard during the winter; we have not noticed any BMSB live stage or feeding activity on walnut trees and fruits during our sampling.

In mid-June, BMSB adults, nymphs, and egg masses were found in almond trees in one orchard located in the same general area. At that site, we recorded a significant number of green nuts with clear gumming, a sign of stink bug feeding. BMSB feeding can be confused with



Fig 4 Internal feeding damage on peach

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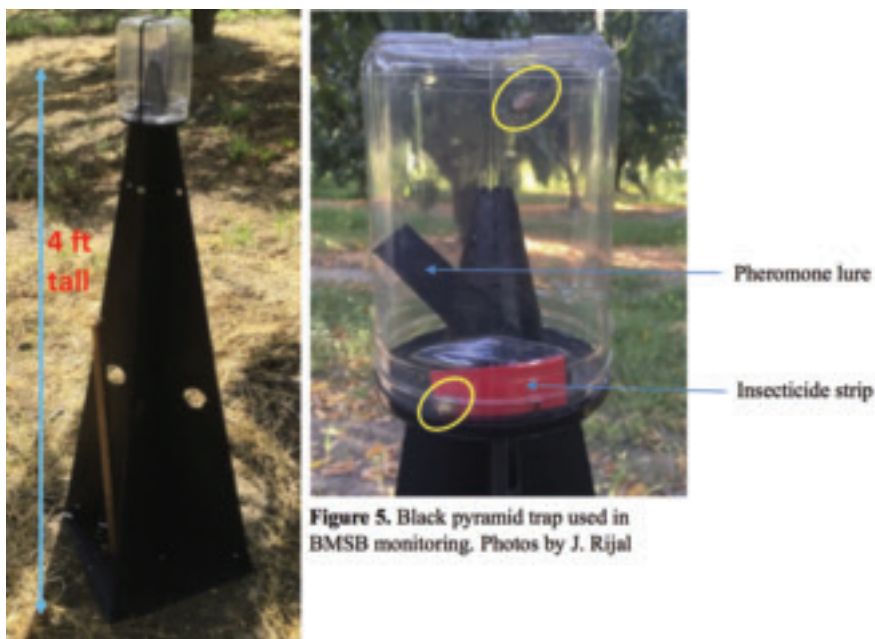


Figure 5. Black pyramid trap used in BMSB monitoring. Photos by J. Rijal

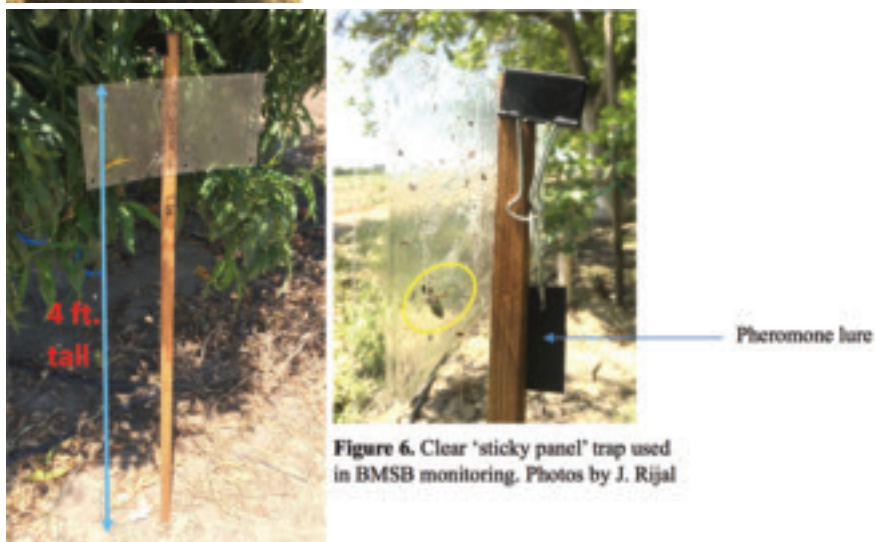


Figure 6. Clear 'sticky panel' trap used in BMSB monitoring. Photos by J. Rijal

that of leaffooted plant bug and other common stink bugs externally. However, excessive gumming and a high number of feeding sites into the nuts with internal necrotic spots (Fig.3) were closely associated with the BMSB feeding signs to young peaches (Fig4).

In some of the sample nut collected, we can see some evidence that BMSB can penetrate to the nut and inside nut meat, but at this point, we don't have enough data to know the extent of damage BMSB can do in almonds.

Based on BMSB monitoring studies and our observations, and reports from growers, there is a clear indication that BMSB has been moving to the agricultural area. At this point, we urge growers and pest control advisers to pay close attention to this stink bug in orchards particularly peaches and almonds. Visual observation in different parts of the orchard is recommended

especially border rows and trees.

Monitoring is critical, especially if the orchard is near urban areas with known tree hosts such as the tree of heaven. Visual observations of egg masses, live insects and damaged fruit (deformed fruits, fruits exuding gum) and beat tray sampling (i.e., shaking branches/twigs to dislodge insects) are early BMSB detection methods. Also, placement of BMSB-specific lures in black pyramid traps (Fig 5) and/or in sticky panel traps (Fig 6), in the border rows of the orchard is recommended to detect BMSB activity and infestation.

The 'sticky panel trap' seems to be equally effective in catching BMSB, based on our short-term observation. This trap is much easier to use and less expensive. Although may be too early to discuss details about options to control BMSB in California, it is good to have information on what's available to use when needed.

Insecticide has been the primary line of defense for BMSB in other States particularly on the mid-Atlantic States where the problem has been the most severe. Although insecticide related data generated from other States may be extrapolated and used in California conditions, the field efficacy data of BMSB targeted insecticides in California is not available, simply due to a low and sporadic presence of BMSB population in California cropping areas. **CFF**

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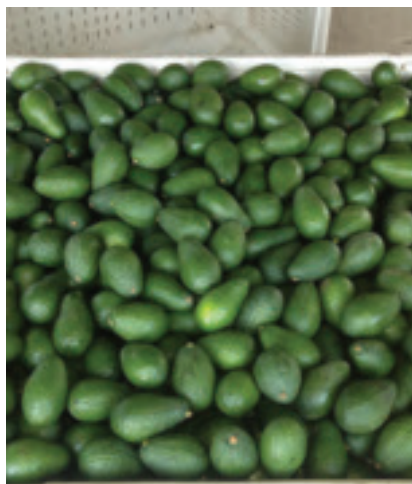
California Fresh Fruit News



Avocado Pest Meeting in Fallbrook, Sept. 28

Southern California avocado growers, mark your calendars for the UC Cooperative Extension "Controlling Pests in Avocados Round Table Meeting" to be held on Sept. 28th from 8:00 a.m. – noon at the Fallbrook Public Utility District (990 E. Mission Rd., Fallbrook, CA 92028).

The discussions will include: an introduction to avocado integrated weed management with UCCE Farm Advisor Sonia Rios; old challenges/new possible solutions - pesticide resistance, new pesticides, etc.... with Mary Lu Arpaia & Sonia Rios; a review of redbay ambrosia beetle & laurel wilt disease with Tim Spann from the California Avocado Commission; and new challenges with laurel wilt disease & other pest challenges with Mary Lu Arpaia & Sonia Rios. Please Register for this free event at <https://ucanr.edu/survey/survey.cfm?surveynumber=21655>. Continuing education credits have been applied for, and light refreshments & pastries will be available upon arrival. Any questions can be directed to Sonia Rios with the UCCE Riverside/San Diego Counties at sirios@ucanr.edu.



CA Red Scale ID & Parasite Life Stages Workshop in Lindcove, Sept. 28

PCAs who want to learn how to better recognize the various life stages of scale and their parasites are invited to attend a Red Scale Identification & Parasite Life Stages Workshop at the Lindcove Research & Extension Center (22963 Carson Ave., Exeter, CA 93221) on September 28th. With this knowledge PCAs can determine the level of parasitism of California red scale in their citrus orchards and make better decisions about scale control tactics.

Led by Dr. Beth Grafton-Cardwell,



CA Red Scale ID & Parasite Life Stages

the workshop will run from 8:00 AM to 4:00 PM. Cost of the Workshop is \$40 (including lunch and classroom materials). Class size is limited to 25 participants so early sign-up is recommended. A check will reserve your place in the class and checks are made payable to the UC Regents. Participants should bring a hand lens and 10-20 pieces of scale-infested fruit from one of their own orchards to the class (make sure to remove all leaves and stems and bring it in a closed bag to protect LREC from Asian citrus psyllid). Continuing education credits (6 other) have been approved for this course. For more information and to sign up for this course, contact Jasmin Del Toro at (559) 592-2408 ext 151.

UC Davis Master Milling Certificate Course, Sept. 28

The UC Davis Master Milling Certificate Course has helped hundreds of olive oil processors produce better oil more efficiently. The course will be led by Leandro Ravetti, among the world's top experts in olive oil processing, growing, and standards. As executive director of Australia's Boundary Bend Limited, Leandro has helped guide the company to rapid growth, optimum efficiency, and top awards at international olive oil competitions. The company's success is guided by innovation, data, and analysis to maximize oil production efficiency and quality.

The course will include a field trip to three olive oil processors in Yolo County, including to Boundary Bend's new U.S. facility in nearby Woodland. Olive oil will be processed on-site at UC Davis by Olive2Bottle Mobile Services. The course begins on Thursday, September 28th at 8 a.m. at the Robert Mondavi Institute Silverado Sensory Theater. For more information and to register for this course, visit

<https://registration.ucdavis.edu/Item/Details/310> by Tuesday September 26th.

California Avocado Society Annual Meeting, Oct. 20 – 21

The California Avocado Society's 102nd Annual Meeting will be held at the Four Points by Sheraton Ventura Harbor Resort on October 20–21, 2017. It will include a Friday Field Tour of a commercial avocado ripening facility, Fruit growers Laboratories, Brokaw Orchard and Dominguez Orchard. A President's Reception BBQ will follow that evening.

Saturday will feature a variety of experts speaking about current and upcoming materials and technology in remote sensing, germplasm cryopreservation, soil and tissue analysis, varieties and rootstocks, and a panel of top growers talking about organics, management problems, planting densities, and orchard pruning. For more information, as well as hotel accommodations, visit <http://californiaavocadosociety.org/annual-meeting.html>.

LREC Citrus Display & Tasting, Dec. 8

Save the date, December 8th (9:00 AM - 12:00 PM), for the annual citrus fruit display and tasting at the Lindcove Research and Extension Center Line. Citrus growers are invited to come taste and discuss new low seeded citrus varieties with Dr. Mikeal Roose, and ask UC advisors Craig Kallsen and Greg Douhan your citrus questions. In addition to taste testing fruit, there will be a walking tour at 10:00 AM starting with a presentation of the Citrus Clonal Protection Program by Dr. Georgios Vidalakis, continuing on to the demonstration orchard with Dr. Tracy Kahn who will discuss varieties.

Directions: Take Highway 198 east to Mehrten Drive



LREC Citrus Display & Tasting,

calfreshfruit.com / Sept/Oct 2017

(approximately 15 miles) and follow the signs to our Event. The University of California, Lindcove Research & Extension Center is located at 22963 Carson Ave, Exeter, CA. The Conference Center is located at the end of Carson Ave on the right. If you have any questions please contact Jasmin Del Toro at 559-592-2408 or jzdeltoro@ucanr.edu.

Update from the California Olive Oil Council

The California olive oil industry is

gearing up for the 2017 harvest, with production forecasted at 4.3 million gallons this year. That's an increase of 0.8 million gallons from last year's harvest 3.5 million gallons. The industry has been experiencing significant growth and investment within the last five years, due to a significant rise in demand for California olive oil in the U.S. The domestic market share of California olive oil has grown from less than 1% to 6%. As of the first quarter 2017, there were about 40,000

(continued on page 14)

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California Fresh Fruit Newsbriefs

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acres in California, managed by over 400 growers/producers of olive oil. Another 20,000 acres is expected for planting by 2020. The California Olive Oil Council also noted that their 2018 Annual Member Meeting will be taking place on April 27-28 in Monterey, CA – so save the date.



UCCE Farm Advisor Janet Caprile Retires

As of July 1st, Contra Costa and Alameda County Farm Advisor Janet Caprile retired after more than 30

years working with UC Cooperative Extension. Agriculture has changed a lot in this area during this time frame, due to changing market conditions, increasing regulations and new pest introductions.

Reflecting on the past few decades and what she has accomplished in collaboration with the industry, she shared some of these successes. “We developed mating disruption and other effective, reduced risk pest management approaches to replace some of our more traditional materials; we published the very first organic production manual in the UC system (Organic Apple Production) leading the way for future organic research on other crops; we eradicated Cherry Buckskin disease, Glassy Winged Sharpshooter, and Vine Mealy Bug; we had a successful program in place to control Spotted Wing Drosophila within a year of introduction and continue to fine-tune this program; we helped to fine-tune irrigation management in response to drought conditions, new regulations, and new water conserving irrigation systems; we changed the county General Plan, the California Health Code, and the California Food and Ag Code to allow for more diverse, direct marketing opportunities for local growers; we provided pesticide safety training to over 3000 farmworkers over the years to improve farm safety and to help growers address new regulations; we provided science-based information to local growers on an on-call basis on a whole variety of topics from solving specific field problems to starting a new farm or enterprise.”

“Of course none of the above would have ever been possible without

the good ideas, direction, generosity, patience, time, resources, trust and support provided to me by the local ag community. Thank you! I feel honored to have been a part of this community and hope to continue to be - but in a slightly different capacity.”

After a summer break, Caprile plans to return on a limited basis to continue with some ongoing research trials and a few other selected activities until a new Farm Advisor comes on board.

Sphecid Wasp of the Genus *Pemphedron* in Raspberries

Message from UC Farm Advisor Mark Boldt: There have been some reports of a small black wasp associated with hollowed out raspberry laterals and some lateral death this past summer. What confounded us was actually getting a live sample, but we finally had a good one submitted (thanks to Jaime Lopez from Reiter Affiliated Companies) and could make an identification that these are sphecid wasps of the genus *Pemphedron*.

According to the High Plains Integrated Management Website, sphecid wasps of the genus *Pemphedron* are aphid hunters. This is good, but the more interesting part for us on this is that these wasps actually excavate chambers out of the pith of plant branches. Critically, the wasps gain entrance to the branch by any vertical break - pruning, tipping or branch breakage. Since neither the xylem nor the phloem elements of the plant are concentrated in the pith, one would not expect a lot of plant damage coming from this activity. That said, the grower who has been communicating



Janet Caprile



Sphecid Wasp

with me on this has indeed reported a correlation with some dead laterals and *Pemphedron* wasp excavation.

To answer the inevitable question, this is a «C» rated pest, meaning it's not invasive and not going to generate unwanted regulatory attention. I would leave it alone, but things change all the time and so it still bears watching given the ability to cause plant problems.

New Orchard Systems Farm Advisor

Butte, Glenn, and Tehama Counties are proud to present Luke Milliron as their new UC Cooperative Extension Orchard Systems Farm Advisor. Milliron is based out of the Butte County Cooperative Extension Office in Oroville. He grew up in Chico and studied Crop Science at Butte College and Chico State. While attending Chico State, he worked as a Student Assistant to Tree Crop Farm Advisor Bill Krueger, who became a mentor for him.

In 2013, he left Chico to pursue a Master of Science degree in Horticulture and Agronomy at UC Davis. While at UC Davis in the midst of drought in California, he studied the measurement of almond tree water stress during dormancy. In 2015, he was selected as the UCCE Horticulture Intern, an internship program funded by the Almond Board of California and the California Dried Plum Board aimed at training the next generation for UC Cooperative Extension. In this internship he worked on UC field trials in Sutter, Yuba and Colusa County almond and prune orchards with Farm Advisor Franz Niederholzer.

More recently, he has been working as an Agronomy Technician at Dellavalle Laboratory, Inc. in Davis. At Dellavalle, he assisted growers with analytic crop nutrient management through soil and plant tissue sampling and irrigation management support in almond, walnut, grapevine and processing tomato systems. "At each step in my journey, I have greatly enjoyed working with growers and other agriculture professionals," he shared. "I am humbled and very excited to work as your farm advisor. I encourage you to contact me by sending an email at lkmilliron@ucanr.edu, giving me a call at (530) 538-7201 or stopping by the office at 2279-B Del Oro Avenue

in Oroville."

Canned Peach Imports Down 18%, Exports Fall 29%

Update from the California Canning Peach Association: Canned peach imports for the 2016/17 marketing amount to 4,647,620 cases, down 18% from last year's record high of 5,685,551 cases imported. China continues to be the leading importer with 2,810,027 cases shipped (61% of total volume) followed by Greece with 1,125,815 cases (24%) and Chile with 317,693 cases (7%). The

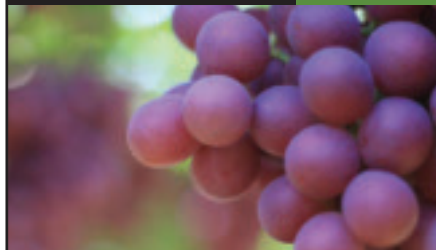
2016/17 import volume represents the equivalent of nearly 90,000 tons of raw product, which amounts to almost 30% of California's 2017 peach crop. U.S. canned peach exports fell by 29% to 400,214 cases which amounts to our lowest export sales volume during the past 40 years. Canada continues to be our largest export destination with 191,447 cases shipped, followed by Mexico with 88,860 cases. Surprisingly, our third largest export destination this year was Venezuela with 24,349 cases shipped vs. no shipments at all during 2015/16.



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Laurel Wilt Disease Devastates Florida Avocado Industry

Seminar Preps CA Growers for the Arrival of this Deadly Fungus

By Nancy Power, Southern California Correspondent

A recent seminar on laurel wilt disease in avocado, held in Fallbrook, brought six speakers from the University of Florida to inform California growers about the new scourge. According to tropical fruit crops extension agent Jeff Wasielewski, the fungal disease from Asia was first recorded in the U.S. in May of 2002 in Georgia, where a female red bay ambrosia beetle (about half the size of a grain of rice) transmitted laurel wilt to a native red bay laurel tree.

The laurel trees respond by blocking off the infected parts of the xylem, causing the leaves to wilt and then turn brown. Another sign is sawdust from the beetle. A cross section of the tree reveals dark streaks in the xylem and tunnels called “galleries” where the fungus grows. The trees die so fast from this disease that they do not even drop their leaves. While the initial entry of the disease into the U.S. was mediated by a beetle, the fungus also can pass through natural root grafts from one tree to another.

Since Georgia, the disease has spread north to North Carolina, west to Texas and south to Florida, where it infests avocado trees. If no measures are taken to stop it, the disease can spread from one tree to 95 trees within 6 months. ALL avocado cultivars are susceptible. So far, 96% of the avocado groves in Florida have been infected,



Jonathan Crane

with an estimated \$1.7 million dollars of fruit loss in 40,000 trees. The cost of control there since 2012 exceeds \$5 million. So far the growers have replaced nearly 15,000 trees, in order to deter the beetles, which thrive more on older trees.

California is susceptible to even greater loss if the disease reaches here. Compared to 7,500 acres of avocados in Florida, California has more than 50,000 acres, mainly in San Diego and Ventura counties.

Plant Pathology

Plant pathologist Randy Ploetz talked about how to slow the spread of laurel wilt, in spite of the discouraging news that the laurel wilt fungus has spread to at least nine different ambrosia beetle species since it arrived in

Georgia. Such lateral transfer to other vector species is unprecedented.

A map of the spread of the disease shows that it follows highways, implicating humans in the dispersal. As a result, the extension service in Florida established a campaign to urge people not to transport wood.

Avocado growers are encouraged to diagnose the disease by looking for wilting, and if found, cutting open the limbs to look for dark streaks in the xylem. If dark streaks are present, tissue samples from three different locations in the tree should be sent by fast delivery (so the samples do not dry out) to the cooperative extension service for a molecular confirmation of the fungus. Trees thus confirmed should be cut down and chipped. Chipping kills both the vector and the pathogen, preventing the spread of the disease.

Besides this sanitation method, trenching between the trees can stop the root-to-root spread, but this is a problem if in-ground irrigation is in place. Root graft spread is the most dangerous method of spread in the orchard.

Although no avocado varieties are resistant, the Mexican-Guatemalan hybrids common in California tolerate the disease better than the West Indian varieties grown in Florida.



Red bay ambrosia beetle

The Mexican-Guatemalan trees have narrower xylem tubes, which slow the spread of the fungus.

Fungicides can help prevent the disease, but they do not help once the disease is present. Triazoles especially are effective if used in the bark (with a surfactant), in soil, or injected through the thick bark of large trees. The fungicides have limits, though: they require annual application, but get less effective each year, and they can damage the trees, not to mention that the treatments are expensive.

Of all of the management approaches mentioned, Ploetz emphasized the importance of removing infected trees.

Plant Physiology

Plant physiologist Bruce Shaffer is investigating ways to diagnose laurel wilt before outward symptoms show, by measuring gas exchange in leaves, rate of photosynthesis, stomatal conductance, transpiration, and water use efficiency. So far he has found that root and stem hydraulic conductivity is lower in infected plants. He is also investigating the laurel wilt tolerance of the three different types of avocado rootstocks (West Indian, Guatemalan and Mexican) and different rootstock/scion combinations.

Entomology

Entomologist Daniel Carrillo explained the life history of the vector beetles and how to manage them. The redbay ambrosia beetle, *Xyleborus glabratus*, and the native ambrosia beetles that now transmit laurel wilt, have pockets in their mandibles that carry the fungal spores. Each vector beetle species has 5-6 fungal symbionts, most of which are not pathogens. The female beetles selectively maintain and transport fungi during dispersal. As poor flyers, the females fly in calm air at twilight. Each female lands on bark and attempts to bore into it, but many die due to the tree's reaction to the attempted invasion. Male beetles, on the other hand, never leave the gallery in the host tree. They mate with their sisters, and then the sisters disperse to the same tree or a new tree.

The redbay ambrosia beetle plus laurel wilt fungus have already killed half a billion native lauraceous trees, including redbay laurel and sassafras,



Randy Ploetz

causing an ecological catastrophe in the southeastern U.S. Avocado is a relatively poor host, in that the beetle does not breed well in it, but the trees still die. Several species of ambrosia beetle can carry the fungus, and multiple species may infect one tree at the same time. The beetles can transmit the disease even if they start boring but do not breed on the tree.

Ambrosia beetle management is difficult because the beetles are inside the tree for 95% of their 30–60 day life cycle. The avocado grower can employ several practices to lessen the impact, however. The first is to maintain healthy trees, because the beetle tends to attack trees that are stressed by flooding, *Phytophthora*, poor nutrition, lightning, freezing, etc. A second practice is pruning to make the canopy more open, as the beetles prefer a dense canopy. A third practice is destroying infected trees by burning them or chipping them into smaller than 5-inch pieces. All parts of the tree need to be chipped, including limbs, stumps and roots. Logs left unchipped can produce hundreds of beetles per week that will infect other trees. Even the wood chips can attract new beetles for up to 3 weeks, so the chips should be spread out to dry, and sprayed twice, 10 days apart, with insecticide or biopesticide, plus a sticker. The sticker prolongs efficacy. The best insecticide is a combination of zeta-cypermethrin and bifenthrin on non-bearing trees. The insecticide Cobalt® is more effective, but it contains chlorpyrifos, which the EPA is moving to disallow.

Syngenta is working on a new form of emamectin benzoate that is acceptable for systemic injection in food trees, but so far this chemical is registered only for ornamental trees.

Beyond insecticides, Carrillo reports that no predators or parasitoids are available for biocontrol, but recommends the commercially available fungus *Beauveria bassiana* and the biofungicides PFR-97 and Met 52. Unfortunately these take 3-7 days to kill the beetles, long enough for the beetles to transmit the disease before they die. Some vector beetle species are more susceptible than others to these fungal products. On the positive side, they also control other pest insects such as mirids and thrips, and are more persistent than chemical insecticides. On the down side, they do not kill beetles already inside the tree, and they are incompatible with some fungicides and insecticides.

On a regional scale, the vector can be managed by restricting the movement of wood and removing infected, unmanaged avocado groves. Meanwhile, the extension service is working on identifying more virulent strains of entomopathogens to kill the beetles, searching for arthropod biocontrol agents, finding controls that work inside the trees, and adding to the known list of ambrosia beetle attractants, such as querciverol and α -copaene, and repellents, such as verbenone and methyl salicylate.

Economics

Edward “Gilly” Evans, spoke about the economics of roguing, with or without replacing the removed trees. His recommendations are based on 100 trees per acre and replanting every 25 years rather than 40 or more years. The cost of infusion with fungicide can be lessened by \$7 per tree by combining it with treatment for *Phytophthora*, reducing the cost from \$1300 to \$700 per acre for laurel wilt. Macro infusion is effective initially, but not sustainable to repeat annually because of the tree response. The beetles prefer a dark, thick canopy, so top working the grove is recommended and is profitable even with low prices for avocados. Replanting the grove with high yielding trees is profitable only if avocado prices are high, but roguing and replacement

(continued on page 21)

California Fresh Fruit

Autumn Orchard Tasks



Orchard Management Considerations Following a Heavy Crop

By Franz Niederholzer

2017 has been quite a year, with at or near record rains and river levels followed by extended summer heat. The rains helped with snow pack and reservoir levels, but extended soil saturation in many orchards didn't prepare prune root systems for the demands of feeding a big crop and cooling the orchard (through transpiration). Many orchards in this region saw heavy crops of small fruit and return of "prune dieback" due to a combination of fruit sunburn, high potassium demand in June/July, and disease infection. The heat also helped suppress sugar levels and slow fruit maturity as harvest approached. With all this cheery background in mind, here are some considerations for orchard practices for the fall, with a focus on cost efficiency and return on investment:

Cost Saving Questions for Fall 2017: Skip pruning? There is a significant savings to growers when skipping pruning in a mature orchards, but only if you are ready to shaker thin the crop if needed. There is NO savings – and probably significant income loss – if you don't prune, but then set a huge crop and don't thin. That will produce lots of small fruit that will break limbs, cause sunburn, and worsen Cytospora infections.

Skip fall potassium? This idea is less attractive this fall than last, as a big crop uses a lot of potassium (K). If you had a big crop this year (and most growers did) consider banding the maintenance rate of 400-500 lbs. of K fertilizer (dry potassium sulfate or muriate of potash) late this fall after leaves begin to drop. Another option is to wait until early April 2018 to check crop set before starting foliar and/or water run K fertilizer



Franz Niederholzer is a UC Farm Advisor in Colusa, Sutter & Yuba Counties

applications. Fall K applications mean one less thing to worry about in the spring and the investment literally isn't going anywhere (it will stay in the soil to be used by the next good crop). If it has been three or more years since you applied a fall, maintenance rate of potassium, this year might be a good year to put it on. More detailed information on K nutrition in prunes can be found at: <http://www.sacvalleyorchards.com/prunes/horticulture-prunes/potassium-nutrition-maintaining-optimal-levels/>

Do you need a full dormant spray? Ask your PCA to do a spur sample to check for scale. Find videos on how to conduct a dormant spur sampling at: ipm.ucdavis.edu/PMG/r606900511.html (sampling form: ipm.ucdavis.edu/PMG/C606/prune-dormantspursample.pdf). If there is no need to spray for scale, but you have a history of aphid pressure, consider a low rate of pyrethroid in late October or November as a dormant spray replacement for this year. A fall aphid spray with a pyrethroid (Asana, Warrior, etc.) can be tank mixed with zinc sulfate foliar fertilizer. A fall pyrethroid spray only controls aphids the following year, but that is the only annual problem in many prune orchards. Peach twig borer can be controlled with B.t. (DiPel, Javelin; doesn't harm bees) tank mixed with bloom fungicides. If there is not enough scale to warrant treatment, skip the full dormant spray for this year.

Skip pre-emergence weed spray? Can you get away for a year with no pre-emergence spray? Times have changed

and fleabane is glyphosate resistant. Talk with your PCA about your options. How much money and time will a weedy orchard cost you at harvest in spilled fruit and barked trees? What are your options? Unless you can mow down the fleabane ahead of harvest, a good pre-emergence program might be worth the cost, even this year.

General Fall Practices to Consider in Prune Orchards:

Pruning: Avoid pruning shortly ahead of rainfall events, especially young trees in new plantings or interplants. Rain-splash can result in costly disease spread to freshly cut branches. If you have to prune ahead of rain, consider a fungicide spray (Topsin-M and/or Rally) after cutting to protect the open, fresh pruning wounds from disease infection.

Prune out existing Cytospora cankers by cutting several inches to a foot below any symptoms (dead bark). The pruned out wood should be removed from the orchard and burned. If an orchard has a lot of dieback/dead wood, consider a special crew or employee to just cut out diseased and damaged wood. This lets them focus on the cuts to clean up the orchard and not go back and forth between regular pruning cuts and orchard clean up. Consider fungicide spray(s) in the orchard to protect pruning wounds if rain is forecast. Information on identifying Cytospora cankers plus pictures of "Good" and "Bad" cuts for Cytospora control that can be laminated into a shirt-pocket sized handout and given to pruners can be found at: <http://www.sacvalleyorchards.com/prunes/pruners-pocket-guide-for-cutting-out-cytospora/>

Irrigation: Keep up with orchard irrigation needs. As the days grow shorter

(continued on page 20)

California Fresh Fruit / Sept/Oct 2017



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Autumn Orchard Tasks

(continued from page 18)

and cooler (soon!), orchard irrigation needs to decline, but not completely cut. Use ET estimate (available for north and south Sacramento Valley at: <http://www.sacvalleyorchards.com/et-reports/>) or soil moisture evaluation (electronic sensor or by hand using auger or shovel) to determine when and how much irrigation water to apply. Don't forget to account for efficiency of the irrigation system (evaporation, etc.)

when deciding how much water to use. Why worry about irrigation headed into the fall? For one, water stressed prune trees are more susceptible to Cytospora canker spread compared to well-watered trees.

Nutrition: Foliar zinc (36% zinc sulfate) can be applied at the beginning of leaf drop in late October or early November at about 20 lbs. material/acre in 100 gallons water/acre. This zinc sulfate rate and timing may drop leaves, disrupting aphid reproduction

and reducing the risk of tree blow over in strong wind. [A low rate of pyrethroid insecticide can be tank mixed with this zinc sulfate application rate and timing for good aphid control next year.]

A lower rate of zinc sulfate (5 lbs. material/acre in 100 gallons water per acre) is an effective zinc foliar fertilizer spray when applied ahead of natural leaf drop (late September or early October). This lighter rate will not accelerate leaf drop. This timing is too early for pyrethroid tank mix for aphid control next year.

Once leaves drop, trees won't pick up nitrogen until bud break in spring. Any nitrogen applied in the fall is likely to be leached from the root zone before spring, especially if we have a wet winter. Don't apply nitrogen between start of leaf drop and after growth begins next spring.

Weed Management: Following a postharvest weed survey (ipm.ucdavis.edu/PMG/C606/prune-fallweeds.pdf), apply mid to late fall pre-emergence herbicide applications with a post-emergence, "burn down" material if needed shortly before moderate rainfall (0.25"-0.5") to move the material into the soil. If the weather forecast calls for inches of rain, wait. Inches of rain can move a product deeper in the soil than desired for the best weed control. Pre-emergence herbicide incorporation calls for a quarter to half an inch of rain.

Consult your PCA about effective pre-emergence herbicides for fleabane. The traditional "Surflan/Prowl + Goal" program doesn't give good fleabane control. Skipping a fall pre-emergence spray may cost more money than you save. "Roundup-only" weed spray programs are no longer effective with the development of glyphosate resistant weeds like fleabane and marehail. Glufosinate (Rely) is now registered in prunes, but good timing and repeated applications may be needed for effective fleabane control.

Gopher Management: Late fall through late winter is an excellent time to focus on gopher control. This is a time when gopher populations are generally lower than the rest of the year, before they begin the spring breeding cycle. [Gophers have two breeding "pulses"--in late winter into spring and then again in the fall.] See recent UC IPM gopher control information at: <http://ipm.ucanr.edu/PMG/r105600211.html>. 



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Laurel Wilt Disease

(continued from page 17)

with higher yielding trees is always a good bet. Monitoring, spot treatment and suppression of the beetle also pays off.

Horticulture

The final speaker at the conference, horticulturist Jonathan Crane emphasized the virulence of laurel wilt disease. Unlike the fungal disease carried by the polyphagous shot hole borer, laurel wilt is not localized in certain parts of the tree, but spreads quickly through the xylem to the entire tree. Crane showed photos of avocado trees that transformed from green and healthy to brown and dead in less than a month due to laurel wilt. Crane warned that if an infected tree is left intact, it becomes the source for 3-5 new infected trees per month, which in turn become the source for yet more infected trees. He urged early detection as the key to management, requiring at least weekly scouting. Crane noted four methods of scouting: manned helicopter, drones, monitoring from the ground, and canine olfactory detection. Of these, drones seem most feasible. Crane warns, though, to be sure to follow FAA regulations, such as keeping the drone in sight. The drones still need the development of a more user-friendly interface and more field-testing of identifying laurel wilt. Their advantage is that they can scout an acre per minute, and so can be used frequently to catch symptomatic trees

early. Trees identified by the drone as having laurel wilt should be rogued immediately. New machines that grind the tree in place in 10 minutes can assist with this. In addition, two to three adjacent trees in all directions from the infected tree should be hat-racked or stumped and grafted with a better cultivar, and spot treated with infusion or injection.

Young trees are less susceptible to the disease spreading underground, because they are not root grafted to nearby trees, so replacing trees more frequently, such as every 25 years, may help. Varieties with narrower trunks and limbs are also less susceptible.

Crane had several recommendations for California to prepare for laurel wilt:

- Determine the native and exotic laurel wilt and ambrosia beetle hosts;
- Identify potential paths of laurel wilt introduction;
- Identify which local ambrosia beetle species are capable of transmitting laurel wilt; and
- Plan with both horticultural and forestry scientific and regulatory agencies to develop a plan for eradication or management if laurel wilt does get introduced to California.

As with huanglongbing disease in citrus, California avocado growers can benefit from the knowledge and experience that Florida growers and researchers have gained from battling laurel wilt and its vectors for the past 15 years since an infected red bay ambrosia beetle entered a port in Georgia and bored into a red bay laurel tree. **CFF**

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Ed Seaman

(continued from page 7)

next year, they are looking to get into blueberry vinegar.

Just like any farmer, Seaman is frustrated with the lack of care the state seems to have for agriculture, reflected by the current laws and regulations coming out of Sacramento. Seaman is especially concerned for the survival of the small farms in California like his own. "The small farmers are really hurting with today's laws and regulations," he expressed. "We lose about 533 of them per year, according to USDA statistics since 1992. The struggles we had starting our business were almost completely due to the fact that we are small farmers – otherwise, we probably could have made it in the conventional market. We really need some policy changes. Our voices need to be heard. To truly be sustainable, you need to be profitable. You can't just look at the environmental practices involved – you also need to consider who is going to farm it, who is willing to maintain the land and make things work for future generations. You can't just keep increasing costly laws and regulations."

To try and make a difference, Seaman participates in organizations like the Wild Farmlands Foundation, which was established on the coast to support small farms. In addition to reaching out to policy makers through these organizations, he also takes every opportunity to educate the public on the importance of agriculture and its needs. Having their farm and fruit stand right

The much-needed early season rains also brought on weeds and erosion.



on Highway 101, they enjoy bringing in customers from all over world, many who get to walk around on the farm and see how their berries are grown.

"We do lots of educational outreach with the kids in Santa Barbara, many of which have never stepped foot on a farm before," he said. "We welcome

them from the schools and other youth groups, and give them the opportunity to participate in some of the cultural practices like hoeing down weeds and harvesting. One 16 year-old girl that came out here saw our neighbor's cow and got so excited because she had never seen a real cow 'moo' before. That just reaffirmed my thought that we really need to get these kids out here. We teach them about how we farm, the history of the area, and about the local nature and wildlife."

Although Seaman didn't have the privilege of growing up on the farm, he is grateful for his family starting up the berry farm, so that his four kids could get the chance to experience life on the farm. They have all worked on the operation at one capacity or another and enjoyed the experience. His youngest is still working at the fruit stand today. These youth are the future of agriculture and its advocates.

Editor's Note: Learn more about Ed Seaman and his berry farm by watching his video interview with California Ag Network on CalFreshFruit.com.



Caneberry mix from Ed Seaman's family farm



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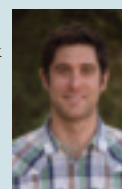
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“Orchard Weed Management”

Brad Hanson, Weed Extension Specialist, UC Davis

Brad
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“Update on Laws & Regulations” (1 hour Laws & Regs)

Marline Azevedo, Inspector, Stanislaus County Ag Commissioner's Office

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“Rodent/Bird Control”

David Kratville, CDFA Vertebrate Program Manager

David
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“Update on California Water Situation”

Aubrey Bettencourt, Executive Director, California Water Alliance

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“FLC - Grower Relations While Managing Labor Shortages”

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