

WEST COAST NUT

FEBRUARY 2019 ISSUE

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Growers Need to be on the
Lookout for BMSB**

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By the Industry, For the Industry

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Economic Outlook for the 2019 Almond Pollination Season

Happy New Year! With every new year comes the realization that almond orchards will be in full bloom before long. This article summarizes some considerations for this year's almond bloom, as well as what to expect in terms of colony supplies and pollination fees in the years to come.

See full article on page 4





ECONOMIC OUTLOOK FOR THE 2019 ALMOND POLLINATION SEASON



Happy New Year! With every new year comes the realization that almond orchards will be in full bloom before long. This article summarizes some considerations for this year's almond bloom, as well as what to expect in terms of colony supplies and pollination fees in the years to come.

by
BRITTNEY GOODRICH
Assistant Professor
Department of Agricultural Economics and
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“...the number of colonies demanded for almond pollination in 2019 will be close to 2 million.”

THE UNITED STATES DEPARTMENT OF AGRICULTURE (USDA) estimates that there were 1.1 million bearing almond acres in 2018. According to the USDA Cost of Pollination Survey, 1.5 million colonies were used in almond pollination in 2017, with an average 1.6 colonies/acre. This is down from the 2016 average of 1.7 colonies/acre. These values suggest that the number of colonies demanded for almond pollination in 2019 will be close to 2 million. For some context, this is nearly three-fourths of the total U.S. honey bee colony population on January 1, 2018.

The supply of colonies for California almond pollination relies heavily on out-of-state apiary shipments which have been steadily increasing with almond acreage. According

to apiary shipment numbers provided by the California Department of Food and Agriculture (CDFA), 1.8 million colonies were shipped into California for the 2018 almond pollination season. As of November 28, 2018, approximately 661,000 colonies have already been shipped into California for the 2019 almond pollination season. This is a decrease of about 2 percent from colony shipments that had arrived in California by November 28, 2017.

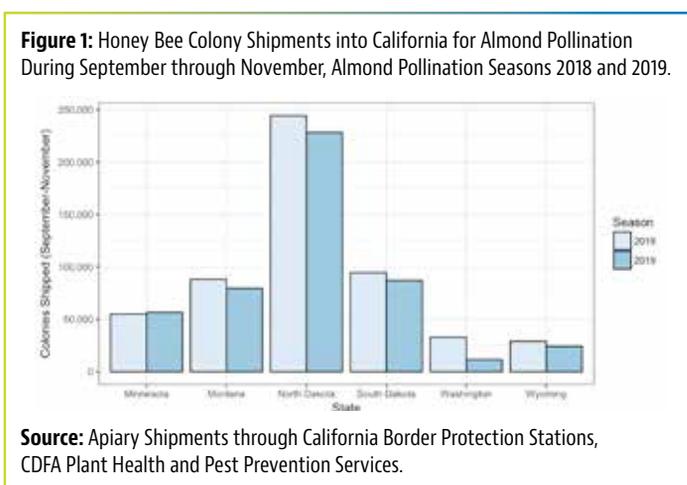
Figure 1 (below) displays colonies shipped during September through November from five states that commonly ship into California prior to the new year (mostly states with cold winters). Shipments from these states seem

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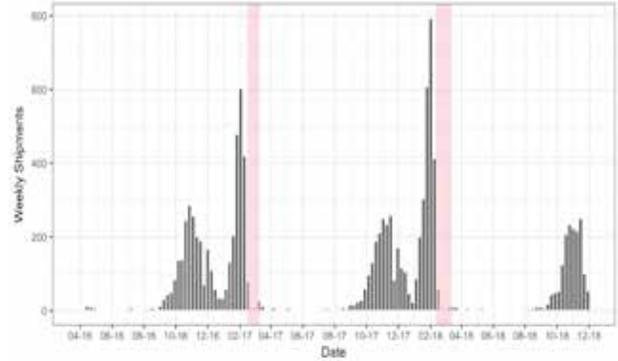
to be down slightly from last year, however not by a large amount.

Figure 2 shows a histogram of apiary shipments into California from April 2016 through November 28, 2018. The beginning of shipments for the 2019 almond pollination season look very similar to the previous two seasons. There has been a trend of increasing colony shipments closer to almond bloom. This reflects increased colony shipments from warmer states (Texas, Florida, Georgia) where beekeepers do not have to worry as much about harsh winter weather and can wait longer to ship colonies.

Colony Shipments by State

Figure 3 shows a heat map of the number of colonies shipped into California for the 2018 almond bloom from

Figure 2: Histogram of Bi-Weekly Apiary Shipments into California, April 2016- November 2018 (Almond Bloom Period for Central California Highlighted.)



Sources: Apiary Shipments through California Border Protection Stations, CDFA Plant Health and Pest Prevention Services; Blue Diamond Grower's Crop Progress Reports.

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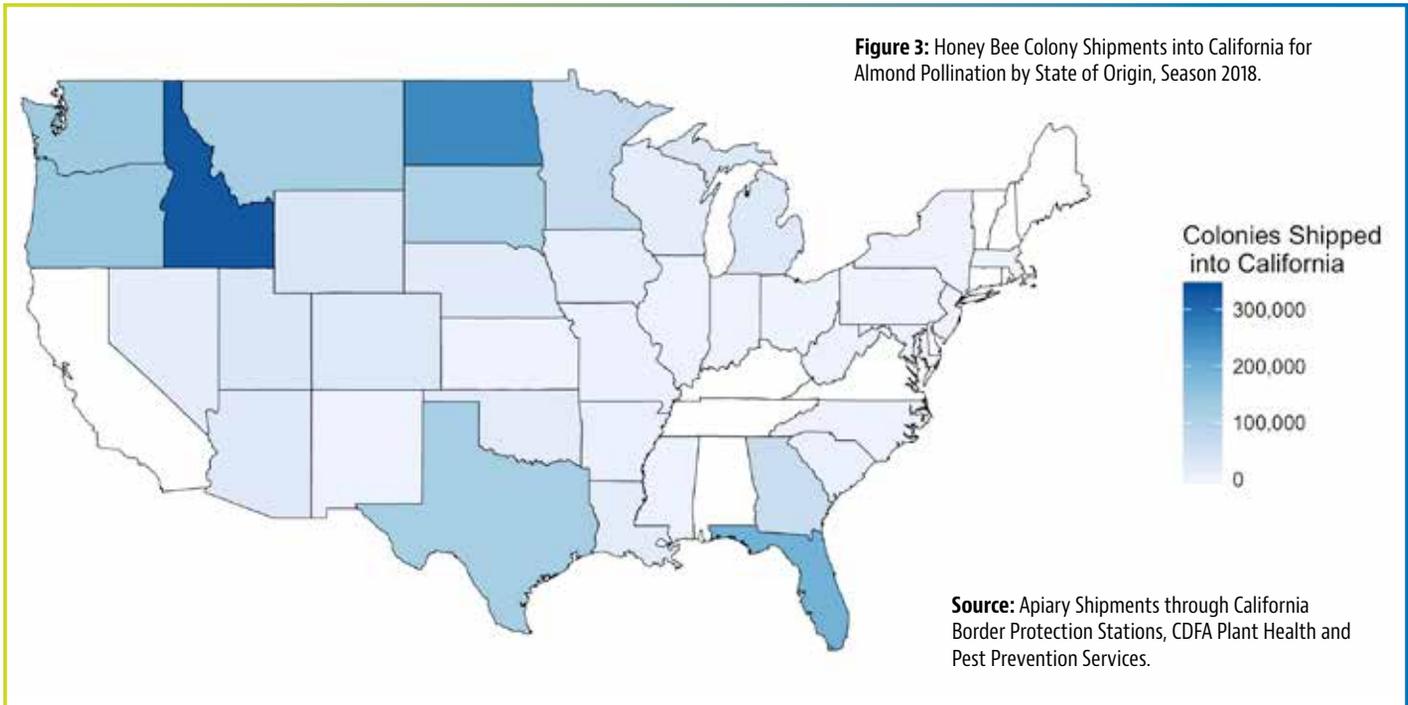


Figure 3: Honey Bee Colony Shipments into California for Almond Pollination by State of Origin, Season 2018.

Source: Apiary Shipments through California Border Protection Stations, CDFA Plant Health and Pest Prevention Services.

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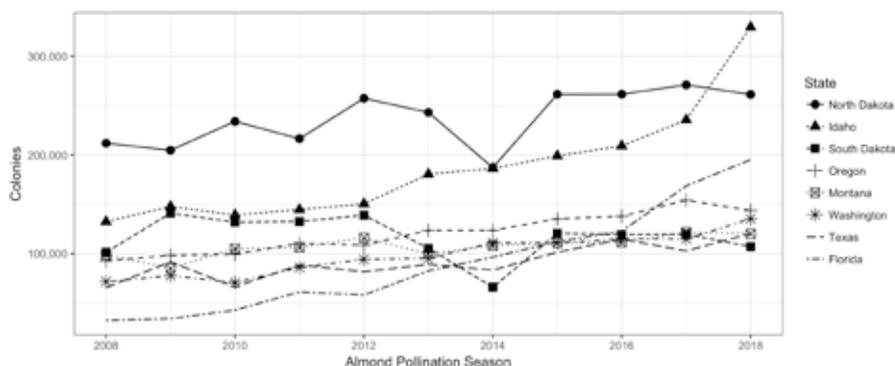
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each state. The top five states shipping colonies into California included Idaho, North Dakota, Washington, Florida, and Oregon. **Figure 4** shows the trends in colony shipments since 2008 from some of the top supplying states.

As seen in **Figure 4**, 2018 was the first year since pre-2008 that any state had shipped more colonies to California than North Dakota. For the 2018 almond bloom, Idaho shipped 339,000 colonies compared to North Dakota's 278,000. I believe this is due to beekeepers in some of the colder

Figure 4: Honey Bee Colony Shipments into California for Almond Pollination from Eight States with Largest Number of Colonies Shipped in 2018, Seasons 2008-2018.



Source: Apiary Shipments through California Border Protection Stations, CDFA Plant Health and Pest Prevention Services.

Table 1: Pacific Northwest State Colony Populations and Colony Shipments into California for the 2017 Almond Bloom.

State	Shipments	Colonies Shipped	Number of Colonies		
			July 1, 2016	October 1, 2016	January 1, 2017
Idaho	560	235,695	79,000	121,000	95,000
Oregon	485	154,161	107,000	98,000	71,000
Washington	341	114,892	57,000	65,000	68,000

Sources: Apiary Shipments through California Border Protection Stations, CDFA Plant Health and Pest Prevention Services; USDA Honey Bee Colonies Report 2017.

states shipping colonies into the Pacific Northwest states prior to entering California. For example, **Table 1** shows Pacific Northwest colony shipments for 2017 almond pollination compared with colony populations reported by USDA. The total number of colonies shipped is often two to three times the colony populations at various points during the year. I suspect some of this is due to the beekeeping industry's movement towards cold storage of bee colonies. Cold storage of bee colonies can reduce varroa mite populations and decrease colony losses over the winter.

As for the future supply of almond pollination services, **Figure 5** displays estimates of the number of colonies that did not participate in 2017 almond pollination in each state based on honey bee colony shipments compared with USDA honey bee colony populations. Most non-participating colonies are located in the eastern U.S. In some areas with a large number of available colonies, ex: Florida, Georgia and Texas, beekeepers may have opportunities for honey production during almond bloom, so it may take higher pollination fees to get remaining colonies to participate. Now, one will notice that there seems to be a large number of colonies still available in the upper Midwest states. As I mentioned earlier, I suspect a large number of these colonies are not available in reality, and are actually being shipped through the Pacific Northwest states due to milder winters and/or cold storage.

NAs exist for Delaware, Nevada, New Hampshire, and Rhode Island because USDA does not publish honey bee

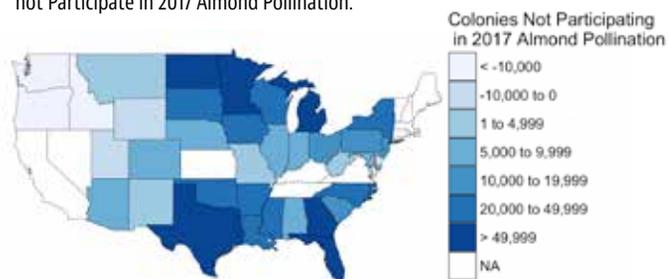
populations for these states.

Supply Issues

The primary influence on the supply of available colonies for almond pollination is colony health and populations throughout the U.S. Colony health issues can impact both the strength of colonies (approximate number of bees/hive) and the total number of colonies that survive the winter. In my research, I have found evidence that increases in state average winter mortality rates decrease the number of colonies shipped into California from that state for almond pollination.

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Figure 5: State Estimates of the Number of Honey Bee Colonies that did not Participate in 2017 Almond Pollination.



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An estimated 65-85 percent of commercial honey bee colonies are located in the North Dakota and South Dakota during the spring/summer months for honey production (Bond, Plattner and Hunt, 2014). Thus, weather during this time period can have an impact on honey production, as well as bee health, due to the availability of nutritious forage. In an article I wrote last year, I discussed a drought in the Dakotas and Montana which likely would affect bee health and colony populations for the 2018 almond pollination season. During May through September 2018, an average of 16 percent of the area in Montana, North Dakota and South Dakota was in a moderate drought or worse. The equivalent number for 2017 was 53 percent of the area. Thus, this season is looking much better in terms of bee health coming from these major honey-producing states.

Another potential issue that could impact colony shipments was Hurricane Michael which devastated areas of Florida's panhandle in October of 2018. University of Florida Extension estimates that 50,000 colonies were located in this area, though it remains unclear how many colonies were actually affected by the hurricane. Florida supplied roughly 195,000 colonies to California almonds in 2018. Thus, the hurricane has the potential to impact up to a quarter of those colonies. This may cause problems for almond growers or

pollination brokers who receive bees from Florida.

Almond Pollination Fees

The average fee for the 2018 almond pollination season reported by the California State Beekeeper's Association (CSBA) was \$190 per colony. This was up by 3 percent from the 2017 average pollination fee of \$184. In comparison, the USDA Cost of Pollination survey reported 2017 average almond pollination fees slightly lower than CSBA at \$171 per colony. The 2018 CSBA pollination fees ranged from \$165-\$210 per colony. The variation likely is due to differences in contracted colony strength. Colonies that average 8 or 10 active frames tend to receive a premium over those that average 6 active frames (See Goodrich and Goodhue (2016) for more information on colony strength).

The CSBA survey respondents projected 2019 almond pollination fees to be around \$198 per colony. In some preliminary research, I explore the future demand for almond pollination services. According to the USDA Almond Acreage Reports, I estimate that 148,000 additional colonies will be needed by 2020. If that is the case, I estimate that almond pollination fees will have to increase by 7.9 percent over their 2017 value to increase colony shipments. This would mean an average per-colony fee of around \$200 by 2020. This estimate seems to be right on track with the CSBA projections for the upcoming season.

Many almond growers likely cringe at the thought of paying over \$200 per colony for almond pollination. However, I wanted to illustrate why prices continue creeping upwards. **Table 2 (page 12)** shows average distances and estimated per-colony shipment costs for each region in the U.S. (**Figure 6**) using a shipment cost of \$3 per mile and 400 colonies per shipment. Recall from **Figure 3 (page 6)** that colonies are now being transported from as far as the north-eastern U.S. to participate in almond pollination. At a \$200 pollination fee, the beekeeper from the Northeast is receiving \$150-156 per colony once shipment costs are accounted for. This does not include any inputs to prepare colonies for almond pollination (labor, food, pest treatments) nor does it include hotel rooms and transportation costs of beekeepers and equipment. So, one can see that \$200 per-colony revenue

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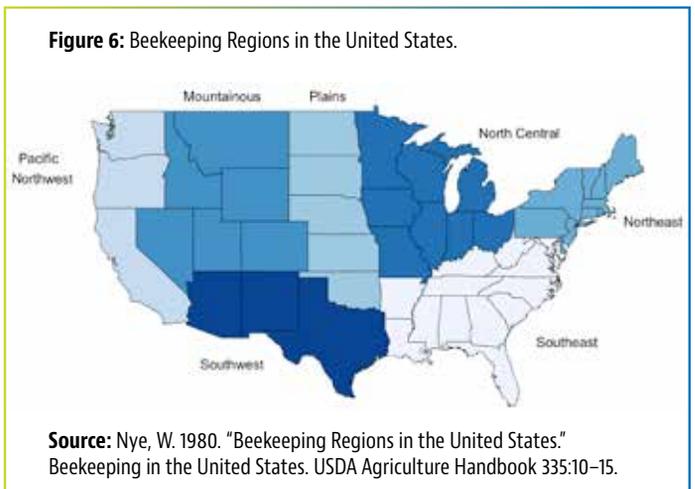
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Figure 6: Beekeeping Regions in the United States.





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can dwindle down pretty quickly.

Other issues for 2019 almond pollination and beyond:

Bee Thefts

Bee thefts continue to be an issue for beekeepers, especially when colonies are in close proximity in remote almond orchards during bloom. Due to this threat, some beekeepers may provide a discount on the pollination fee to locate in almond orchards or holding yards that contain a locked gate. Keep that in mind if some of your orchards have gates that can be locked.

Bee Where Program

Beginning January 1, 2019, both California and out-of-state beekeepers are required to register their colony locations with the county agricultural commissioner. Previously, this had been required, however the California Agricultural Commissioners and Sealers Association had

Table 2: Average Distance and Per-Colony Shipment Costs by Region.

Region	Average Distance (Miles)	Minimum (\$/Colony)	Average (\$/Colony)	Maximum (\$/Colony)
Pacific Northwest	781	9.62	11.71	13.81
Mountainous	896	6.30	13.44	18.32
Southwest	1,049	10.08	15.73	22.12
Plains	1,560	22.17	23.41	25.55
North Central	2,125	27.73	31.88	36.27
Southeast	2,349	26.85	35.23	41.85
Northeast	2,960	40.68	44.40	49.16

Sources: Apiary Shipments through California Border Protection Stations, CDFA Plant Health and Pest Prevention Services; USDA Honey Bee Colonies Report 2017.

no authority to penalize non-compliance. The appropriate fine for non-compliance is still under discussion, but it could range from \$50 to \$1,000. It is my understanding that fines will not be awarded until the 2020 almond pollination season.

The registration cost is \$10 per beekeeper, no matter how many colonies. The goal of this program is to help minimize pesticide exposure for honey bee colonies by alerting beekeepers when pesticide applicators plan to apply chemicals nearby. Additionally, this will provide better information on the true causes of bee kills when pesticide exposure does occur.

I suspect most beekeepers will be given information regarding the Bee Where Program when they pass through California Border Protections Stations, however it is a good idea to make sure they are aware of it to avoid fines in the future.

For more information and to register hives online visit: <https://beewherecalifornia.com/>

Summary

The number of colonies required for almond pollination services continues to be a large percentage of the total colonies in the U.S. If demand for almond pollination services continues to increase, expect higher pollination fees in the coming years. Make sure to communicate with your beekeeper and pollination broker, and maintain good relationships to ensure a secure supply of pollinators going forward. Wishing you a happy, healthy and prosperous 2019!

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2019 NITROGEN CONSIDERATIONS

NITROGEN FERTILIZATION IS IMPORTANT ON FIRST-YEAR SECOND GENERATION ALMOND TREES FOLLOWING WHOLE ORCHARD RECYCLING

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WHOLE-ORCHARD RECYCLING (WOR), involves grinding whole trees into wood chips, spreading the wood chips evenly on the soil surface, and incorporating them into the soil before replanting. This approach could be a sustainable method of tree removal that can enhance both air and soil quality. Before

air quality restrictions, orchard removal meant pushing trees into a large pile and burning them. But when air quality regulations were implemented in 2002 under the Clean Air Act, old orchards were ground up with a tub grinder and the woody debris was hauled to a co-generation plant to generate electricity. However, since 2015,

many biomass co-generation facilities have closed throughout California because utility companies are looking for cleaner sources of energy (solar and wind) and not renewing contracts. The remaining co-generation facilities still open have reduced the amount of wood debris they will accept from orchard waste (more from forest waste) and reduced the price they pay for the debris. Thus, tree fruit and nut growers, who wish to remove dead trees and old orchards, need an alternative method of orchard removal that is also sustainable.

When the woody debris of ground trees is burned in a co-generation plant, carbon (C) stored in the wood is lost from the orchard system. A recycled orchard returns approximately 30-60 tons of wood chips per acre depending on the previous orchards tree size, spacing density, and the varieties. The large quantity of woody debris contains an estimated 30,000 to 60,000 lbs of organic C. There are benefits and tradeoffs associated with returning this large volume of C into the soil prior to replanting. Organic C, which is the C stored in organic matter, promotes the physical and microbiological properties that influence improved water infiltration, retention, and aeration. The enhanced soil structure promotes tree root growth and may reduce the incidence of replant disease. However, the higher carbon to nitrogen (N) ratios of organic amendments like wood chips can decrease the availability of applied N fertilizers. Consequently, growers may need to apply fertilizer N at rates greater than what is normally recommended for trees in their first leaf. Another concern

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is that the woody debris may be so large that it interferes with normal soil preparation and orchard management practices. If whole-orchard recycling can be managed so that it does not reduce the availability of nutrients for new trees, does not worsen replant disease, or interfere with harvest, and enhances long term soil health and

nutrition, then growers will be more likely to adopt grinding and incorporating as an alternative to burning the woody debris from their orchards.

Initial WOR Trial

In our initial orchard grinding trial established in 2008 at the Kearney Research and

Extension Center, stone fruit trees were recycled at 30 tons per acre using the Iron Wolf (a 50-ton rock crusher), and compared to field burning and incorporating the ash. The second orchard was replanted to almond and ultimately, greater yields,

Continued on Page 16



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significantly more soil nutrients, organic matter, and total carbon were observed in the grind treatment when compared to the burn. Leaf petiole analysis also revealed higher nutrient levels in trees growing in the grind treatment, thus proving in the long term, the high levels of organic matter from the recycled orchard did not stunt replanted trees. Later studies at Kearney found that WOR increased the soil water infiltration rate and soil moisture retention, while decreasing soil compaction and bulk densities. Significantly higher microbial biomass carbon was observed in the WOR treatment while microbial biomass nitrogen was decreased. A deficit irrigation trial established at Kearney provided evidence that trees growing where the previous orchard was recycled showed less water stress. Based on the positive results from this trial and the closure of co-generation plants, we estimate almond growers have chipped and incorporated more than 20,000 acres since 2015.

Additional Trials

With the adoption of whole orchard recycling, eight additional research trials were established throughout California to further evaluate the impacts of whole orchard recycling on tree health and soil quality. Initial observations in the new trials revealed that our nitrogen recommendations for first year almond trees needed revision, following whole orchard recycling, as reduced shoot growth in second-generation orchards was often observed in early spring after replanting. As a consequence, nitrogen applications were increased to address the likely imbalance between the carbon to nitrogen levels in the soil (often referred to as the C:N ratio).

In a previous study conducted by David Doll, UCCE Farm Advisor in Merced County, he determined that first year almond trees grew best when given between 3-4 ounces of actual N (25-35 lbs N/acre) in their first growing season. The applications are typically spread out so that no more than one ounce of actual N is applied per tree per application. This recommendation may not be enough following WOR, especially if 40-60 tons of wood chips are incorporated back into the soil. In 2017, working in Louie Tallero's recycled orchard in Manteca, we tripled

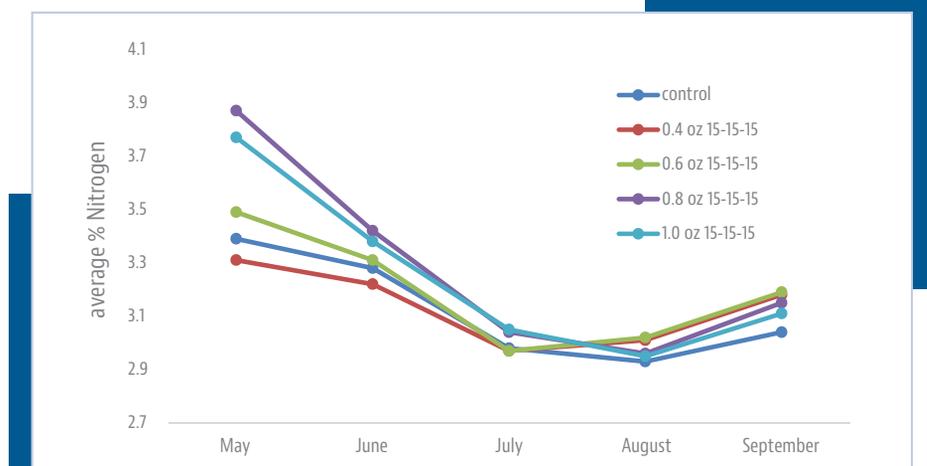


Figure 1. Percent Nitrogen in leaf tissue from May-September.

David's recommendation after we noticed reduced shoot growth, and applied 11 ounces of N per tree (approximately 100 pounds N per acre). Trees that had initially showed reduced shoot growth responded nicely to the additional nitrogen. Another factor in need of study is the unaccounted reduced efficiency of applying nitrogen through a double-line drip system, where only an estimated 20 percent of the emitters reach the trees early in the first-year. As the trees mature the double-line drip system will obviously become more efficient delivering nitrogen to trees with larger root systems.

Nitrogen Trial

In 2018, we put out a nitrogen trial in Jeff Warkentin's first-year orchard in Parlier to see if we could determine more accurately the nitrogen requirements of first year almond trees after whole orchard recycling. In order to more precisely apply the nitrogen, triple 15 granular fertilizer was hand applied to each tree. We put out five treatment rates with 5 tree replicates, in a Latin Square designed experiment. Nitrogen rates of 0.0, 0.40, 0.60, 0.80, and 1.0 ounce of nitrogen per tree were applied once per month, for five months, from March through July. After five months, each treatment received 0.0, 2.0, 3.0, 4.0, and 5.0 ounces of additional nitrogen per tree. These applications were in addition to the Jeff's fertigation through the drip system at a rate of 1.73 ounces of N applied monthly from April to August (with the exception of May when a 2.5 ounce application was made). We expect that the grower applied nitrogen was not all immediately available because of the emitter spacing

and the limited range of the small tree roots, especially in the first year.

Our first nitrogen application in March seemed to have an almost immediate impact. Considerable precipitation in March effectively dissolved the granular nitrogen, and differences in shoot growth were detected between treatments soon after (pictures 1 and 2—trees with and without nitrogen treatments in March). Leaf analysis showed that our nitrogen treatments early in the season seemed to have a greater impact on nitrogen tissue levels than applications later in the season (**Figure 1—leaf analysis May-September**). Trunk diameter data showed that we did not receive any additional benefit for applying more than 4.0 ounces of actual nitrogen per season in addition to what the grower applied (**Figure 2—trunk diameters from monthly applications of N**).

Timing of N

Timing of nitrogen may be more critical early in the growing season after whole orchard recycling. In Dr. Greg Browne's studies, where he applied nitrogen with whole orchard recycling and anaerobic soil disinfestation, he too observed an increase in shoot growth early in the spring with early nitrogen applications. It may be that we can use less nitrogen more efficiently if we apply it earlier in the growing season or at planting time. We will attempt to study early nitrogen efficiency in more detail in future trials. But at this point in our research, we would recommend to growers that they apply at least 6-8 ounces of actual nitrogen per tree (50-70 lbs N/acre) in the first year of tree growth following whole orchard recycling. And that early

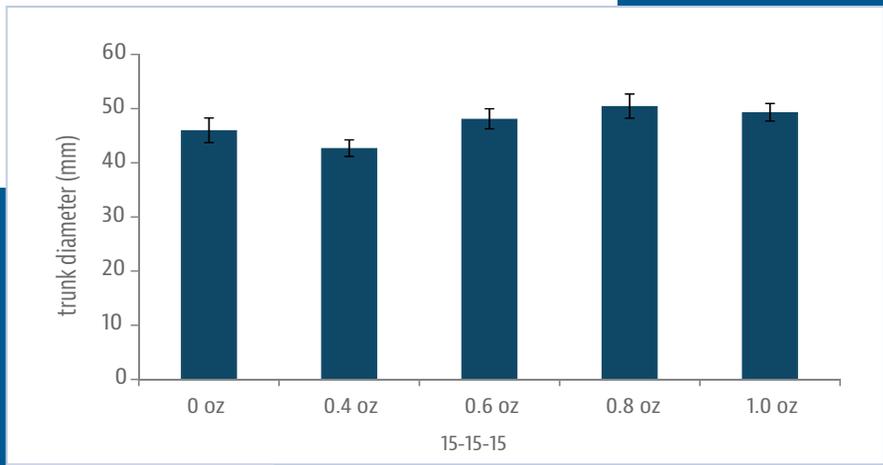


Figure 2. Trunk diameters of first year almond trees given additional monthly applications of nitrogen.

applications may be more important than applications later in the season. Remember that nitrogen applications should be spread out so that no more than one ounce of actual nitrogen is applied per tree per application in the first year of tree growth.

In our WOR trials, we did not have to apply additional nitrogen in the second year of our studies to achieve the tree-growth we expected. We hypothesize that

in the first season after WOR, the wood chips, and the microorganisms decomposing them, compete for the nitrogen applied to first-year trees. The wood chips and soil microorganisms may also bind and immobilize excess nitrogen that may otherwise leach through the soil profile where young tree roots have not yet expanded in the spaces between trees. As the wood chips decompose, nitrogen should be released

slowly and become available for uptake by the trees. Increased nitrogen efficiency may be observed as the wood chips decompose and release bound nitrogen. Samples of the wood chips were analyzed for their nutrient contents, which averaged 0.31 percent nitrogen, 0.20 percent potassium, 0.60 percent calcium, and 50 percent carbon. Returning 64 tons of wood chips to the soil per acre provides 396 pounds of nitrogen, 768 pounds of calcium, 256 pounds of potassium, and 64,000 pounds of carbon per acre. These nutrients will not be immediately available to the next-generation orchard, but as the woody material decomposes and soil organic matter increases, the stored nutrients will be released gradually and naturally.

WOR Funding

The team of researchers studying whole orchard recycling has increased in the last couple of years because of funding opportunities and the need to find an alternative to orchard waste burning in

Continued on Page 18



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co-generation facilities. The Accelerated Innovation Management (AIM) program of the Almond Board of California (ABC), which emphasizes stewardship of resources, sustainability, and production efficiency, has funded our whole-orchard recycling project to compare whole-orchard recycling with conventional orchard residue removal and burning in a co-generation facility, to refine the life cycle assessment (LCA) model for the evaluation of carbon dynamics, to quantify the physical, chemical, and biological soil properties that result from whole-orchard recycling, and to assess the effects on the growth, health, nutrition, and water use of the replanted orchard.

In 2016, the California Department of Food and Agriculture (CDFA) ranked increasing soil organic matter a funding priority as world leaders were discussing the capture of carbon in agricultural soils as a formal part of the United Nations Climate Change Conference Agreement. Dr. Amélie CM Gaudin was funded by the CDFA to study the “Potential of Whole Orchard Recycling to Build Sustainability and Resilience of Almond Production.” In 2018, Dr. Mae Culumber was funded by the CDFA and the ABC to study the “Influence of Whole Orchard Recycling on greenhouse gas emissions (GHG) and Soil Health in a Newly Established Almond Orchard.” Our team of researchers also includes Dr. Greg Browne, a plant pathologist with the United States Department of Agriculture (USDA)/Agricultural Research Service (ARS) in University of California (UC) Davis, Dr. Andreas Westphal, a



1. Photo of a control tree that received no nitrogen in March.



2. Photo of a tree that received 0.8 oz of Nitrogen in March.

nematologist at UC Riverside, Dr. Elias Marvinney and Dr. Emad Jahanzad, post-doctoral scientists studying at UC Davis, Dr. Suduan Gao, a soil scientist with the USDA-ARS in Fresno, and Dr. Amisha Tashee Poret-Peterson, a microbiologist with the USDA-ARS in UC Davis. Our team of UC Farm Advisors includes and Dr. Mohammad Yaghmour, in Kern County, Dr. Phoebe Gordon, in Madera County, Dr. Franz Niederholzer, in Colusa, Sutter, and Yuba Counties, David Doll, in Merced County, and Luke Milliron, in Butte, Glenn and Tehama Counties. We hope that this team will demonstrate the success of whole-orchard recycling and provide scientific evidence to support legislation that allows growers to receive carbon credits for recycling their orchards into the soil. These carbon credits would encourage sustainable agriculture and help compensate growers for the expenses they incur when adopting whole-orchard recycling.

Expensive Undertaking

Whole orchard recycling has been an expensive undertaking for growers who used to get their orchards removed for practically nothing when co-generation facilities were paying nicely for their wood waste. Now growers can expect to pay from \$600-700 per acre to have their orchard ground up, whether they are keeping the wood chips or not. If growers decide to keep their wood chips, and recycle their orchard, they can expect to pay an additional \$300-400 per acre to spread their wood chips evenly back onto the soil surface. Typically, after spreading, growers will follow their normal replant program of deep ripping, stubble disking, and soil fumigation. To off-set these expenses we have observed about a 1,000-pound kernel increase per acre from trees growing where the previous orchard was recycled after 8 seasons in our original trial at Kearney. The San Joaquin Valley Air Pollution Control District (SJVAD) has recently approved a program that will reward growers with funding from \$300-600 per acre up to \$60,000 per year to implement whole orchard recycling. For more information on these incentive programs, contact Jacob Whitson with SJVAD at 559-230-5800 or at Jacob.Whitson@ValleyAir.org.

A big thank you to Louie Tallerico and Jeff Warkentin for letting us experiment with nitrogen rates in their orchards.

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5-YEAR ALMOND OUTLOOK REVEALS *Profitable Prices*



by **ROLAND FUMASI**

Roland Fumasi, Ph.D. is a senior horticulture analyst for Rabobank's RaboResearch Food & Agribusiness team. Headquartered in Fresno, California, he monitors and evaluates global market events and megatrends that affect the North American fresh fruit, fresh vegetable, and tree nut industries.

From an office in Fresno, the RaboResearch Food & Agribusiness team has developed a proprietary computer model to compare and analyze scenarios that determine price risk for the U.S. almond industry. Using the model for a reliable, statistical basis, Rabobank generated an outlook that shows that market-clearing prices are highly likely to remain profitable over the next five years for California almond growers.

One of the economists who helped develop the tool, Roland Fumasi, shared the team's outlook at the 2018 Almond Conference. Since then, the team has run updates for Rabobank clients, demonstrating the tool's ability for rapid analyses when there are changes to the market environment.

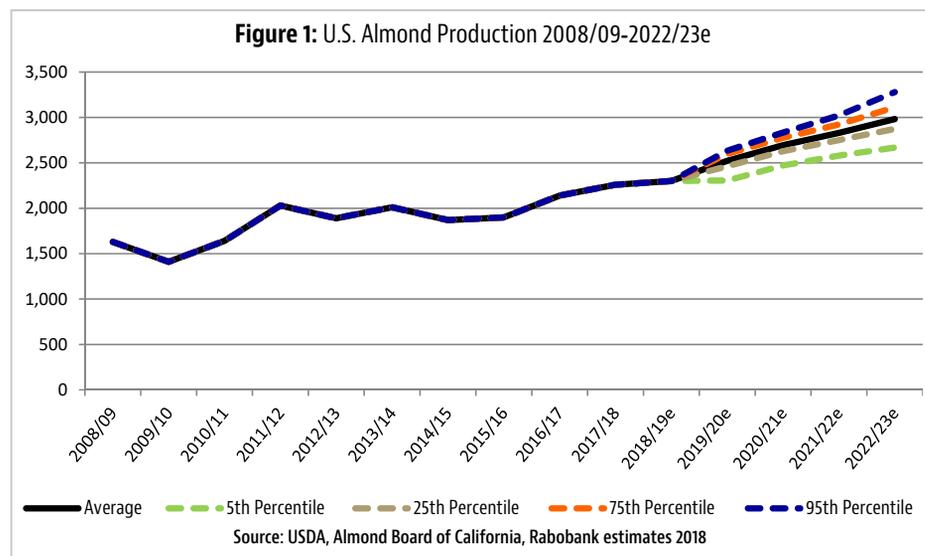
Record Almond Crops to Continue

While the official 2018 United States Department of Agriculture (USDA) California almond crop estimate was last set at 2.45 billion pounds, recent indications are that the crop is likely to be closer to 2.30 billion pounds, on an estimated 1.07 million bearing acres. Rabobank expects that number to rise to approximately 1.33 million bearing acres by 2022. In the absence of any severe yield-related issues, they expect an average yield of about 2,250 pounds per acre in 2022, resulting in

production of roughly 3 billion pounds in four years (see Figure 1).

Due to the lighter than originally expected 2018 crop, these results vary slightly from the original baseline estimates made in November 2018 and shared at the Almond Conference. The resulting higher prices—which the industry's already experiencing—change the short-run net planted acreage estimates, which impact 2022 average yields and production. While

Continued on Page 22



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Continued from Page 20

the average yield estimate is now lower, the increased bearing acreage estimate more than compensates, and the 2022 production estimate has increased by 80 million pounds.

Potential yield variability, estimation risk and unexpected changes in Rabobank's basic assumptions result in an estimated range of likely production over the next few years. Accounting for this potential variability, there is a 50 percent chance that annual California production is between 2.87 billion and 3.11 billion pounds by 2022, and a 90 percent chance that it is between 2.67 billion and 3.28 billion.

Global Almond Demand Growth Keeps Up

Global almond demand continues to be driven by a powerful combination of taste, convenience and healthfulness coupled with continued rising incomes in developing countries, which drive changes in eating habits. Over the next five years, Rabobank expects U.S. domestic demand to continue to rise while remaining at approximately 32 percent of global demand for the U.S. crop, reaching just over 900 million pounds by 2022/23.

Rabobank's estimates have demand increasing for all export markets, with total export demand reaching 1.96 billion pounds during the 2022/23 marketing year. The European Union (EU) retains its title as the top export

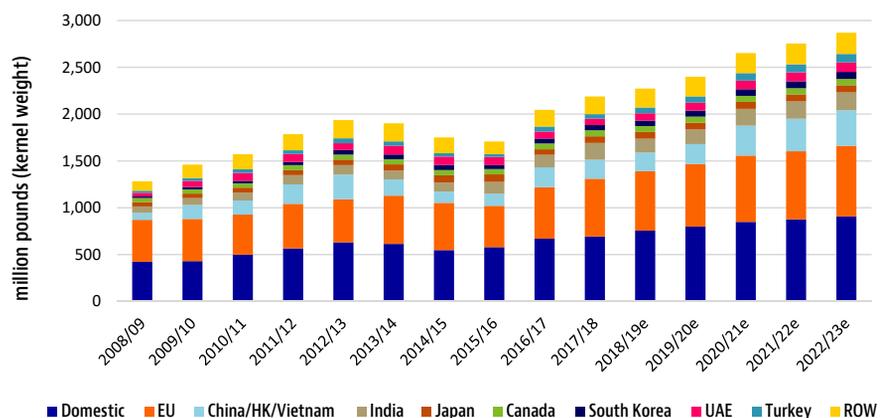
market for U.S. almonds, but mainland China, Hong Kong and Vietnam combined are expected to have the highest growth rate in demand—14 percent compounded annual growth rate (CAGR)—going from 9 percent of total demand in 2017/18 to 13 percent of total U.S. almond demand by 2022/2023. Turkey is expected to have the second highest growth rate at 13 percent CAGR, while the United Arab Emirates (UAE), South Korean and U.S. markets round out the top five, with expected CAGRs of 8 percent, 6 percent and 6 percent respectively. Total global demand growth is expected to rise by a CAGR of 6 percent between 2017/18 and 2022/23, reaching 2.87 billion pounds in the next five years.

These results are based on the assumption that the Chinese, Indian and Turkish retaliatory tariffs on U.S. almonds remain in place through the 2019/2020 marketing season, and are then removed. This is why U.S. almond exports get a considerable bump in 2020/21 (see Figure 2, below).

While only the average demand estimates are presented in Figure 2, Rabobank does account for potential demand-side variability in the analysis. Although the likelihood of extreme results is low, Rabobank estimates that 2022/23 U.S. almond shipments could range from a low of 2.47 billion pounds to a high of 3.29 billion pounds. The

Continued on Page 24

Figure 2: Global U.S. Almond Shipments 2008/09-2022/23e



Source: USDA, Rabobank estimates 2018

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¹ Profit increase based on 2017 almond price/lb. and average yield/bearing acres with 8.3% increase in yield versus untreated over three-year trial, per trial data of five locations with a single application of Velum One at 6.5 or 6.85 fl. oz./A.

² Velum One applied at 6.5 oz./A, spring 2017, via drip irrigation. Trees planted in January 2017. Increase in green canopy pixels based on an average of two rows of untreated trees compared to an average of two rows of Velum One-treated trees.

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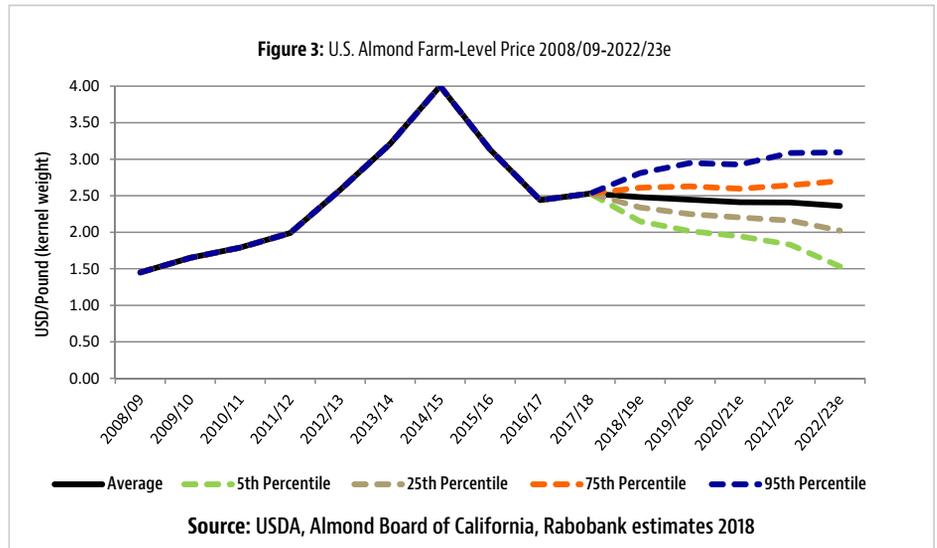
estimated shipments range accounts for both supply-side and demand-side volatility.

Average Conditions Have Prices Relatively Stable, but...

Based on the average supply and demand expectations, average annual U.S. grower prices range from USD 2.48/pound in 2018/19 to USD 2.36/pound in 2022/23. At the time of writing, reported blend price was approximately USD 2.47/pound—pretty close so far. However, risk (volatility) is always looming.

Rabobank estimates that there is about a 5 percent chance of the 2018/19 seasonal average price finishing below USD 2.15/pound and a five percent chance that it finishes north of USD 2.80/pound, but most likely it will average between USD 2.34/pound and USD 2.61/pound with 50 percent probability.

Greater uncertainty exists as we look



further out. In 2022/23, the analysis shows a 75 percent chance that prices remain above USD 2.00/pound, and a 25 percent chance that prices are at least USD 2.70/pound. However, prices also have an approximate 25 percent chance of being below USD 2.00/pound (see Figure 3).

While prices are expected to decline

slightly—under average conditions—they are highly likely to remain above break-even for the majority of California growers. Average break-even price is approximately USD 2.00/pound in 2018. In 2019, Rabobank will be adding a cost-side component to the analytical tool, which will enable them to account for estimated changes in production costs and directly estimate profitability per acre.

Prices Exhibit More Upside Than Downside Risk, but Retaliatory Tariffs Limit Potential

When accounting for the potential volatility in the industry over the medium-term, based on standard inflationary and foreign currency assumptions, Rabobank recognizes that there is a much greater probability that prices remain in the profitable zone for most California growers than chances are that they drop below the profitable threshold. While there is a small chance that the five-year average price—from 2018/19 to 2022/23—finishes below USD 2.00/pound, it is 17 times more likely that the average price finishes above USD 2.50/pound. These baseline results assume that the retaliatory tariffs end after the 2019/20 marketing year.

If the retaliatory tariffs were to remain in place, then the probability of the five-year average price being below USD 2.00/pound remains low, but it more than doubles. However, tariffs limit the upside potential. The probability of the five-year average

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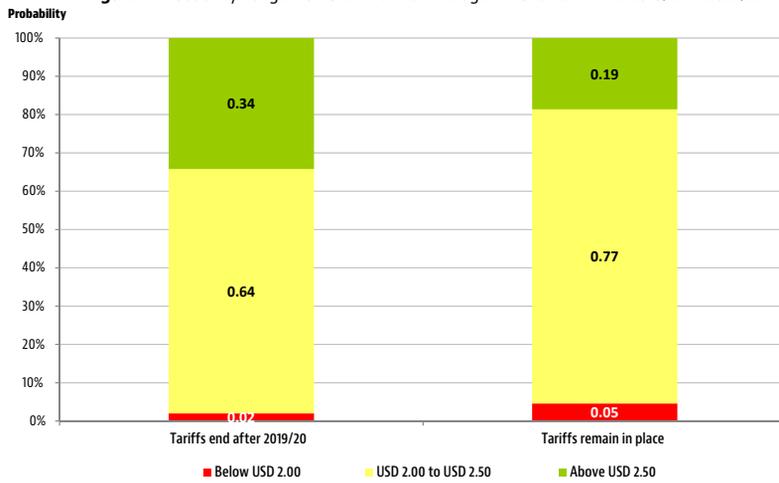

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Figure 4: Probability Ranges for U.S. Five-Year Average Almond Farm Price 2018/19e - 2022/23e



Source: USDA, Almond Board of California, Rabobank estimates 2018

price being above USD 2.50/pound goes from 34 percent to 19 percent, if the retaliatory tariffs were to remain in place for the next five years. The most likely outcome, under either scenario, is that the five-year average price is somewhere between USD 2.00 and

USD 2.50 per pound (see Figure 4).

Yes, potential average prices are skewed to the upside. Under average conditions, the expected growth in global demand—including carry-in—for U.S. almonds should keep pace with the expected supply growth. Alas, a

relatively stable system, but wait...

While risks such as increased tariff rates do pose a threat to future prices, the biggest source of potential volatility in the system remains yield risk. We're seeing that impact play out in the current marketing year. As the almond market matures over time, and almonds become a more common item for consumers globally, prices will likely become even more sensitive to supply-side volatility—both ups and downs.

Yield volatility is much more skewed to the downside than the upside. Weather shocks, high pest levels or disease pressure create yield losses, not significant yield improvements. Therefore price volatility is skewed to the upside. That's encouraging news for California almond growers, who can continue to make budgeted yields.

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THE EFFECTS OF WINTER SHAKING on Bud Loss and Yield in Almonds

By WES ASAI | Pomology Consulting, Turlock, CA

THE REMOVAL OF WINTER MUMMY nuts in almonds is the cornerstone for an effective Navel orangeworm (NOW) management program. Even with good cultural practices such as mating disruption, in-season sprays and prompt harvesting, the potential for NOW damage is high due to the survival of the overwintering populations in these mummy nuts and the food source these nuts provide for the subsequent generations.

Amongst the many reasons growers cite for not doing winter sanitation (“My drivers are on vacation that time of year”, “My shakers are in for service during winter”, “I did not have NOW

damage last year so I don’t need to winter shake”), one other significant concern is often mentioned. That is that nuts don’t come down good until several winter rains in December and January, and by then too many buds are dropping when trees are shaken in late-January. Research by former University of California Cooperative Extension (UCCE) farm advisor G.S. Sibbett et.al. in the early 1980’s demonstrated no detrimental effects from late-January shaking, even though some bud drop was occurring at that time. This peaked my interest to carry this test even further into bloom.

2018 Trial

In 2018, two separate trials were conducted to measure the effects of late winter shaking on the amount of buds that drop and their potential effect on yield that year. Two different locations were used. One was a mature full-bearing orchard, and the other was a younger orchard with increasing production. Both sites were set up as replicated Randomized-Complete Blocks. There were three different shaking dates at each site. The first was the normal early-January shaking date, the second was a later date the first week of February (February 5th) and the last shake date was the second week of February (February 10th). These trials were conducted on my own orchards with my own shaker, since convincing another grower to shake this late with the amount of buds dropping would create a stressful situation.

The trees in the mature bearing

Continued on Page 28



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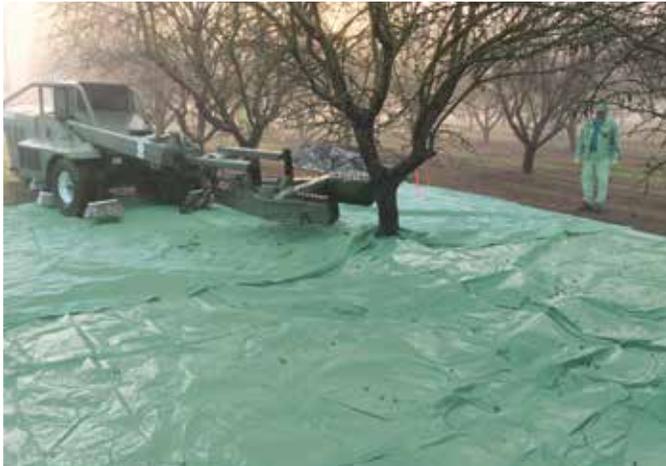


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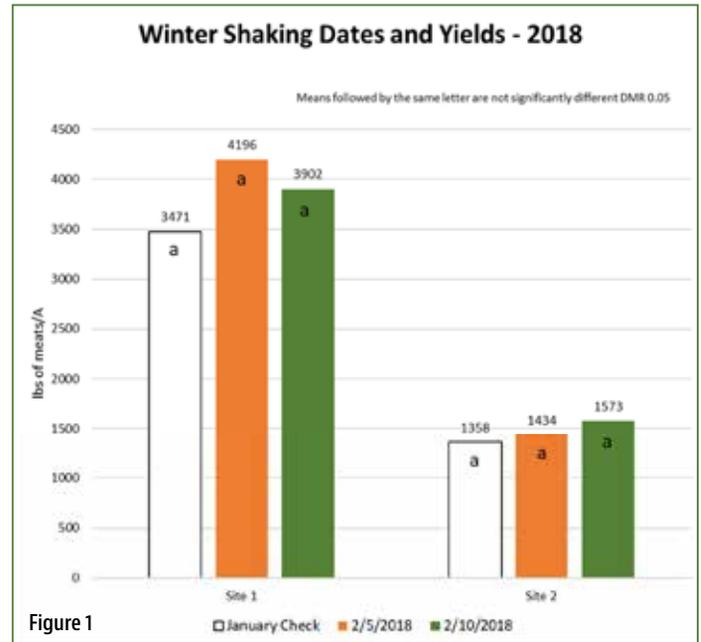
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orchard were tarped and shaken. Buds were collected and counted at both late-shake dates. As expected, the later the shake date, the greater the number of buds removed. On the February 5 date, an average of 5,083 buds per tree were removed. On the February 10 shake date an average of 8,672 buds per tree were removed, with one tree losing over 10,000 buds!



Mummy nuts being shaken in early February. Photo courtesy of Wes Asai.



Keeping it in Perspective

As bad as this looks and sounds, one must keep things in perspective. A typical full-canopied Nonpareil tree in a 22' x 15' spacing that sets a 3000 pound crop has over 38,000 blossoms. This average is based on doing bud and percent set counts on replicated trials over the past 30 years. So even if a tree loses over 8,000 buds per tree with a late shake, is this negatively affecting yield? **Figure 1, above**, are the yield data for these two sites.

It is interesting to note that even with the tremendous bud drop with the late shake dates, there was no significant decrease in yields at either site. In fact, numerically the yields were higher in the later shake dates at both sites. As a follow-up in 2019, I am repeating this trial and increasing the number of replications to see if potentially there is a statistical yield increase by thinning these buds. While one years' data is not reason to expect yield increases from late shaking, and by no means am I blanketly suggesting that all growers do so. However, what this may show is that those growers who have not winter-sanitized late into January for fear of crop reduction, need not be as concerned as previously thought. More to follow after the 2019 data is generated.



Flowers and buds were collected from the tarps after shaking. Photo courtesy of Wes Asai.

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NEW MD TECHNOLOGY AND PRODUCTS INTRODUCED IN 2018 – HOW DID THEY FARE?

Nut growers today are increasingly finding that good winter sanitation and chemical applications alone are no longer enough to combat the growing spread of navel orangeworm. As a result, greater numbers of growers now are using mating disruption to increase their success in warding off the pest as part of an integrated pest management strategy.

Two new mating disruption products developed and manufactured by insect monitoring and control company Trécé — CIDETRAK® NOW MESO for almonds and pistachios, and CIDETRAK® CMDA + NOW MESO for walnuts – entered the market in 2018 and already are drawing positive reviews from nut growers and pest control advisers.



Vince Chebny, Lab R&D Manager for Trécé

Trécé developed the products in its own laboratory, then fine-tuned and field-tested the two solutions in collaboration with researchers from the University of California, Davis and USDA's Agricultural Research Service, for maximum effectiveness. "We saw

excellent results across the board," said Brad Higbee, Trécé's Director of Field Research. "Growers and PCAs were pleased with every aspect of the products, ease of application, and reduction in both trap capture and damage."

According to Higbee, CIDETRAK® NOW MESO for almonds and pistachios significantly increases the number of unmated NOW females

"We saw excellent results across the board. Growers and PCAs were pleased with every aspect of the products, ease of application, and reduction in both trap capture and damage."

— Brad Higbee, Director of Field Research for Trécé

and dramatically reduces the number of multiple-mated females by more than half. Correspondingly, the data shows a 50-80% reduction in damage compared to grower standard insecticide programs in trials where there was a difference.

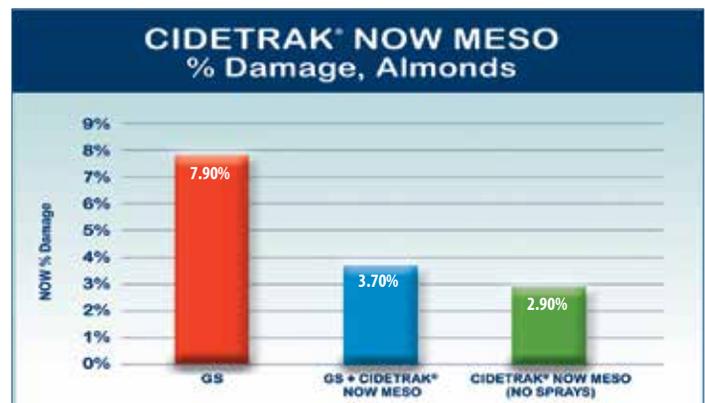
CIDETRAK® CMDA + NOW MESO for walnuts is equally effective. A unique combination of codling moth (CM) pheromone and a patented male and female behavior modifying kairomone (DA) as well as NOW pheromone allows growers to disrupt codling moth males and females and NOW males.

"The navel orangeworm seems to be expanding its range and density in different areas."

— Dirk Ulrich, almond grower/consultant

"More and more researchers are endorsing the benefits of mating disruption," Higbee said. "Growers and PCAs are also praising the effectiveness of both products and now consider them an essential part of a complete pest management program."

Dirk Ulrich, an almond grower, research PCA and CCA used CIDETRAK® NOW MESO on a test plot in 2018 and was surprised to discover he had higher pressure than he anticipated before trial initiation.



Source: Dirk Ulrich, 2018



Brad Higbee, Director of Field Research for Trécé and Dirk Ulrich, almond grower/consultant

“The navel orangeworm seems to be expanding its range and density in different areas,” Ulrich said. “I had an area on one ranch that I farm that has been pretty low pressure. I’ve never really had damage, and I’ve never really sprayed for NOW, but this year, I encountered much more pressure and I had more damage than ever before.”

According to Ulrich, NOW damage has been climbing steadily, rising from less than 1 percent in 2015 to 1 percent in 2016 and then more than doubling to 2.2 percent in 2017.

“In fact, I used the grower standard with and without CIDETRAK NOW MESO compared to the grower standard insecticide program alone. This consisted of three hull-split sprays timed appropriately. The damage was 7.9% in the grower standard, 3.7% or about 53% less in the grower standard plus CIDETRAK® NOW MESO and 2.9% or about a 63% reduction in the CIDETRAK® NOW MESO alone. Very impressive performance to say the least, even though, I had put it on later than I would normally, due to the late registration!”

“I really liked the simplicity that Trécé built into the uniquely packaged/RTU application system that allowed for fast and accurate application at the very low rate of 20 per acre. My rate of application was around 4 acres per manhour.”

— Dirk Ulrich, almond grower/consultant

“Moreover, I really liked the simplicity that Trécé built into the uniquely packaged/RTU application system that allowed for fast and accurate application at the very low rate of 20 per acre. My rate of application was around 4 acres per manhour. The packaging allowed me to open what I needed, which on a large scale will allow for greater inventory management and checking field utilization and labor use.”

Ulrich will be using NOW MESO in 2019. “I’m planning on using it on larger acreage. Great product! I plan to recommend it to my growers this season!”

Another Trécé product engineered for walnuts, CIDETRAK® CMDA + NOW MESO, addresses the double threat of infestation that occurs when nuts damaged by codling moths serve as a breeding site for navel orangeworm. Research has demonstrated that pear ester DA and CM and NOW pheromones in a CIDETRAK® CMDA + NOW MESO dispenser significantly reduces mating and walnut nut damage from codling moth and navel orangeworm.

CIDETRAK® CMDA + NOW MESO, which uses two dispensers, one for each moth, are hung together on one hanger and placed 20 per acre at mid-canopy. The dispensers are easy to hang and labor efficient.

Hanging them together has demonstrated more than 95 percent disruption and reduction in male moth capture in pheromone traps for codling moth and navel orangeworm.

Codling moth is different with each generation. First-generation larvae cause the nutlets to drop from the tree under certain conditions. Nuts attacked by larvae of the second and third generations remain on the trees. Feeding damage to the kernel leaves them unmarketable and they are also a breeding site for NOW, which may result in 8-12 or more surviving NOW larvae vs. one CM larvae.

Second-generation larvae frequently enter through the side of the husk where the two nuts touch. After the shell hardens, the larvae enter the nuts through the soft tissue at the stem.

Codling moth not only damages the nut, but it provides a breeding site for NOW. This makes it vital to prevent codling moth damage.

Monitoring continuously with pheromone/kairomone based traps, establishing and tracking degree days, checking canopies for damage and calculating the level of infestation is necessary season long for best results.



CIDETRAK NOW MESO applied in pistachio orchard

Rich French, distributor with Bear River Supply used CIDETRAK® CMDA + NOW MESO last year and said, “It’s a good tool in the toolbox, and we will be using it again this year.”

Programs that have used CIDETRAK® CMDA + NOW MESO or CIDETRAK® NOW MESO alone or in combination with insecticide sprays have been found to be very effective.

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‘PERSONAL TRAINERS’ Helping to Build a Better Bee



By THE ALMOND BOARD OF CALIFORNIA

FOR ALMOND GROWERS, more bees often equal more almonds, and an important factor in ensuring an ample harvest may be whether a beekeeper uses a “personal trainer.”

Not the kind of trainer that makes you do lunges, though. Instead, this training program—led by the non-profit Bee Informed Partnership (BIP), with support from the Almond Board of California—and others helps beekeepers monitor colony health and maintain important routines that help keep bees alive, healthy and in good supply when the time comes to pollinate millions of almond trees across California’s Central Valley.

“Our beekeepers lose 35 percent fewer colonies than other commercial operations,” said Karen Rennich, BIP’s executive director.

That amounts to billions more healthy bees available to pollinate almonds and other crops, and according to Rennich, there is room to grow this success through broader adoption of improved monitoring of bee health.

Preventing Colony Losses

Colony losses, especially over the winter season, pose a major threat to busy beekeepers. Colony mortality



Beekeepers working with the tech teams enjoy about 35 percent fewer losses, that means about 80,000 more colonies survive. Image courtesy of the Almond Board of California.

often results from uncontrolled infestations of Varroa mites, tiny parasites that literally suck the life out of bees and their broods. Even a few mites can quickly proliferate and destroy a hive.

“If we were to make a list of the top

10 enemies of bees, Varroa mites would probably be nine of them,” Rennich said. There are, of course, other threats that can harm colonies, such as diseases.

Continued on Page 34

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“THIS PROGRAM HAS IMPROVED BEE HEALTH FOR COMMERCIAL BEEKEEPERS.”

—KAREN RENNICH

Colony losses, especially over the winter season, pose a major threat to busy beekeepers. Image courtesy of the Almond Board of California.

Continued from Page 32

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The key to controlling mites is consistent monitoring to gather reliable, timely data about infestation levels. This information tells beekeepers when to act, giving them a much better chance of intervening in time to prevent hive losses.

Born out of a U.S. Department of Agriculture grant in 2011 and converted into a nonprofit in 2014, BIP offers several programs to monitor, assess and improve the health of bees across the U.S.; one such program is BIP’s Technical Transfer Teams, which work directly with commercial beekeepers to assess colony health, including incidence of parasites and diseases so that beekeepers can act to maintain colony health. Five such teams operate around the country, including Oregon, Texas, Minnesota, Florida, and California, and these typically serve multistate regions surrounding their home bases. Hawaii, which supplies queens but not pollination, also participates. The Almond Board has supported the BIP since its inception and even before this in 2010 with funding for a prototype program in Northern California.

The California team is based in Oroville, and serves a key region for bee breeding, with more than 75 percent of U.S. queens bred within a short distance. With a staff of just two—John Klepps, a beekeeper and University of California Cooperative Extension (UCCE) crop protection agent, and Robert Snyder, also a UCCE crop protection agent—the California tech team works efficiently with nearly two dozen commercial beekeeping operations. Nationwide, all of the beekeepers BIP works with collectively manage around 580,000 bee colonies, about a quarter of the bees needed to pollinate California almonds each year.

The teams visit and monitor each beekeeping operation

Continued on Page 36

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Maximizing profitability in your almond orchard starts with maximizing nut set every year. Achieving consistency in set and minimizing alternate bearing cycles is the key to consistent high yields and higher profitability. The secret is ensuring your trees have the right nutrients, at the right time, in the right form and right mix.

Nut set is influenced by boron which stimulates pollination. Boron is synergistic with calcium and enhances its affect. Molybdenum plays a direct role in nut set and retention by increasing pollen production. Moly also synergizes boron. Agro-K's Top Set DL is the right tool to apply from pink bud through bloom. Top Set DL supplies a balanced nutrient mix that significantly improves nut set. It is soft on blooms, bees and other beneficial insects. It penetrates tissues rapidly and thoroughly to drive increased nut set.

Once set, nuts need more size and weight to maximize yield. Size is driven by cell division and phosphate is a key energy source that drives this process. Calcium is a critical factor in nut weight. Getting it into the nut during cell division is the key to heavier nut meats. More calcium uptake during the cell division in the leaves creates thicker cell walls that are more tolerant of diseases like rust and scab, allowing your fungicide program to be more effective. Getting calcium where it is needed at this peak demand timing is therefore very important. Applying Vigor SeaCal provides this key calcium along with an effective seaweed nutrient that reduces the stress that

accompanies the ethylene the tree produces during bloom. It also supports the benefits of phosphate for increased cell division leading to increased nut size. When tank mixed with AgroBest 9-24-3 a high phosphate/low potassium fertilizer blend more P is available to drive improved nut cell division and leaf cell division for larger leaves to support increased photosynthesis, nut size and nut retention. Agro Best 9-24-3 is the most cost effective liquid phosphate available. It is specifically designed with minimal potassium content for early season foliar applications to give you more P per dollar and less K at a time when the tree requires very little K. Foliar applications of potassium applied during cell division will antagonize calcium uptake and negatively impact leaf cell wall integrity and nut weight.

The energy requirements to maximize nut fill and bulking is significant and requires large healthy and efficiently functioning leaves. Micro Mix DL contains zinc and a complete mix of micronutrients. Zinc is essential for maximum leaf size, vascular function, pollination, and root growth. The micronutrients are essential for the complete development of chlorophyll in the leaves. As bloom ends the leaves are beginning to form and this is the start of increased demand for all these nutrients. At this timing the leaves are still small and a minimal rate of Micro Mix is all that is needed. After this point very rapid leaf out occurs and increased rates of these nutrients are required and an application of System Leaf Max should be discussed with your PCA.



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four to six times annually. The key to success is consistent, regular checkups—something beekeepers may skip when they are especially busy and overworked.

“Sometimes we use the analogy of a personal trainer,” Rennich said. “Many beekeepers know about the importance of colony monitoring, but they get busy, just like most of us know we need regular exercise but put it off when we are busy. But, some people will exercise if they have a relationship or are part of a team that works with a trainer. The ongoing commitment and relationship with the tech teams ensures that the monitoring happens whether the beekeeper is busy or not.” Based on this monitoring, the beekeepers can then take action when needed to safeguard colony health.

Return on Investment

Avoiding bee losses also means avoiding potentially huge economic losses for beekeepers. Normal rates of colony loss approach 40 percent annually. However, because beekeepers working with the tech teams enjoy about 35 percent fewer losses, that means about 80,000 more colonies survive. Because a colony can earn a beekeeper \$250 to \$300 per year, tens of millions of dollars in potential revenue is protected.

“For every dollar invested in this program, we estimate the return is about four dollars,” Rennich said.



Image courtesy of the Almond Board of California.

She believes the project could expand to cover more U.S. beekeeping operations in the future, not only providing monitoring services, but also training operators how to spot infestations and take appropriate action. Either way, it could help prevent bee shortages in the future as demand for pollinators continues to increase.

“What I’ve seen is there is a fear of shortages, and we may be looking at a future where we might be short of bee colonies,” Rennich said. “It may be much more cost-effective to keep the bees you have healthy.”

The Almond Board’s Long-Term Commitment

The Almond Board continues to demonstrate a long-term commitment to pollinator health, investing in more than 120 different research projects since 1995, including six new projects in 2018 totaling \$441,345. Those research programs address improvements in five priority areas where pollinator health is threatened: Varroa mites, other pests and diseases, lack of adequate forage and nutrition, lack of genetic diversity and assuring pesticide use and practices during almond bloom are compatible with bee health. In addition to research, the Board has developed and extended Honey Bee Best Management Practices for California Almonds to assure almonds remain a good and safe place for bees. For more information see Almonds.com/BeeBMPs.

Bob Curtis, who retired in 2018 as the Almond Board’s Director of Agricultural Affairs, said BIP’s Technical Transfer Teams have been a particularly effective investment.

“Before the Bee Informed Partnership, there was a lack of infrastructure for systematically monitoring bee health,” Curtis said. “This provides more structure and assists beekeepers with making decisions about hive health. This program has improved bee health for commercial beekeepers. The losses for beekeepers who participate are significantly lower.”

That, in turn, is very good for almond growers and fits with the Almond Board’s goals, he said.

“We’re committed to bee health and we want to ensure there is a sufficient supply of bees,” he said. “This program does that.”

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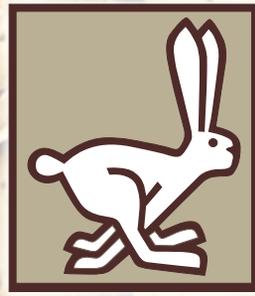
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ALMOND AND PISTACHIO GROWERS NEED TO BE ON THE LOOKOUT FOR BMSB

By CECILIA PARSONS | Associate Editor

AFTER SEVERAL YEARS OF WARNINGS that brown marmorated stink bug (BMSB) posed a threat to California agriculture crops, damage by this invasive species has been confirmed in Merced and Stanislaus counties.

Three almond orchards in those counties sustained measurable damage due to BMSB feeding starting early in the 2018 growing season according to Jhalendra Rijal, University of California Cooperative Extension (UCCE) Integrated Pest Management

(IPM) advisor in Stanislaus County. He reported BMSB invasion in a peach orchard in 2016, and almond orchard in 2017 in Stanislaus County as the first report of BMSB infestation in California crops.

First Detection

Since first detection in California in 2002, BMSB has been found 34 counties. Reproducing populations have been reported in residential and urban areas of 16 counties. Stanislaus and Merced

counties had reproducing populations in agricultural crops since 2017.

BMSB feeds on a wide variety of fruit, nut and ornamental crops and prefers overwintering in human-made structures and wooded areas. This pest has also invaded Oregon and Washington where it has caused damage in apple, pear and hazelnut crops.

Both BMSB nymphs and adults use piercing-sucking mouthparts to feed on leaf and fruit tissues. This feeding, specifically the injection of digestive enzymes to facilitate nutrient extraction, results in necrotic spots. Feeding on developing fruit causes fruits to abort or leads to malformation.

Based on active trapping results in both counties, Rijal said several almond and peach orchards were found to have reproducing populations of this pest. BMSB were trapped in seven almond orchards and seven peach orchards in 2018. Some had very low numbers of BMSB, but two almond orchards had moderate to very high populations. In one orchard more than 700 adult BMSB were caught in traps. The next highest count was 120 in another almond orchard. Other orchard traps caught 10-15 adults.

“This is significant. To my knowledge, it is the first time to have actual crop damage by BMSB that triggered the insecticide use at least in one orchard,” Rijal said. “From what I have seen in last two seasons BMSB is going to be a challenging pest.”

Rijal said when BMSB was first detected in California, there were doubts it could become established and reach population levels found in the east due to hot California summers.

Although there might have some impact by direct sunlight to the egg



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Adult BMSB feeding on almonds. Signs of infestation include fruit gumming and aborted nuts on the ground. A large bug, BMSB can be seen feeding on fruit. This invasive pest has markings that distinguish it from other shield-type bugs. Photos courtesy of Jhalendra Rijal UCCE Stanislaus and Merced counties.

mass and nymphs, healthy orchard canopies are protecting this pest from the heat, Rijal believes, allowing it to become established.

Damage

In the most heavily affected almond orchards, early season damage left piles of aborted nuts on the ground. Seasonal damage to kernels was found at harvest. It is clear, Rijal said, that BMSB has become established in Merced and Stanislaus counties, although the population levels vary among locations. A cage study conducted in 2018 at UCCE Stanislaus showed nuts with BMSB had 80-95 percent early season nut drop last week of March through mid April. Later feeding impacted nut quality. The major type of feeding damage to kernels were gumming, presence of multiple dark spots and presence of 'dimple' on fruit. Shriveled kernels are also found

Rijal is advising almond and peach growers in San Joaquin, Stanislaus and Merced counties to be on the lookout for BMSB infestations in their orchards and to use sticky panel traps with BMSB lures if they have seen some kind of stink bug damage in previous seasons.

Traps

Rijal said he used two types of traps to monitor orchard BMSB levels in 2018. The first was a four-foot tall pyramid shaped trap on the ground primarily used in research. The traps contained a pheromone lure and insecticide strip. Adults would fly into the trap while both adults and nymphs would crawl up and into the trap. The second type of trap was a sticky panel trap attached to a stake about four feet from the ground.

Continued on Page 40

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Continued from Page 39

This type of trap typically attracted more adult BMSB and is a suitable trap option for growers and pest control advisors, he said. These traps should be placed in border rows of the orchard to intercept adults moving into the orchard.

Insecticides

Like leaffooted bugs and other large bug species, BMSB is difficult to kill with insecticides because it is highly mobile and can readily move to other host plants. Rijal said even with timed spray applications only a percentage will be killed and the rest will likely move back into the orchard, this is based on the experience from the mid-Atlantic states where BMSB has been the most severe problem within the United States. Administrative Committee for Pistachio notes that use of broad-spectrum insecticides to kill BMSB will also have negative effects on native predators of pest bugs, causing secondary pest outbreaks. Pesticide resistance can also develop. Pest management strategies



Pyramid trap for brown marmorated stink bug used by UCCE advisor Jhalendra Rijal in 2018 to determine populations levels in almond orchard. This research trap contains both a lure and an insecticide strip. Adults and crawlers were found in the trap. Photos courtesy of Jhalendra Rijal UCCE Stanislaus and Merced counties.

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can be affected by BMSB migrating into crops, making it difficult to control.

A wasp, *Trissolus japonica* or ‘samurai wasp’ is known to lay eggs on BMSB egg masses, parasitizing them. Part of the research being done by University of California (UC) Riverside involves placing sentinel egg cards at BMSB egg sites to determine wasp populations. This wasp has been found in mid-Atlantic states and recently in Oregon and Washington. It is not known to be in California.

BMSB and Pistachios

BMSB research being conducted at UC Riverside is showing that BMSB can pose a threat to pistachios as well. Researcher Ricky Lara has been conducting feeding trials in quarantine and under permit. Trials indicate that BMSB stylets can pierce developing pistachio shells and feeding on kernels can cause necrosis mid to late season.

The Riverside study also showed degree-day models project the first generation of BMSB could be expected in this crop in late June to early July. When feeding on pistachios, BMSB produces a gel-like salivary sheath. Presence of this sheath on pistachios in the study was evidence of BMSB feeding on pistachio nuts.

Brown marmorated stinkbug is similar in shape to other large bug pests in nut crops,



Sticky traps placed on borders of an orchard to detect the presence of BMSB. Pheromone lures attract adult BMSB. Photos courtesy of Jhalendra Rijal UCCE Stanislaus and Merced counties.

but is distinguished by white bands on antennae and legs and a prominent light-dark banding on the abdomen. BMSB eggs are white to light green in color and

are barrel shaped. They are laid in clusters on leaves. First instar is difficult to distinguish but 2nd to 5th instar nymphs have white bands on antennae and legs.

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Microbiology, MACRO IMPACT

By RICHARD KREPS | Contributing Writer

AS A FARMER, YOU HAVE TO KNOW YOUR SOIL. Keeping track of the essential nutrients on reports helps us decide what amounts of each nutrient to apply. Taking samples at different depths help us monitor current amounts, leaching events, and accumulation amounts. Comparing acetate extractions to saturated pastes and water extractions help us to decide what nutrients are available, out of balance, which are tied up and those that are going to be. But none of that will ensure that the nutrition you apply actually gets into your roots. You have to be like a master chef to create the perfect recipes for your orchard. I'd like to paraphrase an analogy from a great biochemist, Dr. Sidhu from Fresno State: 'Think of your soil as a kitchen.' Your soil's cation exchange capacity is your pots and pans; how many ingredients can you get in the pot.



Complex interactions between plant roots and microorganisms. (Haichar et al., 2014)

Water is the stock we are cooking in. Fertilizers are your ingredients. You are the chef that provides the recipe we are going to use, but the real work is done by the cooks. Those cooks are the active microbiology that is going ballistic under your feet to provide a meal a tree can eat. Trees don't have the luxury of going down the street to try another restaurant if they don't like the one in which they are currently dining. You have to make it appealing. Biology is like those magical spices and seasonings that bring it all together and make it the perfect meal.

Benefits of Active Microflora

We now know the benefit to an active microflora in our guts that make us healthy. A properly functioning digestive system has about 5 pounds of active biology working diligently to digest the food we eat. It assimilates the nutrition into forms we can actually absorb and also signals the body which nutrients we need more of and lets us know when we have eaten something that it doesn't like. When we take antibiotics to kill something that is not beneficial we have to basically kill the good ones too. The soil works the same way. Active biology digests, manipulates and decomposes the nutrients in our soil allowing a plant to absorb them. Like antibiotics, fungicides, insecticides, nematicides, and herbicides can knock back the population of beneficial biology as well. Overwatering, severe dehydration, and hard freezes can do the same thing. We have to constantly reinoculate the soil with beneficial biology and keep the soil it's growing in conducive to its health.

Soil Biology

There are two main schools of thought we face in soil biology. One says to provide the raw ingredients (food sources) to help the beneficial biology do its thing, while the other says to actually add that active beneficial biology itself. I have seen both work well and make a difference. I have also talked with farmers that felt like they wasted their hard earned money on an inoculation that didn't work. It is important that we are applying the proper forms of biology for the responses we want.

One of the most beneficial forms of soil biology that has shown great promise is mycorrhizae. There are studies showing nutritional movement and signaling through mycorrhizal populations to feed younger trees in a forest that don't get the sunlight of the taller trees shading them out. Many studies

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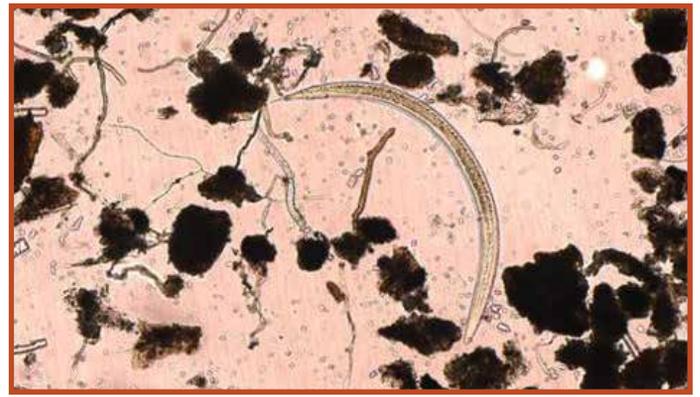


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Microbes in the soil are central players converting carbon into greenhouse gases. Credit: Alice Dohnalkova/PNNL

Soil microbiology shown at the microscopic level.

(one in particular by J.W. Kloepper, Australasian Plant Pathology 1999) have shown how specific soil borne and foliar microbiology has helped to control, eliminate or suppress fusarium, rhizoctonia, pythium, sclerotium rolfsii and verticillium, to name a few. It really shouldn't be a surprise as most of the antibiotics we take as humans to combat illness comes from biology itself. Many companies have added organic acids, sugars, starches and carbohydrates to their nutritional products to act as a medium to promote assimilation and microbiological stimulation. Those carbon sources act as food for soil borne microbiology. They make their environment more conducive for reproduction as well as chelate nutrition for later use. Composts and compost teas can be teaming with active biology as well as a food source for biology. There are multiple options and approaches that can all be beneficial at the right time and place.

The research has become irrefutable that soil biology plays a huge role in our orchards health, or lack thereof. Manipulating the soil to make it more conducive to that biology or actively attempting to modify the population of specific biology has become a major focus for many agricultural companies. Working with your Agronomists, pest control advisors (PCA) and certified crop advisors (CCA) should give you the tools you need to make better decisions in choosing the right approach. Biology needs to play a part of that approach. Giving your soil the right recipe for its health will taste so much sweeter at harvest.

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Walnut Scale & Frosted Scale Management



By DANI LIGHTLE | UC Cooperative Extension, Glenn, Butte & Tehama counties and By EMILY J. SYMMES | UC Cooperative Extension Sacramento Valley Area IPM Advisor and Statewide IPM Program

UC CE | University of California Agriculture and Natural Resources | Cooperative Extension

MUCH OF THE TALK THIS WINTER has focused on low walnut prices and decisions on which practices are essential vs. which can be placed on the back burner this year. Where does management of walnut scale and frosted scale fall on that list?

The risks of high populations of frosted and walnut scale include increased stress on trees and increased risk of *Botryosphaeria* (Bot) infections. Scale feeding sites on scaffolds and branches are susceptible to Bot. Infections will sporulate, increase inoculum, and may lead to limb dieback. Loss of fruiting wood, combined with fruits blighted by *Botryosphaeria*, represent a direct loss to your crop and, consequently, your bottom line. Minimizing disease entry points to maintain low levels of inoculum is an important management goal. On the other hand, if scale populations are low, it costs you money to apply a spray that is not required. One of the main goals of integrated pest management (IPM) is to weigh the costs of a treatment against the loss that occurs from doing nothing.

When is Your Scale Population Worth Treating?

How do you decide whether your population is worth treating? You first need to know how severe your pest pressure is, and this can best be done by monitoring during the dormant season. To monitor for scale pests, examine scaffolds, limbs and branches for presence of pests and evidence of biological control activity. Make sure to look at recent prunings as well, or get up in the tree canopy

on a pruning tower. Be sure to vary your observations by height as well as throughout the orchard, as populations may vary spatially. Examine a minimum of 100 branches and scaffolds from trees distributed throughout the orchard.

Photos 1 through 3 (walnut scale) and photos 4 and 5 (frosted scale, page 46) give you an idea what to look for. In the case of walnut scale, the scale cover can remain attached to the tree long after the insect beneath has died. Take time to peel back the scale covers to evaluate the viability of walnut scale populations (live or dead, **photos 1 and 2**, respectively). If you have applied insect growth regulator (IGR) insecticides at proper timing in the last year or two, research indicates that these IGRs can suppress scale populations for two to three years. If monitoring indicates that walnut scale is dead and frosted scale is not an issue in the orchard, you may be able to skip a scale treatment this spring.

While scouting, be sure to take note of parasitism (**photo 3**). Parasitoid populations can build over time and provide substantial biological control of scale pests at no cost to you. If monitoring indicates few live scale and high rates of parasitism, holding off on an insecticide treatment will save you money and allow those parasitoid populations to increase. The decision tree (**Figure 1, below**) can be used to help you

Continued on Page 48

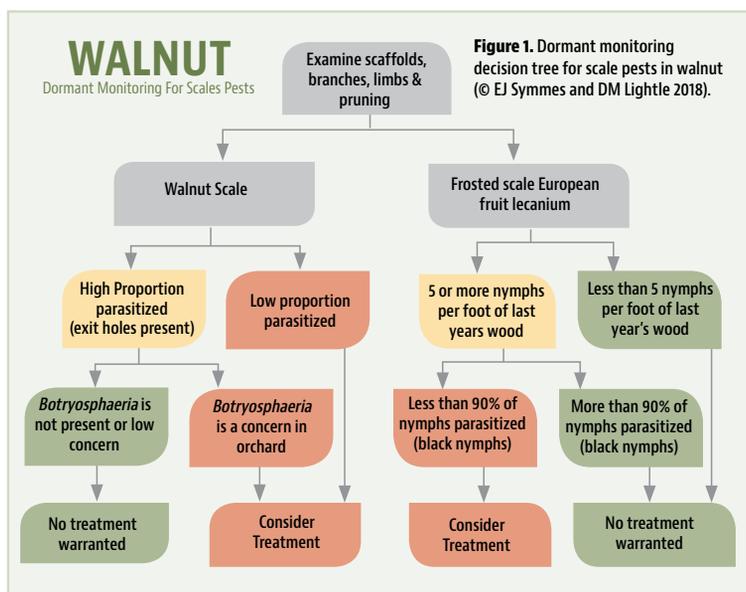




Photo 1. Live walnut scale adults. (Photo Credit: University of California Statewide IPM Program)



Photo 2. Dead walnut scale adult. (Photo: E.J. Symmes)



Photo 3. Parasitized walnut scale adult. (Photo Credit: University of California Statewide IPM Program)



Photo 4. Healthy (non-parasitized) frosted scale nymphs. (Photo Credit: University of California Statewide IPM Program)

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determine whether populations may require treatment.

Delayed Dormant Treatments

If monitoring indicates a need for treatment, IGRs are effective management options. They can be applied at a delayed-dormant timing (March) or crawler timing (mid spring, when scouting indicates crawlers have emerged).

Considerations for a delayed-dormant application:

- Treat only if dormant monitoring indicates need. Utilize the treatment decision tree (**Figure 1**), orchard management history, and risk tolerance to help decide your need.
- Often this will be a stand-alone treatment (only the insecticide in the tank for this pass through the orchard).
- Depending on other orchard activities and labor availability, there may be a benefit to having the treatment completed before April/May, while there are fewer pressing tasks to be completed.
- Follow up your treatment with spring crawler monitoring using double-sided sticky tape for walnut scale or visual observations of eggs/crawlers beneath frosted scale bodies (**photo 6, page 47**).
- Considerations for a crawler application:
- Time treatment to target peak crawler emergence. In our



Photo 5. Parasitized frosted scale nymph. (Photo Credit: University of California Statewide IPM Program)

- research trials, this has typically been approximately one week after detection of the first crawlers.
- Use double-sided sticky tape for monitoring crawlers.
 - For walnut scale, look for the appearance of small, yellow, mite-sized crawlers building up on the edges of sticky tapes (**photo 6, page 47**).
 - For frosted scale and European fruit lecanium, lift the adult female bodies and visually look for eggs (small, white, shiny in appearance; resemble tiny grains of rice, (**photo 7, page 47**) and crawlers (small, yellow, mite-sized; will be actively moving out from beneath the scale

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Photo 6. Walnut scale crawlers trapped on double-sided tape, high magnification. (Photo: E.J. Symmes)



Photo 7. Frosted scale with eggs. (Photo: E.J. Symmes)



Photo 8. Frosted scale with crawlers. (Photo: E.J. Symmes)

body, **photo 8**).

- Do not time this treatment based on calendar dates (e.g., first week of May). Our monitoring over the past several years indicates that crawler emergence timing is variable. We have observed onset of emergence as early as the third week of April and as late as the third week of May.
- There may be a cost-saving benefit if the crawler application is coupled with another well-timed application (e.g., insecticide for another pest, fungicide, bactericide, nutrient) by saving a pass through the orchard.
- Precise timing can be difficult to achieve for some

operations amongst the other tasks that need to be completed in the orchard during this time-frame.

For additional information on pest identification and treatment options, see the UC IPM guidelines for walnut scale at: ipm.ucanr.edu/agriculture/walnut/Walnut-Scale/ and frosted scale at: ipm.ucanr.edu/agriculture/walnut/Frosted-Scale-and-European-Fruit-Lecanium/.

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Preventing Crop Loss from WALNUT BLIGHT

Treating early and aggressively is the best route to take in preventing crop losses due to walnut blight.

By CECILIA PARSONS | Associate Editor

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SPRAY TIMING, RATE AND COVERAGE are the fundamentals of any effective spray program, said University of California Cooperative Extension (UCCE) farm advisor Luke Milliron.

Size of mature trees makes good coverage a challenge as the material must make contact with bud or nutlet surface to provide protection from blight infections.

“Use a big machine, go slow and use spray cards to check the coverage,”

Milliron said.

Walnut blight is caused by the bacterium *Xanthomonas arboricola* *pv juglandis* (*Xaj*). The bacteria overwinter on the tree’s outer bud scales. The developing leaf and shoots inside the dormant bud become infected when they emerge and are splashed with water carrying the bacteria. The infection causes a dark sunken lesion on the blossom end of the walnut husk and kills the developing kernel. Later in the

season, blight lesions develop elsewhere on the husk. These lesions begin as small water soaked spots that later darken. They can lead to cracking, inviting secondary insect or disease damage, but do not invade the kernel.

The combination of wet weather as the shoots begin to emerge and high levels of the inoculum in the orchard can lead to severe crop loss. Yield losses under high pressure conditions can reach 50 percent, Milliron said, if there is no blight prevention program in place.

Prayer Stage

Protecting the emerging shoots and flowers from infection depends on timing. First sprays of the growing season should coincide with early shoot emergence. UCCE orchards advisor emeritus Richard Buchner and Jim Adaskaveg, plant pathology specialist at University of California (UC) Riverside report that when 40 percent of the shoots are elongating, the first protective spray should be applied. Milliron



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Rick Buchner, University of California Cooperative Extension farm advisor for Tehama County, shows walnuts buds at prayer stage which is an indicator of when to spray for walnut blight. All photos courtesy of Kathy Coatney.

said he is advising growers with high-pressure conditions to consider first spraying at catkin emergence or bud break. Under moderate to low pressure conditions time first spray at 20 percent female flowers visible. This stage is called the 'prayer' stage as the unfolded leaves resemble praying hands. Under very low pressure conditions spray at 40 percent prayer stage.

Seven to ten days later, a second spray can be applied to protect the remaining opening buds. The decision to apply a third spray depends on number of infected buds, weather conditions, variety and disease history of the orchard.

Overwintering Inoculum

Milliron is an advisor in Butte, Tehama, and Glenn counties, a region where higher levels of *Xaj* are found. Blight pressure was high this past season, he said, with early leafing varieties in Tehama County hardest hit. The toughest situations, he noted, are in orchards with high levels of overwintering inoculum and extensive rain-fall. Early leafing varieties including Vina, Serr, Ivanhoe and Tulare can be particularly affected as the buds and developing nuts are exposed for a longer period during wet conditions. There may also be a genetic component. Studies on this are being conducted by the UC Davis

Continued on Page 52



Walnuts buds at prayer stage in an orchard in Tehama County. Prayer stage is an indicator of when to spray for walnut blight.



Rick Buchner, University of California Cooperative Extension farm advisor for Tehama County, shows walnuts buds at prayer stage which is an indicator of when to spray for walnut blight.

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Continued from Page 51

walnut breeding program, Milliron said. Development of blight resistance is a key objective of the program.

Blight damage on later leafing walnut varieties depends on the population of the overwintering bacterium on the bud scales. The inoculum levels in dormant buds can be used to predict disease severity.

The Chandler variety can be affected by blight. Buchner reported that 50 percent crop damage has occurred in Chandler orchards when overwintering bud populations were high and wet conditions prevailed. Chandler orchards with low inoculum levels had few blight infections, even during wet weather.

According to the UC blight management guidelines, late leafing walnut varieties have less opportunity time to build high walnut blight populations. Probability of disease incidence is not eliminated, only reduced. The guidelines suggest a strategy of applying



Rick Buchner, University of California Cooperative Extension farm advisor for Tehama County, shows walnuts buds at prayer stage which is an indicator of when to spray for walnut blight.

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the first two spray applications with the goal of maintaining low inoculum levels.

Inoculum Levels

Estimates of inoculum levels can be done by collecting 50-100 buds per orchard block and having them evaluated in a microbiology laboratory. Buds can be sampled in December, January and February and later for late leafing varieties. UC guidelines recommend selecting 100 dormant walnut spurs with fat terminal buds from trees throughout the orchard. Low-level spurs represent a good sample as the bacteria sprinkle down through the tree canopy. The spurs should be stored in a paper bag to avoid condensation until delivered to the lab.

Another strategy is to use the disease levels noted in the previous growing season to determine the level of infection. A disease rating scale can be used annually. Low disease risk is less than 50 total blighted nuts per tree. Moderate risk is 50-150 blighted nuts per tree and high disease risk is more than 150 blighted nuts per tree. In orchards where catkins emerge before the pistillate flowers, if there was

“Use a big machine, go slow and use spray cards to check the coverage,”

—Luke Milliron

disease incidence the previous year and rain is forecast during bloom, a spray application should be considered when 30-40 percent of catkins emerge.

Copper Applications

Dense tree canopies and high levels of inoculum resulting in high disease pressure can reduce the effectiveness of a spray application. Common mistakes with walnut blight control include being late with first spray, material rates too low, poor spray coverage, using a weak material in high blight level orchards, half sprays from every other row application, and not tank mixing with a Mancozeb formulation.

Walnut and other growers who rely on copper applications received good

news recently that followed comments submitted by California Walnut Commission, the US Environmental Protection Agency announced it will not reduce the current annual application rate for copper on walnuts. In 2017, EPA announced a 25 percent reduction in the amount of copper walnut grower could use.

The UC guidelines recommend copper tank mixed with Manzate flowable as a spray choice. In 2018, a new registration for Kasumin 2L was announced. Adaskaveg said, Kasumin 2L has consistent efficacy when applied with either copper or mancozeb. It is not a silver bullet, he noted. Used alone it only has moderate efficacy and poses an elevated risk for walnut blight

resistance development.

The Kasumin registration allows for a rotation of chemistries to prevent resistance. The rotation of Cu-mancozeb, kasumin-mancozeb, kasumin-Cu was determined by Adaskaveg to be highly effective. Each of the chemistries have a different mode of action in targeting bacteria as denoted by the FRAC group M1 for copper, M3 for mancozeb and 24 for kasumin.

Kasumin 2L may only be used in a maximum of two applications consecutively. There is also a minimum interval of seven days between applications. Alternate row spraying is not allowed. Other restrictions include a pre-harvest interval of 100 days. Additional restrictions are due to the classification as an antibiotic, meaning its use is prohibited in orchards with animal grazing or fertilization from animal manure sources.

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Managing Eastern Filbert Blight IN HAZELNUTS

Eastern Filbert Blight (EFB) is a fungal canker disease of hazelnut that slowly kills the tree.

By KATHY COATNEY | Editor



Eastern filbert blight can result in an unproductive orchard within three to seven years. Trees are still alive but with many dead branches and few, if any, nuts. All photos courtesy of Jay Pscheidt.

JAY PSCHIEDT, EXTENSION PLANT pathology specialist with Oregon State University (OSU) has done work on EFB in hazelnuts.

“This fungus is systemic in the tree and continues to work down into the tree, killing it as it goes,” Pscheidt said.

EFB is found throughout the Willamette Valley, but there are a few growers in the Roseburg area where the disease has not been detected, Pscheidt said.

EFB Infection

Trees are susceptible to EFB infection from budbreak until late spring.

Rain and wind release the spores from cankers and spread them to healthy shoots. The only susceptible site for EFB infection is on the new shoot, so in order for chemical control to be effective it has to target the expanding shoot tip.

Wounds and natural openings on hazelnut trees have not been found as

entry points for the fungus, but EFB can be spread between regions, orchards and trees.

Spread Between Regions

Long distance spread between regions can be through infected nursery stock, and it’s believed that was how EFB was originally introduced into the Pacific Northwest from the East Coast.

Infection can also happen with orchard stock, and trees can be infected in the nursery before shipment. Early detection, quick scouting and tree removal will help reduce EFB in the orchard.

Quarantines on shipments from the East Coast helped keep EFB out of the western hazelnut growing regions for nearly a century. Quarantines have also been imposed within Oregon to prevent movement of nursery stock from the northern Willamette Valley to the mid and southern valley areas. A five-year moratorium on retail and landscape sales was put in place on all *Corylus* in Oregon to prevent the spread of EFB. A quarantine remains in place to prevent the introduction of different biotypes of the fungus from out of state to help protect the new resistant hazelnut varieties.

In other parts of the U.S. like—Ohio, Pennsylvania and New Jersey—there are other types of fungus that can override and break down this resistance, Pscheidt said.

“They have cankers just as though there was no resistance there at all,” Pscheidt said.

“We have not seen any of those fungi, those biotypes of that fungus out here,”

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Pscheidt said.

“It’s possible that given enough time the fungus could potentially break it down here,” Pscheidt said, but EFB is a slow moving fungus.

“To complete one turn of the lifecycle is two years. So it’s very slow in that respect,” Pscheidt said, especially if compared to rust on wheat.

For instance, if a new wheat variety is released, the rust can bring it down within a couple of years. This is because rust has many, many, many cycles in a one growing season, Pscheidt explained.

The chances are good that there’s that one mutation that all of the sudden becomes able to attack that resistant wheat and off it goes,” Pscheidt said.

“That could still happen in Eastern Filbert Blight,” Pscheidt said, but it’s a much slower process, and it could be three to five years before the disease was recognized.

Spores Released During Rain Events

A. anomala ascospores are released with the fall rains and continue through the following spring.

When rain begins, the hourly rate of ascospore capture increases until the fifth hour of rain. After that, it remains relatively constant for the next 5 to 12 hours of rain, then gradually declines.



Most Jefferson trees show no infection at all. A few cankers may develop but are smaller, generally do not have stroma and a third may heal over within two or three growing seasons.

The rates of ascospore release associated with rain is highest at budbreak and then decreases in April and May and into early June when the reserve of ascospores is depleted.

Spread Between Orchards

Stopping the spread of EFB between orchards has been more challenging.

An EFB spore is about 10 times smaller than a hazelnut pollen grain, and they become airborne by wind during rain. Research shows that EFB spores can be moved from infected areas by wind and when they land on other hazelnut trees it will infect them.

Other Potential Sources of Infection for Spreading EFB Include:

- Twigs with cankers can be a source of infection (nuts are not a source), and they can be moved long distances when transported in harvest bins or on orchard equipment.
- Debris from nut bins is another source of infection and should be burned or buried.
- Farm implements need to be inspected and cleaned before they are transported from infected to clean orchards.
- Movement of EFB spores by bird feet is considered very unlikely.

The threat of EFB spreading within an orchard is also of concern. Spores are ejected into the wind after cankers are wet for as little as five hours. Rain splashed spores that hit neighboring trees are washed down the scaffolding to

Continued on Page 58

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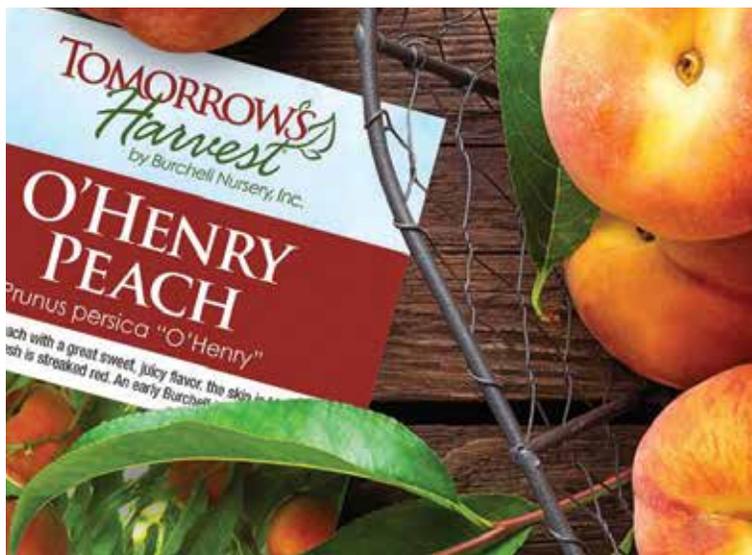
By Barbara Cocks

"There is something special about digging your hands into the soil, gently preparing the spot where a new tree will be planted to grow tall and strong, and bear delicious fruit to share with family and friends," says Tom Burchell.

For more than 75 years three generations of the Burchell family have been at the forefront of research and development of hundreds of varieties of fruit and nut trees. Irvin Burchell, the founder and patriarch of the family, believed that each tree and plant that bore the family name was a living promise made to their customers, that the investment they were making when buying them and then nurturing them needed to be worthy of their choice.

His success is certainly a story of genetics, both through the painstaking research and development of each Burchell variety and also of the three generations of leadership of the company. Tom Burchell, who has led the company since 2005, may have inherited his traits of humility, positivity and perseverance, but he's honed his skills through study and hard work. Holder of an Ornamental Horticulture degree from Cal Poly San Luis Obispo, Burchell initiated the product development division at Burchell Nursery, and now it collaborates with nurseries in Chile, Australia, South Africa and Europe.

"While I'm proud of the nursery's past, I'm focused on the future and how the nut breeding program can help farmers be ready for whatever it holds. This requires innovative thinking, but also takes daily diligence, as bringing new varieties to market is roughly a 10 year commitment," says Burchell. But Burchell has the vision to focus on long-term goals (no surprise, he's completed marathons, including running the Boston Marathon).



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In 2009 Burchell launched the retail division of the company, Tomorrow's Harvest, for the home orchardist and gardener offering everything from fruit to nut trees, herbs to ornamentals, shrubs to strawberries, lingonberries to lavender all having been carefully cultivated.

With the success of the Tomorrow's Harvest® brand in retail stores across the country and online, Burchell sought to find a way to give back to the communities and to the people who had supported his business endeavors. "While on vacation, I began to think about the creation of what has become our Give & Grow Hope

program," says Burchell. For every Tomorrow's Harvest tree purchased the company will donate a tree through its Give & Grow Hope organization to a deserving community group to provide access to fresh fruit, so people can enjoy delicious fruit-filled recipes like those Burchell enjoyed growing up.

"My mom would call dad and he would be sure to fill a bag with peaches, plums or nectarines before heading home so my mom could make one of our favorite dessert, like Fresh Peach Pudding," Burchell says.



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An out of the ordinary peach cobbler.

Fruit Filling:

- 1 cup flour
- 1/2 cup sugar
- 2 teaspoons baking powder
- 1/2 teaspoon salt
- 1/2 teaspoon cinnamon
- 1/2 cup milk
- 3 cups sliced, peeled peaches

Syrup:

- 1-1/2 cups water
- 1/2 cup sugar
- 1/2 cup packed brown sugar
- 1 tablespoon butter

Directions:

Preheat oven to 400°. Grease an 8×8-inch or a comparable sized baking dish. Set aside.

In a large bowl, whisk together the flour, sugar, baking powder, salt, and cinnamon. Stir in the milk just until combined. Gently fold in the peaches. Spread into the bottom of prepared pan and place on a rimmed baking sheet.

In a large saucepan, combine the water, both sugars, and butter. Bring to a boil, stirring until the sugars are dissolved. Pour over the peaches. Bake for 40-50 minutes or until filling is bubbly. Serve with a scoop of ice cream, if desired.

Yield: 6 servings; Prep time 15 minutes; Cook time 50 minutes.

Recipe by LIZ BERG



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growing shoots or suckers on the trunk.

Patterns of diseased trees within an orchard show that spread of the disease happens on the northeast side due to the fact that many of the rainstorms in the spring move from the southwest to the northeast.

Expansion of Cankers

EFB cankers will continue to expand each year. The cankers will lengthen from a few inches on small branches to over three feet on large branches of susceptible varieties. They will also expand around the branch.

The expanding cankers girdle the limb and cause dieback, but the leaves on the branches can remain attached after dieback.

Unlike many other canker fungi, EFB does not survive in dead, dry tissue. The fungus must have live tissue to grow and reproduce, so when the branch dies, the fungus also dies.

The Latent Period

The latent period is the time from when a spore infects a hazelnut shoot until a canker symptom is visible. The disease infects a bud so the buds start growing, and that juvenile tissue is very vulnerable on a susceptible cultivar, Pscheidt explained.

“It’s not until the late summer after that infection has occurred that we typically see the first symptoms occur—the canker and the black bumps,” Pscheidt said, adding it’s generally a two year lifecycle.

Planting Resistant Varieties

Most growers are choosing to plant resistant varieties, which significantly reduces their risk of EFB, Pscheidt said.

Planting resistant varieties is the easiest way to management EFB. Resistant varieties include:

- Lewis
- Clark
- Gem
- Sacajawea
- Santiam
- Yamhill
- Dorris
- Wepster
- McDonald
- Jefferson

There are resistant pollinizers available, too.

Pscheidt advises growers planting new orchards to inspect the trees and make sure there aren’t any cankers. Finding the disease early is important, he stressed.

To date, the resistant varieties are holding up extremely well, Pscheidt said, and as a result acreage has doubled since the resistant varieties were released.

Some growers are interplanting the resistant varieties with heavily diseased trees, which isn’t recommended because it increases the risk those trees will become infected if they have high enough exposure to the fungus, Pscheidt said.

“The more spores that there are in the air, the better able it might be to infect these new trees. So putting a resistant tree in the middle of an infected orchard puts it at greater risk,” Pscheidt said.

“We did a study where we were tracking cankers on some of these resistant types, and we had a 35 acre orchard that was planted between heavily infected orchards, so we ended up getting a lot of them (cankers),” Pscheidt said.

“We had a 100 or so cankers that we were following and a third of them actually healed over and got better,” Pscheidt said, adding the cankers didn’t disappear, but the trees were able to fight off the fungus as it grew and became established.

About a third of the cankers stayed the same, and the other third the fungus was winning, Pscheidt said.

The take away here is, the fungus can cause trouble in resistant varieties, too, Pscheidt said.

Management of EFB

Management of EFB includes: scouting, spraying and pruning.

It’s very important to scout for disease and early detection is critical. It’s recommended that growers scout orchards at least twice a year, including new resistant varieties the year after planting.

A total of four fungicide applications are recommended, and they should start early to mid-march (budbreak) and

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continue every two weeks, depending on the weather and material used.

Fungicides are also recommended for resistant varieties the first spring after planting.

“When they do plant that a new orchard they might want to use a fungicide that very first year,” Pscheidt said.

Once the tree has EFB, pruning out the diseased wood is important as pruning is the only way to remove EFB from the tree.

Prune one to three feet below the visible cankers. With susceptible trees that have several cankers, they must be removed. Resistant trees with one or two cankers should be lightly pruned.

Removing the material by pushing it out of the orchard and burning stops the disease, but research has also found that using a flail mower and chopping the material is also effective.

“What we’ve found with our research is that if you cut it out of the tree and leave it on the ground as is the spores could still come up out of there and be a problem,” Pscheidt said.

The fungus can still be found when the material was chopped and left on the orchard floor, Pscheidt said, but the inoculum is reduced to the point that it isn’t a problem.

Comments about this article? We want to hear from you. Feel free to email us at article@jcsmarketinginc.com



Some cankers on 'Jefferson' may continue to grow each year and should be removed.



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DIVERSIFICATION: Do Chestnuts Make Financial Sense?

If "Chestnuts Roasting on an Open Fire" is your favorite Christmas song, you might be a chestnut grower.

By CECILIA PARSONS | Associate Editor

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THIS NICHE NUT NEEDS ALL THE notoriety it can get, as most domestic consumers don't realize that U.S. chestnut production is in direct competition with imported chestnuts.

"The buyers are more familiar with the Italian-grown chestnuts, but ours have the same flavor and quality as the imports," claims Luke Wilson who farms, stores and ships chestnuts in Butte County.

Up and Coming Specialty Crop

Wilson harvests chestnuts from a 20-acre block and a 10-acre block and markets the nuts to wholesalers who are able to move them in bulk.

"This is an up and coming specialty crop and we need the recognition from buyers and consumers to move volume," Wilson said.

The last of Wilson's chestnuts are usually moved out of cold storage and sold by December. After the 2017 harvest, Wilson said he wished he had more chestnuts to sell. This year, finding buyers proved more difficult.

"I wouldn't go out and plant 100 acres of them," he said.

Chestnut Production

The United States is one of the few regions in the world that can produce chestnuts, yet it does not have a significant chestnut industry, with domestic growers only adding one percent to the world's chestnut production total. As of 2018, the United States Department of Agriculture (USDA) reported only 919 farms producing chestnuts on 3,700 acres. The top five chestnut producing states are Michigan, Florida, California, Oregon and Virginia.

Research conducted by University of Missouri Center for Agro-forestry



Chestnut open burrs on tree. Photo courtesy of Sandy Harrison.

found U.S. chestnut producers are mainly part time farmers and size of production operations is 3-10 acres.

To meet demand the United States imported 88,000 metric tons of chestnuts valued at \$254 million in 2018. Leading the imports are Italy, China and France.

The USDA refers to chestnuts as a 'grain' growing on a tree. Kernels are 40 percent carbohydrate, 40 percent water and less than 5 percent oil. The cream-colored kernel is covered with a pellicle. The leathery shells are dark colored. The hull is a prickly burr that splits open as nuts mature. Chestnuts are sold fresh and must be kept in cold storage from harvest to market. They have a short shelf life if not processed.

Nut size, degree of burr separation from the shell, ease of pellicle removal and flavor are all important quality characteristics of chestnuts.

Chestnut Pricing

National Ag Statistics Service reports that the value to the nut is related to size. Value ranges from 75 cents to \$2.50 per pound wholesale and from \$2 to \$5 per pound retail, depending on the market. Value-added marketing options include farmers markets (in season) ethnic markets, restaurant food distributors, mail order and seasonal food processors. In addition there is a growing consumer base for U-pick and agritourism operations.

According to retired University of California Cooperative Extension (UCCE) farm advisor Paul Vossen, size of the individual chestnut is important in the fresh market. Larger nuts (16-28 grams each) command higher prices.

Production costs vary greatly depending on site and management practices. On a good site, a mature orchard should yield 3,000 pounds per acre. Vossen said with improved cultivars and cultural practices, per acre yields can rise.

At a wholesale price of \$2 per pound, and a yield of 3,000 pounds per acre, gross return to growers would be \$6,000 per acre per year. Land, purchase of quality trees, water, harvest cost and cold storage costs have to be considered. A positive cash flow could be realized by years 10-15 and productive commercial life of a chestnut tree can be more than 100 years.

Chestnut Varieties

The chestnut tree is in the same family as beeches and oaks. Chestnut trees vary in growth habit depending on variety, but are generally very large with spreading limbs. They are most productive growing in well drained soils. Four species of chestnut are grown in North America. The American chestnut was native to the Appalachian forests of the

Continued on Page 62



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Chestnut bin. Photo courtesy of Sandy Harrison.

Continued from Page 61

United States from Maine to Georgia and as far west as Michigan and Louisiana. This species was virtually wiped out in the early 1900s by a fungal disease chestnut blight.

Trees grown for commercial nut production are mainly hybrids, and resistant to blight.

The main variety grown in California is 'Colossal' which is grown with the pollenizers Silverleaf and Nevada.

Chestnuts trees have both male and female flowers on the same tree and are wind pollinated. Each pistillate flower differentiates into three pistils within the burr. If pollinated, the ovaries of all three will develop into nuts; but the middle one will be flattened. In some cultivars, two pistillate flowers fuse resulting in four to six small and poorly shaped nuts.

In the Central Valley, Colossal burrs will begin to dehisce in mid September, shedding the nuts. Nuts will continue to drop for the next three to five weeks with or without the burr.

Sandy Harrison has been a chestnut grower since 2004 when a mature 10-acre orchard was purchased. The land, near Gridley, also supported kiwi

and peaches, but Harrison said the decision was made to stick with one crop and that would be chestnuts. In 2005 more chestnut trees were planted.

"It made sense for us," she said.

Harrison's operation, Harrison's California Chestnuts, sells direct to stores and individual customers and also belongs to a co-op for bulk sales to wholesalers.

Challenges of Growing Chestnuts

Farming chestnuts has been a challenge, as Harrison said they had no prior experience with the crop. Irrigation, with a drip system is done May-September. The trees do not do well with over irrigation, but inadequate irrigation can affect nut size and volume. Some pruning is done to remove branches that block tractor access and to open canopies to add light.

The main disease issue with chestnut trees is phytophthora, Harrison said. The disease can severely affect young trees. In mature trees, yield can take a hit. Blight, a disease that wiped out native U.S. chestnuts in the east, is not a problem today.

Chestnut trees are usually planted on a 20 by 20 spacing, but it can vary with variety and pruning program.

“Starting up a new orchard is a challenge, but we feel grateful for the income the orchard provides,”
—Sandy Harrison

Harvest

Chestnut harvest in California begins in September. Unlike other tree nuts, chestnuts are not shaken from the tree. Mechanical shaking could knock off the unopened burrs, Harrison said, and removing them mechanically is an extra expense. Instead, the nuts fall to the ground and then they are swept and picked up off the orchard floor by machine every other day through harvest which usually ends in October.

Chestnuts must be placed in cold storage at 33-34 degrees F immediately after harvest and kept there until sold to preserve quality. This year the crop was sold by mid November, Harrison said.

After 15 years of growing chestnuts, Harrison affirms the crop can have a positive cash flow, but there is a long learning curve to achieve optimal production. Cold storage costs and de-husking the nuts are added expenses.

“Starting up a new orchard is a challenge, but we feel grateful for the income the orchard provides,” Harrison said.

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Form I-9— Know the Requirements

By AMY WOLFE | Contributing Writer

In agriculture our labor needs change with the seasons, which means we are regularly pulling together the new-hire-paperwork packet for our employees. One of the most critical, and frankly complicated, forms in that packet is the Form I-9, the Employment Eligibility Verification form that needs to be filled out for every person hired in the U.S. after November 6, 1986. Let's spend some time diving into each section and its requirements.



Section 1. Employee Information and Attestation (Employees must complete and sign Section 1 of Form I-9 no later than the first day of employment, but not before accepting a job offer)

Last Name (Family Name) Doe	First Name (Given Name) John	Middle Initial A	Other Last Names Used (if any) N/A	
Address (Street Number and Name) 123 Main St.	Apt. Number 1	City or Town Washington	State DC	ZIP Code 00000
Date of Birth (mm/dd/yyyy) 01/01/1970	U.S. Social Security Number 123-45-6789	Employee's E-mail Address john.doe@email.com	Employee's Telephone Number 202-123-4567	

I am aware that federal law provides for imprisonment and/or fines for false statements or use of false documents in connection with the completion of this form.
I attest, under penalty of perjury, that I am (check one of the following boxes):

1. A citizen of the United States

2. A noncitizen national of the United States (See instructions)

3. A valid permanent resident (Alien Registration Number/USCIS Number)

4. An alien authorized to work—until expiration date, if applicable, mm/dd/yyyy:
(Some aliens may write "N/A" in the expiration date field. (See instructions))

Aliens authorized to work must provide only one of the following document numbers to complete Form I-9:
An Alien Registration Number/USCIS Number OR Form I-94 Admission Number OR Foreign Passport Number.

OR (See instructions) Do Not Check in This Space

1. Alien Registration Number/USCIS Number: _____
OR
2. Form I-94 Admission Number: _____
OR
3. Foreign Passport Number: _____
Country of Issuance: _____

Signature of Employee: *John A. Doe* Today's Date (mm/dd/yyyy) **Date Employee Completes Section 1**

Be sure you are using the most recent version of the form, only use blue or black ink and no highlighter or whiteout markings.

Section 1: Employee Information and Attestation

It is the employee's responsibility to provide the following information:

- Full legal name
- Other names used, like a maiden name
- Current address, no P.O. Boxes
- Date of birth
- Mark the appropriate citizen or noncitizen box
- Signature and dates

It is the employer's responsibility to review the information provided by the employee in Section 1 and ensure all of the information is filled in legibly, including the employee's signature and the date signed. You should note whether your employee indicated in Section 1 that their employment authorization will expire, and mark your calendar with the date to re-verify. In addition, be sure you are using the most recent version of the form, found in the upper right-hand corner of the first page. It is also important to only use blue or black ink and never use a highlighter or whiteout on the form. These latter reminders are important as an employer can be given an administrative citation for not following the directions on any part of the form.

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Section 2: Employer Review and Attestation

Employers must complete and sign Section 2 on the I-9 within 3 business days of the date of hire of the employee (the hire date means the first day of work for pay). For example, if your employee began work for pay on

Monday, you must complete Section 2 by Thursday of that week. If the job lasts less than 3 days, you must complete Section 2 no later than the first day of work for pay. The employee must present documents that verify his or

her identity and the right to work in the United States. A variety of documents satisfy both requirements and are referred to in List A of the instructions. Alternatively, an employee can present a document from List B validating their identity and List C with their work authorization. To review a complete list of the accepted documents, including pictures of examples for reference, visit I-9 Central at https://www.uscis.gov/i-9-central/acceptable-documents/list-documents/form-i-9-acceptable-documents?topic_id=1&t=b.

It is the employer responsibility to take the documents provided and subsequently complete the section with the employee's name, along with the information from the documents in the appropriate List A, B or C column. Employers are responsible for visually inspecting the documents presented to ensure they are legally acceptable and genuine. In addition, the business name, address, date hired, date signed, and signature lines should all be completed.

In Section 2, common administrative mistakes include not following the correct date format (mm/dd/yyyy), example, 01/08/1980. It is often common for employers to not complete the form within the three business days, as previously mentioned. Lastly, illegible handwriting creates challenges when and if the form is ever audited.

Section 3: Reverification and Rehires

This section requires attention when your employee's employment authorization or documentation of employment authorization has expired. Employers should not re-verify the following documents:

- U.S. citizens and noncitizen nationals
- Lawful permanent residents who presented a Form I-551, Permanent

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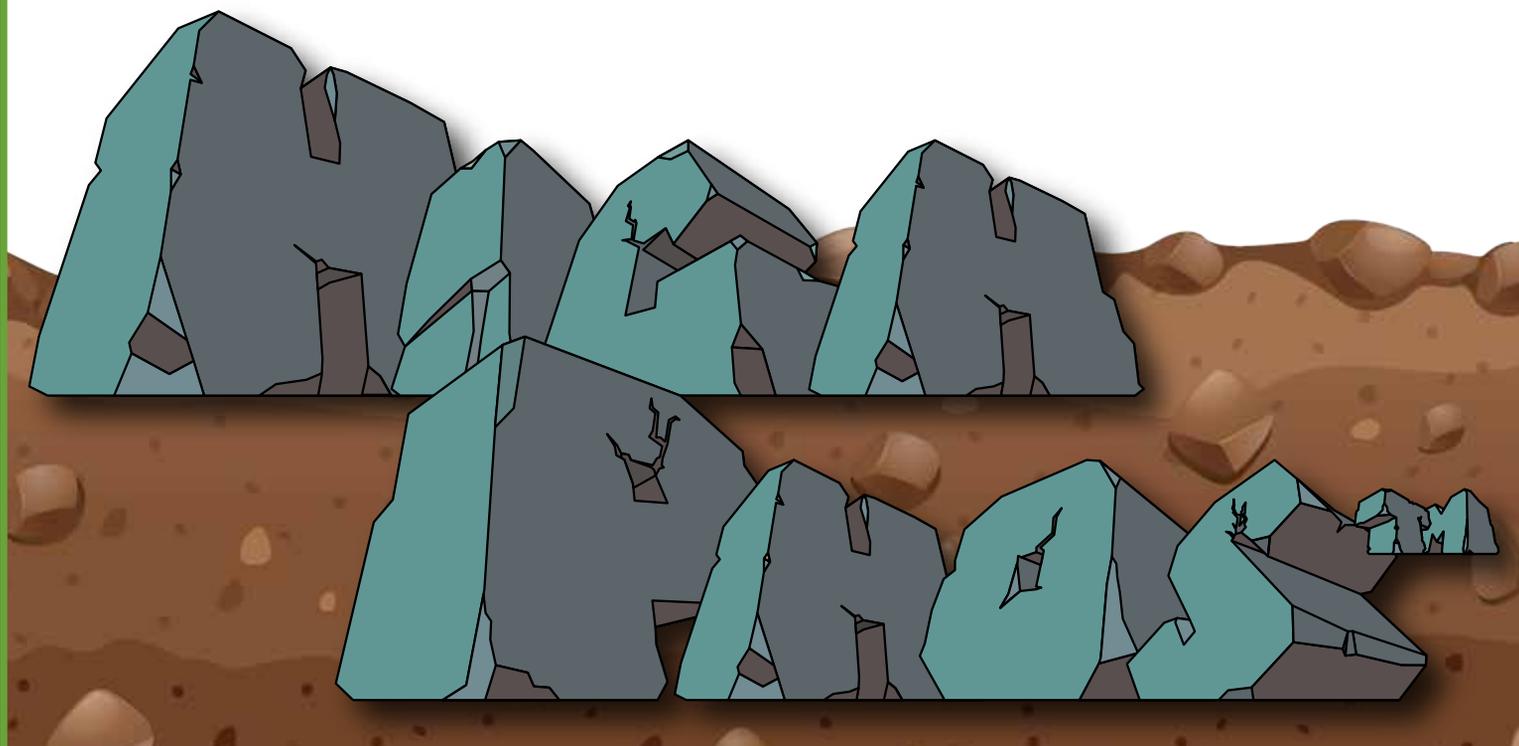
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Resident or Alien Registration Receipt card for Section 2. This includes conditional residents.

- List B documents

That being said, if you rehire an employee within three years from the date that the Form I-9 was previously executed, you may either rely on the employee's previously executed Form I-9 or complete a new form. If you choose to rely on a previously completed Form I-9 follow these guidelines:

- If the employee remains employment-authorized as indicated in the previously executed form and doesn't need additional documentation, then reverification is not needed.
- If the previously executed form indicated a document that is subject to reverification, if it has expired then it needs to be reverified and the updated information should be noted in the section.

Learning Resources

Explore multimedia content to learn about what the employment eligibility verification process means to you, including your rights, your roles, your employer's responsibilities, and your privacy.

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Videos

How to complete Form I-9, Employment Eligibility Verification:



SECTION ONE, EMPLOYEE INFORMATION AND ATTESTATION



SECTION TWO, EMPLOYER REVIEW AND ATTESTATION

If completing the Form I-9 feels overwhelming, visit USCIS website, I-9 Central for further explanations and training videos.



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If you already used the Section 3 on the current Form I-9, a new form will need to be completed Section 3. Remember that employees hired after three years from the date of the original hire must complete a new I-9 Form.

Form I-9 Storage and Retention

The question of how and how long to store I-9s is one of the most common points of confusion for employers. The forms instructions are fairly detailed in these areas and as such, it is best to make sure you read the directions thoroughly and on an annual basis so as to ensure no new details are missed. The following is practical synopsis of what to keep in mind:

Storage:

Form I-9 must be on file for all current employees—full-time, part-time, regular, and seasonal.

- Store the forms securely in a way that meets your business

Continued on Page 70

CONSUMERS AROUND THE GLOBE ARE BUYING CALIFORNIA WALNUTS

Over 30 billion California walnuts have made their way into export markets for snacking, commercial and home baking, trail mixes, savory sauces, restaurant menus, ready-to-eat meals and more this past crop season.

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Top 10 Export Markets:



Currently, the California Walnut Commission (CWC) conducts targeted marketing programs in eight countries throughout Europe and Asia, including an EU regional industrial program, positioning California walnuts distinctive quality, taste, versatility and nutritional benefits. Industry growers, handlers, and the CWC have made great strides by working together and will continue building demand in an ever-expanding global market.

Here are the numbers:

Walnuts were the 4th leading export commodity from California.¹

Every \$1 spent in California walnut export promotion returned over \$26 in export revenue to the industry.²

Each \$1 in FAS-taxpayer support for California walnuts export promotion generated over \$15 in tax revenue creation.²

Spending on export promotion in 2017 created 2,682 jobs.²



66%

66% of the California walnut crop was **exported** in the **2017/18** crop year.



walnuts.org

¹ California Agricultural Statistics Review 2016/2017 by CDFA

² Economic Evaluation of the California Walnut Commission's Export Promotion Programs: An Analysis of the Direct and Indirect Impacts, January 2018, Harry M. Kaiser, Cornell University





Continued from Page 68

- needs—on-site, off-site, storage facility or electronically.
- Store the forms and copies of documents separately, if you choose to make copies.
- Ensure that only authorized employees have access to the files.
- Be prepared to make them available within three days of an official request for inspection.

Retention:

Forms should be kept either:

- Three (3) years after the date of hire or
- One (1) year after the date employment terminates, whichever is later

If completing the Form I-9 feels overwhelming, visit USCIS website, I-9 Central for further explanation and training videos at, <https://www.uscis.gov/i-9-central/learning-resources>.

For more information about the Form I-9, or any worker safety, human resources, labor relations, pesticide safety, or food safety issues, please visit www.agsafe.org, call (209) 526-4400 or

email safeinfo@agsafe.org.

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WALNUT GROWERS LEAD IN FOOD SAFETY TRAINING

By THE WALNUT BOARD

Walnut Board funding continues for a third year of grower Food Safety Modernization Act (FSMA) training

WALNUT GROWERS HAVE BEEN taking advantage of the California Walnut Board's (CWB) funding for the mandatory Produce Safety Rule (PSR) 8-hour training being performed by Safe Food Alliance and several other firms for the past 3 years. Starting in 2019, all growing operations

are required to have at least one person to have attended the training. At present, over 1,300 growers and huller dehydrators have received the free training throughout the growing regions. The processing plants have also taken advantage of funds for training; California walnut handlers are

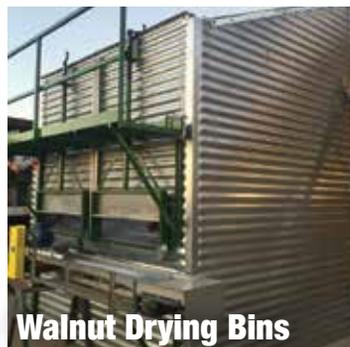
also required to have one person per operation trained in the more comprehensive food safety rules and attend the 2.5-day Preventive Controls (PC) Rule training.

New training dates are set for 2019. We have two grower training sessions scheduled so far this year. Chico on February 25th and Stockton on March 14th. More dates will be released soon and check our website at www.wallnuts.org for link to the Safe Food Alliance registration page and the coupon code walnuts growers can use so it's doesn't cost anything.

Also new in 2019 there will be trainings for huller dehydrators on the new Food and Drug Administration (FDA) expectations for washing and drying inshell walnuts. The GMP (Good Manufacturing Practices) binder will be completely updated to meet FDA's new food safety requirements under the FSMA standards. When these locations and dates are firmed up we will update the walnut website and use publications like this one to spread the word. FDA and California Department of Food and Agriculture (CDFA) will begin inspections on farms this harvest season so don't delay if you haven't already taken the training.

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NEW AND CHANGING LABOR LAWS GO INTO EFFECT ON JANUARY 1ST

By ROGER A. ISOM | President/CEO
Western Agricultural Processors Association



AS OF JANUARY 1ST SEVERAL NEW labor laws and changes to existing ones went into effect, and agricultural employers need to make sure they are in compliance. Included in the new or modified laws are changes related to sexual harassment, overtime and minimum wage.

Sexual Harassment

Following the widespread attention to the issue, the state legislature passed a slew of bills addressing sexual harassment. One of the more challenging ones, in terms of ability to comply, will be the new sexual harassment training requirements as set forth by SB 1343. By January 1, 2020, all supervisors must receive at least two hours of sexual harassment prevention training, and all non-supervisory employees must receive at least one hour of sexual harassment training. This includes seasonal employees like those that work at a cotton gin or a tree nut huller or processor. Existing law requires the trainings to include harassment based on gender identity, gender expression, and sexual orientation and to include practical examples of such harassment and to be provided by trainers or educators with knowledge and expertise in those areas. The bill also requires the department to produce and post both training courses to its website, which employers may utilize instead of hiring a trainer. It is not yet available.

AB 1619 greatly enlarges the statute of limitations for filing a civil action for damages for sexual assault to 10 years after the alleged assault or three years after the plaintiff discovered or reasonably discovered injury as a result of the

assault, whichever is later.

AB 2770 codifies case law to ensure victims of sexual harassment and employers are not sued for defamation by the alleged harasser when a complaint of sexual harassment is made and the employer conducts its internal investigation. This bill specifically deems complaints of sexual harassment based on credible evidence as a privileged communication that will not subject a party to a defamation claim from the alleged harasser. This bill also provides additional protections to employers by expressly allowing employers to inform potential employers about the sexual harassment investigation and findings, and

whether or not the employer would hire the alleged harasser and whether the decision to not rehire is based upon the employer's determination that the alleged harasser engaged in sexual harassment.

Beginning January 1, 2019, SB 820 requires all settlement agreements entered into will prohibit and make void any provision that prevents the disclosure of factual information related to civil or administrative complaints of sexual harassment, sexual assault, workplace harassment, or discrimination based on sex. This bill does not prevent parties from mutually agreeing to settle, but it will prohibit individuals and/or businesses from

Reminder – Minimum Wage Increase Effective January 1st

This is just to remind employers that minimum wage goes up on January 1st, as per the following schedule:

For employers with 26 or more employees:

TIME PERIOD	WAGE
JANUARY 1, 2019 – DECEMBER 31, 2019	\$12.00
JANUARY 1, 2020 – DECEMBER 31, 2020	\$13.00
JANUARY 1, 2021 – DECEMBER 31, 2021	\$14.00
JANUARY 1, 2022 UNTIL ADJUSTED ANNUALLY BY CPI*	\$15.00

For employers with 25 or fewer employees:

TIME PERIOD	WAGE
JANUARY 1, 2019 – DECEMBER 31, 2019	\$11.00
JANUARY 1, 2020 – DECEMBER 31, 2020	\$12.00
JANUARY 1, 2021 – DECEMBER 31, 2021	\$13.00
JANUARY 1, 2021 – DECEMBER 31, 2022	\$14.00
JANUARY 1, 2022 UNTIL ADJUSTED ANNUALLY BY CPI*	\$15.00

requiring a claimant to remain silent about the alleged assault/harassment as a condition of settlement. Further, SB 820 will expressly authorize provisions that (1) preclude the disclosure of the amount paid in settlement of a claim and (2) protect the claimant's identity and any fact that could reveal the identity, so long as the claimant has requested such anonymity and the opposing party is not a government agency or public official.

Overtime Update

On January 1, the new overtime provisions for agricultural employers go into effect, at least for those companies with more than 25 employees. As the new year begins, AB 1066 lowers the 10-hour-day threshold for overtime to 9.5 hours in a day and 55 hours per week when overtime pay is required for those employers with 26 or more employees. Here is a reminder of the phase-in schedule for all agricultural employers:

Employers with more than 25 employees:

- January 1, 2019: Overtime must be paid for work in excess of 9 ½ hours per workday or in excess of 55 hours per week.
- January 1, 2020: Overtime must be paid for work in excess of 9 hours per workday or in excess of 50 hours per week.
- January 1, 2021: Overtime must be paid for work in excess of 8 ½ hours per workday or in excess of 45 hours per week.
- January 1, 2022: Overtime must be paid for work in excess of 8 hours per workday or in excess of 40 hours per week. Any work in excess of 12 hours in one day must be compensated at the rate of no less than twice the employee's regular rate of pay.

Employers with 25 or fewer employees:

- January 1, 2022: Overtime must be paid for work in excess of 9 ½ hours

per workday or in excess of 55 hours per week.

- January 1, 2023: Overtime must be paid for work done over 9 hours per workday or in excess of 50 hours per week.
- January 1, 2024: Overtime must be paid for work in excess of 8 ½ hours per workday or in excess of 45 hours per week.
- January 1, 2025: Overtime must be paid for work in excess of 8 hours per workday or in excess of 40 hours per week. Any work in excess of 12 hours in one day must be compensated at the rate of no less than twice the employee's regular rate of pay.

Is this where it ends? No one can answer that at this point, but with this year's changes to the state legislature, we can be assured there be more changes to labor law proposed in 2019.

Comments about this article? We want to hear from you. Feel free to email us at article@jcsmarketinginc.com



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CHALLENGES TO ALMOND PASTEURIZATION

[Keeping the crunch while ensuring food safety are twin goals for almond processors.]

By CECILIA PARSONS | Associate Editor



SINCE PASTEURIZATION WAS REQUIRED by law for almonds sold raw in North America, processors have been challenged to both meet the standard to kill Salmonella while preserving the crunch, flavor, texture and nutritional characteristics of almonds.

Pasteurization is the process of using time and temperature to kill microbes in food. After outbreaks of Salmonella poisoning were traced to almonds, the industry, working with the United States Department of Agriculture (USDA), developed a mandatory pasteurization

program along with best practices guidelines for growers and processors.

Tim Birmingham, the Almond Board's director of quality assurance and industry services, said the marketing order is encouraging development of technologies that will help processors meet the goals.

Growers also play a part, Birmingham said, by implementing practices in their orchards that reduce the risk of microbial contamination. The pasteurization program is designed for control of a minimum 4-log reduction of Salmonella bacteria on almonds. If those levels are

exceeded during production, there could be issues. Growers need to do their part to control contamination, Birmingham said.

There are a number of pasteurization technologies in use today that do maintain raw characteristics and the industry currently has validated capacity for in excess of 1.1 billion pounds. Pasteurization methods in use to maintain the raw characteristics include blanching, oil roasting, steaming and use of propylene oxide (PPO) a compound approved by the Food and Drug Administration (FDA) for use to pasteurize food products including nuts, cocoa powder and spices. The five pasteurization technologies showcased at the annual Almond

Conference represent options for the almond industry. Birmingham said one size does not fit all in almond processing and that different equipment is designed for different throughputs.

Napasol NA

The Swiss company Napasol North America (NA) began as a sterilization process for the medical field, but 12 years ago moved to pasteurization of low moisture foods. Co-founder Cameon Ivarsson said the company now has 30 units operating that are validated for a 5-log kill. Their process is undergoing the Almond Board of California (ABC) Technical Expert Review Panel.

Ivarsson said the Napasol NA system is four times more effective than boiling water and can pasteurize at temperatures below 100 degrees F, which is suitable for more fragile food products and allows them to retain raw characteristics.

Almonds move through the process in bins and six bins at 1,750 pounds per bin can be pasteurized in nine minutes with complete documentation of the temperatures throughout. The preheat stage of the process uses hot air. Steam and vacuum is applied for pasteurization and the final step uses cool air to cool the nuts. Ivarsson stressed that the process does not wet the nuts so there is no need for a drying step. Nuts maintain their flavor and texture characteristics and undergo no mechanical damage in the transportation. The nuts remain in the bins throughout the process, never coming into contact with the equipment, so there is minimal line downtime for cleaning. The steam process delivers a uniform distribution of heat and temperatures documented throughout the process.

Log5

Log5, a Dutch company, has developed a unique air treatment system that controls temperature, moisture content of pasteurizing air, moisture content of preheating air and airflow. The Log5's AwCP system, said company representative Jochem Dekker, was borrowed from the cocoa industry to prevent flavor change. Fat content in almonds and cocoa is similar, he noted. The AwCP system is also suitable for different types of nuts with different challenges for process settings and design.

This pasteurization process delivers the perfect mix of highest reduction

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of pathogens with treatment time and product quality.

Steam, Dekker said, is not the most effective method for pasteurization, as it can cook the product. The Log5 system uses water activity rather than steam. Dekker said the system preheats the product first to avoid abrupt temperature change. The aim is to avoid heat stress in the preheating period. There is no direct steam/product contact. Condensation is avoided by keeping temperatures above the dew point.

Capacity of the system, Dekker said, depends on the density of the product. The Log5 system can handle 10,000 pounds of almonds per hour.

Dekker said due to increasing allergen concerns, pasteurization at the source by single nut type processors will become common. Available technology will also push demand for high quality, natural pasteurized almonds. The unwanted side effects of high roasting will push pasteurization in combination with roasting, he added.

JBT Technologies

An American company, John Bean Technologies (JBT) showcased a pasteurization process that compresses time. The key to this solution, said Ramesh Gunawardena, is the proper sequence of heat and time and striking a balance between variables.

With compressed time, this system increases throughput, while effectively achieving the required kill. This system uses a conveyor to move almonds through the process and was designed to ensure all nuts on the conveyor received identical treatment.

Compressed time and correct fluid conditioning are essential components of the process Gunawardena said. As an example, he said loose skins on almonds could be caused by localized vapor stagnation, prolonged exposure to wet steam, and a limited pathway for vapor release. The JBT system avoids damage by lower bed depth, increased zone velocity and fluid distribution balance.

Gunawardena included operating costs in his presentation, noting that at a capacity of 4300 pounds per hour throughput the cost per pound was about 0.0312.

Benefits of the system include a continuous process, clean product, very short dwell time, and shorter footprint.

Operating costs were estimated at \$32.76 per hour for gas, electricity and water.

CoolSteam Technology

Paul Favia with Laitham Machinery said their CoolSteam technology was designed specifically for pasteurizing delicate products like almonds.

The Laitham system uses steam, but all steam is not created equal, Favia stressed. Their homogenous steam/air mixture achieves rapid lethality as moisture uptake is controlled. The temperature is never above 212 degrees F. The four-step process includes pre-heating to increase surface temperature to reduce or control condensation, the CoolSteam pasteurization is a gentle heat transfer and then dry heat removes all residual moisture. Cooling takes the product to ambient temperature or below for storage.

The end product looks and tastes raw with no skin damage, flaking or color change, Favia said.

Revtech

The French company Revtech uses a vibrating, electrically heated tube to

move almonds through the pasteurization process. Jim Becker explained that the system developed by Revtech could be tailor made to fit all types of processing operations.

The continuous tube runs vertically and provides a controlled atmosphere for the pasteurization process. Becker said the vibrations move and mix almonds and the heated tube provides direct contact with a hot surface.

In this efficient transfer of energy to product, the flow rate for this process is 200 pounds per hour to five ton per hour. Temperature range is 120 to 800 degrees F. Residence time is 1-40 minutes. The atmosphere in the tube includes air, steam and nitrogen.

Becker said the main advantages to the Revtech system include low labor cost, no recontamination and machinery can be adapted to facilities. Pasteurization takes about 100 Kw per hour per ton with a cost of \$12 per ton.

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FDA'S "INTENTIONAL ADULTERATION" RULE

By JON KIMBLE | Safe Food Alliance

► Don't Get Behind

As with many of the Food and Drug Administration's (FDA) new rules from the Food Safety Modernization Act, or FSMA, the Intentional Adulteration rule sets a standard for the industry that's similar to what many food processors already have in place. Companies which have a Global Food Safety Initiative (GFSI) certification, like Safe Quality Food (SQF) or British Retail Consortium (BRC), already have a "Food Defense" plan that includes consideration of facility security measures such as locking doors, installation of fences, security camera systems, protection of digital resources, design of processing equipment, and even mail controls.

Whether or not you have a system like this in place, don't assume that your programs already meet the requirements of the rule. In addition to the usual food defense programs,

there are some new requirements to consider. And of course, if your company still doesn't have a food defense program you should take a serious look at what this rule expects from processors.

► First, the Basics

This rule, as with the Preventive Controls rule, applies to most companies who are required to register with FDA as a food processor—the majority of the food processing industry. This includes both domestic companies and those foreign companies whose product is sold in the U.S.

For readers that import products into the U.S., take note! Part of your "Foreign Supplier Verification Program" may soon need to include verifying that food defense controls are in place at your supplier's facility.

In true FSMA fashion, compliance dates are staggered based on Company size:

COMPANY SIZE	COMPLIANCE DATE
Very Small Businesses: Less than \$10 Million in total manufactured, processed, packed, or held	July 2021
Small Businesses: Less than 500 FTE Employees	July 2020
All Others	July 2019



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► The Rule's Requirements can be Summarized as Follows:

- Develop a food defense plan
- Conduct an assessment of potential risks to product from intentional adulteration (Adulteration may be committed by trespassers, visitors, or even employees)
- Determine mitigation strategies (Controls to reduce risk)
- Implement the plan
 - Train employees
 - Implement your mitigation strategies
 - Monitor your control measures (Mitigation strategies)
 - Apply corrective actions where needed
 - Verify the plan and its controls
- Reanalyze the plan periodically
- Of course, keep records

► What's New or Different from GFSI Programs?

In previous years food defense has been managed much like good management practices (GMP). Companies would use a standard checklist to assess their facility controls by doing a facility inspection, perhaps by using the tool from Food Safety Inspection Service (FSIS) used by many manufacturers. While these tools are helpful, they don't meet the new requirements that FDA has developed. Thankfully there are some new tools available, as we'll discuss below.

Under this rule, FDA will expect to see a more robust food defense program, similar to a hazard analysis and critical control points (HAACP)-based approach, focused on risk assessment rather than just inspection of the facility. A full assessment of the facility and each process step will need to be conducted just like a HACCP plan:

1. Assemble a food defense team
2. Describe the product (or products) under evaluation—those products that your company produces
3. Develop a process flow diagram
4. Describe the process steps
5. Assess risk at each step based on 3 factors:
 - a. Severity of potential public health impact
 - b. Degree of access (ease of access) to product
 - c. Ability to successfully contaminate the product, considering the nature of the process, design of equipment, etc.
6. Identify & implement mitigation strategies (control measures)
7. Monitor mitigation strategies
8. Apply corrective actions as needed, when something goes wrong
9. Verification of the program (internal audits, inspections, third party audits, or similar activities)

With regard to processing steps, the FDA has already provided guidance on the key activity types considered high risk, which they will expect food processors to focus on in their facilities. Those activity types are:

Receiving and loading of bulk liquid ingredients/raw materials (we believe that powdered products may also be considered to have a similar risk profile)

► Liquid storage and handling processes

Secondary ingredient handling (any point where dry or liquid ingredients are handled or manipulated, such as opening, measuring, transporting in bulk, etc.)

Mixing, grinding, and similar activities

As you can see based on the above, the FDA views ingredients or products that are handled and processed in bulk as greater risk. Beyond this, it is each processors' job to conduct a full assessment of all their processes and their facility layout, and to also identify controls needed at any step.

► Available Guidance and Tools

There are a variety of tools that the FDA has made available for the industry. The difficulty is sifting through all of the information they've provided, as it can be overwhelming. Here are a few key items we recommend:

The FDA has published an excellent guidance on the rule and has more guidance planned in the future. You can sign up for email updates on FSMA on their website.

The FDA's "Food Defense Plan Builder" is a piece of software that can be downloaded and used to build a compliant program. This tool walks users through the process of identifying process vulnerabilities and crafting appropriate control measures.

The FDA has provided a short training that can be

Continued on Page 80

Figure 1: The Beginning Stages of Building a Food Defense Plan, Utilizing FDA's "Food Defense Plan Builder".

The screenshot shows the 'Food Defense Plan Builder' software interface. The window title is 'Food Defense Plan Builder - Nutty Nut House'. The interface is divided into several sections:

- Company Information:** Fields for Company Name (Nutty Nut House), Address (123 4th Street), City/State (Nutville, CA), Country (USA), and Postal Code.
- Facility Identifier Numbers:** A table with columns 'Description' and 'Number'. One entry is 'FDA Registration #'.
- Facility Description:** Text input field containing 'We roast the most delicious, nuttiest of nuts'.
- Employee Description:** Text input field containing 'We only employ the most employed employees in our operation'.
- Product Description:** Text input field containing 'We roast the nuttiest of nuts in the roasiest roaster to deliver the tastiest taste'.
- Food Defense Team:** A table with columns: Name, Title, Phone, and Primary Contact.

Name	Title	Phone	Primary Contact
Bob the Builder	President / CEO		<input type="checkbox"/>
Freddy Food Safety	Food Safety Manager		<input type="checkbox"/>
Olive Operations	Operations Manager		<input type="checkbox"/>
Handy Marvyn	Maintenance and Engineering Manager		<input type="checkbox"/>

Continued from Page 79

administered to all staff members to help them understand regulatory requirements and assist the company in meeting the training requirements.

The Food Safety Preventive Controls Alliance (FSPCA) has various types of training available in various formats, for members of management involved in developing food defense programs.

► Food Defense Plan Example

So, what does a food defense plan look like? We tried out the FDA's Food Defense Plan Builder, to put together an example of what this might look like for your company. The first step in building the plan was to input some basic company information. This includes company contacts, address, and some other basic information. You can see our example (Figure 1, page 79).

Next, we input some information about our company's broad mitigation strategies, similar to the items typically included in the FSIS checklist mentioned above. This includes facility lighting, security measures, traffic controls, etc. Specific items which are noted as gaps by the team are flagged by the program as needing correction. (Figure 2)

After assessing the company's broad

Continued on Page 82

Figure 2

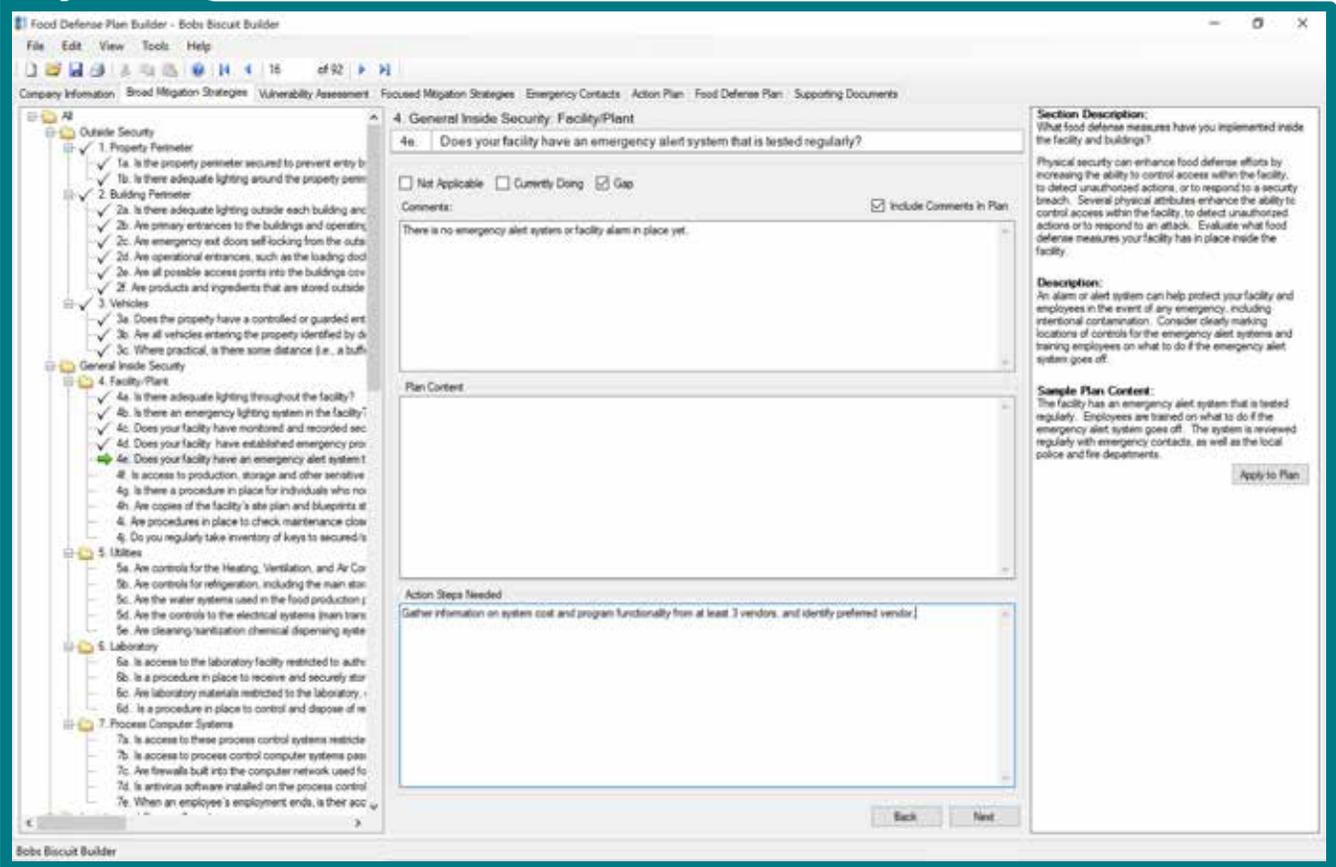


Figure 3

Process Name	#	Process Steps	Accessibility	Vulnerability	Sum	Actionable
Roasted nuts	1	Bulk raw nut receiving & transfer to bins	5-6 Partially Accessible	3-4 Barely Vulnerable	10	<input type="checkbox"/>
Roasted nuts	2	Bulk Oil Receiving	7-8 Accessible	5-6 Somewhat Vulnerable	14	<input checked="" type="checkbox"/>
Roasted nuts	3	City Water Supply	3-4 Hardly Accessible	1-2 Not Vulnerable	6	<input type="checkbox"/>
Roasted nuts	4	Bin storage of raw nuts in warehouse	5-6 Partially Accessible	5-6 Somewhat Vulnerable	12	<input type="checkbox"/>
Roasted nuts	5	Bulk oil in storage tank	5-6 Partially Accessible	5-6 Somewhat Vulnerable	12	<input type="checkbox"/>
Roasted nuts	6	Bin dumping, water & salt application	3-4 Hardly Accessible	3-4 Barely Vulnerable	8	<input type="checkbox"/>
Roasted nuts	7	Oil Roaster	3-4 Hardly Accessible	1-2 Not Vulnerable	6	<input type="checkbox"/>
Roasted nuts	8	Cooling belt	3-4 Hardly Accessible	3-4 Barely Vulnerable	8	<input type="checkbox"/>
Roasted nuts	9	Bin filling	3-4 Hardly Accessible	3-4 Barely Vulnerable	8	<input type="checkbox"/>
Roasted nuts	10	Bin storage	3-4 Hardly Accessible	3-4 Barely Vulnerable	8	<input type="checkbox"/>
Roasted nuts	11	Shipping	3-4 Hardly Accessible	3-4 Barely Vulnerable	8	<input type="checkbox"/>



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Continued from Page 80

mitigation strategies, the specific processing steps are entered into the program with a focus on areas that are more accessible (or less secured) and processes with

the greatest potential to be tampered with. There is a numeric rating system which aids the team in their vulnerability assessment, but ultimately the team decides which items need to be acted on in order to reduce the company's

vulnerability. (Figure 3, page 80)

As a result of reviewing our processes, we identified that the bulk oil receiving is an area that has some vulnerability and needs some additional focus to reduce risk. The program summarizes

Figure 4

Measure # or Process Step	Action Steps	Status	Responsibility	Priority	Target Cmpit Date
2a. Is there adequate lighting outside each building and in between buildings?	Identify contractor and install better lighting at North end of facility.	New	Handy Manny		12/3/2018
2b. Are primary entrances to the buildings and operating areas monitored and secured?	As noted in 4e below, determine feasibility of alarm system installation.	New			12/3/2018
2c. Are emergency exit doors self-locking from the outside, with alarms that activate when the doors are opened?	As noted in 4e below, determine feasibility of alarm system installation.	New			12/3/2018
3b. Are all vehicles entering the property identified by decals or other form of company-issued visual identification? This may include forms of permanent identification for employee vehicles, and temporary identification for vehicles belonging to visitors, contract workers, suppliers, and customers.	Team does not feel this is a priority at this time due to the small number of employees (less than 25).	New			12/3/2018
4c. Does your facility have monitored and recorded security cameras such as a closed circuit television (CCTV) system?	Assess feasibility of a video monitoring system along with the alarm (4e).	New			12/3/2018
4e. Does your facility have an emergency alert system that is tested regularly?	Gather information on system cost and program functionality from at least 3 vendors, and identify preferred vendor.	New			12/3/2018
Roasted nuts - 2. Bulk Oil Receiving	Bulk oil receiving is in an area that is not highly visible. Drivers are checked in but staff are not physically present at all times once unloading begins, and no security cameras are in place.	New			12/3/2018

all identified action items from both the assessment of our company's broad security measures, and the assessment of our processes, in a single tab. This is our team's list of action items—our "To Do List". (Figure 4)

Finally, we're able to publish a summary food defense plan that can be shared with any regulators or auditors who visit the facility, and that we can use as an internal reference. (Figure 5)

Perhaps your company's plan will look like this one, or maybe it will look totally different. Whether your company has been proactive in meeting the new regulation, or there's still some room for improvement, developing a food defense plan that's practical, effective, and beneficial is something your company should make a priority. It's not just an issue of regulatory compliance, it's an issue of protecting critical company assets. It just makes good business sense.

If you are interested in learning more about this topic or any of the services we offer, reach out to us at foodsafety@safefoodalliance.com.

Comments about this article? We want to hear from you. Feel free to email us at article@jcsmarketinginc.com

Figure 5

Nutty Nut House
123 4th Street
Nutville, CA, USA

Facility Identification #: _____
Facility Description: We roast the most delicious, nuttiest of nuts.
Employee Type Description: We only employ the most employed employees in our operation.
Product & Processes: We roast the nuttiest of nuts in the roasting roaster to deliver the tastiest taste.

FOOD DEFENSE TEAM

Name	Title	Phone	Primary Contact
Bob the Builder	President / CEO		
Freddy Food Safety	Food Safety Manager		
Olive Operations	Operations Manager		
Handy Manny	Maintenance and Engineering Manager		

BROAD MITIGATION STRATEGIES

Section	Measure	Response	Plant Contact	Comments	Action Steps
3. Property Perimeter	3a. Is the property perimeter secured to prevent entry by unauthorized persons (e.g., by security guards, fences, walls, or other physical barriers)?	Currently Strong			
	3b. Is there adequate lighting around the property perimeter?	Currently Strong			
2. Building Perimeter	2a. Is there adequate lighting outside each building and in between buildings?	Gap		The North end of the property is dark at night. The facility is otherwise well lit.	Yes
	2b. Are primary entrances to the buildings and operating areas monitored and secured?	Gap		Entrances are secured but not monitored.	Yes



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